Effects of Moderate Swim Exercise on Adiposity and Metabolic Function in Mice

Roberta L. Pohlman
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Conclusions: Of been insufficiently active and obese.

Active group (IA - those who didn't meet PA recommendations) and Active group (AT - those who met PA recommendations). Body composition was analyzed by BMI and obesity was

Methods: A cross-sectional study was done with a sample of 404 TST employees (189 women - 46.8%), aged 42.1±10.1 yrs and BMI: 26.0±4.3 kg/m2, randomly recruited and stratified by

results: 181 volunteers (44.8%) reported a LSTP, 193 (47.8%) were IA and 68 (16.8%) were obese. ST frequencies and association analysis are shown on Table 1.

Conclusions: We observed a negative association between ST and PA level as for the body composition. Volunteers who reported a longer ST period showed a higher risk (estimated by OR) of been insufficiently active and obese.

<table>
<thead>
<tr>
<th>Variables</th>
<th>LSTP</th>
<th>SSTP</th>
<th>X2</th>
<th>p</th>
<th>OR (95% CI)</th>
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<tbody>
<tr>
<td>PA level</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>IA</td>
<td>110</td>
<td>83</td>
<td>22.2</td>
<td>&lt;0.0001</td>
<td>2.61 (1.75 - 3.91)</td>
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<tr>
<td>AT</td>
<td>71</td>
<td>140</td>
<td>4.06</td>
<td>0.04</td>
<td>1.71 (1.01 - 2.89)</td>
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<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>≥ 30</td>
<td>38</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 30</td>
<td>143</td>
<td>193</td>
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</tbody>
</table>

Purpose: To analyze the association between sitting time, PA level and body composition among Brazilian civil servants from the Superior Labour Court (TST).

Methods: A cross-sectional study was done with a sample of 404 TST employees (189 women - 46.8%), aged 42.1±10.1 yrs and BMI: 26.0±4.3 kg/m2, randomly recruited and stratified by

1Brazilian Supreme Labor Court Health Service and University of Brasilia Faculty of Medicine - Cardiovascular Laboratory, Brasilia, Brazil. 2Brazilian Supreme Labor Court Health Service, Brasilia, Brazil.

(No relationships reported)

Public health recommendations for physical activity (PA) have focused on the minimal PA that everyone should accumulate on a regular basis. Recently, studies have shown that sedentary

behaviors, as sitting time, could also be important in the public health context.

Exercise is often prescribed as a method of weight loss and weight management, whilst other health benefits of exercise are less emphasized. Weight loss is not the only benefit of exercise and

such as those competing in sport at older ages may further the understanding of the nexus between aging, physical activity and obesity.

267
RESULTS: There was a significant reduction in mean body mass (-3.2±3.2 kg, p<0.0001), however, there was large individual variability (range: -14.7 - +3.7 kg) and approximately half (n=59) failed to change body composition as predicted - body mass (-0.8±2.11kg) and fat mass (-1.3±2.1kg). Despite this, their mean improvement in measured health markers was statistically significant: AF (+5.6±7.2mg/kg/min-1, p<0.0001) and fat free mass (+0.5±1.3kg, p=0.002) significantly increased, while HR (-3.7±5.7bp) and diastolic BP (2.4±6.1mmHg, p=0.008), waist circumference (-3.2±2.7cm, p<0.0001) and % fat mass (-1.4±1.8, p<0.0001) significantly decreased. Improvements in blood pressure changes were more marked when hypertensive (135/90mmHg) individuals were examined separately. This group became normo-tensive by reductions in systolic (-13.0±10.1mmHg) and diastolic (-8.3±5.9mmHg) BP, which were independent of weight loss.

CONCLUSIONS: These data demonstrate that significant and meaningful exercise-induced health benefits can be achieved even with little or no weight loss. Therefore, the current public health focus on weight loss should be reduced and more attention focused on improving general health. Supported by: Biotechnology and Biological Sciences Research Council (BB51/B/05079 and BB/G005524/1).

1223 Board #5 May 30 9:30 AM - 11:00 AM
Minimal Changes in Breathing Mechanics at Peak Exercise in Endurance-trained Obese Individuals
Santiago Lorenzo1, J. Todd Bassett2, Raksa B. Moran2, Jessica N. Pineda2, Tony G. Babh, FACSM1, 1Texas Health Presbyterian Hospital Dallas and UT Southwestern Medical Center, Dallas, TX.
2Texas Health Presbyterian Hospital Dallas, Dallas, TX.
(No relationships reported)

PURPOSE: Alterations in respiratory mechanics predisposes healthy obese individuals to low lung volume breathing at rest and during exercise, which places them at risk of developing expiratory flow limitation (EFL). The high ventilatory demand in endurance-trained obese adults further increases their risk of developing EFL as well as their work of breathing. Therefore, we measured breathing mechanics and ventilatory dynamics during exercise in endurance trained obese individuals.

METHODS: Seven (5M/2F) endurance-trained obese adults (35±3y, 37±5%body fat, 33±4 BMI, means±SD) underwent hydrostatic weighing, pulmonary function testing, submaximal and maximal cycle exercise testing, and the determination of the oxygen cost of breathing during eucapnic voluntary hyperpnea (Evh).

RESULTS: Pulmonary function was normal (FVC 109±14%predicted, FEV1 108±11%predicted, PEF 119±13%predicted, MIV 129±6%predicted, TLC 1014%predicted, FRC 45±6%TLC). Peak VO2 and work rate were 135±16 and 133±9%predicted, respectively. Peak ventilation, tidal volume, and breathing frequency were 1254±65 (77±14%MVV), 2.6±0.6 (56±5%FVC), and 49±8 bpm, respectively. During submaximal exercise end-expiratory lung volume dropped slightly but it returned to resting levels at peak exercise (rest 41.5±5.7, submaximal 38.1±8.5, peak 42.0±7.2%TLC). Slight EFL at peak (165±5% of tidal volume) without desaturation (98±1%) was observed in 6 subjects (5W/1M). During submaximal exercise the ventilatory response (VE/VO2 slope) was 25±1, and at peak exercise the rate of perceived breathlessness ( Borg 0-10 scale) was 7.7±1.6. The estimated oxygen cost of breathing during EVH was 1.75±0.74µL.O2/ML and during peak exercise averaged 7.4±3% of peak VO2.

CONCLUSIONS: Fit obese individuals were able to adequately increase ventilation and match the elevated metabolic demand associated with high fitness without substantial alterations in breathing mechanics. We conclude that endurance-trained obese individuals with normal lung function are not limited by breathing mechanics, which is good news for otherwise healthy obese adults who wish to participate in vigorous exercise training.

1224 Board #5 May 30 9:30 AM - 11:00 AM
Fat Free Mass Response Of Overweight Males Following 12 Weeks Of High-intensity Intermittent Exercise
Mehrdad Heydari1, Judith Freund2, Stephen H. Boucher, FACSM1, 1University of New South Wales, Sydney, Australia.
2St Vincent’s Hospital, Sydney, Australia.
(No relationships reported)

PURPOSE: To examine the effect of a 12-week HIIE intervention on FFMs of sedentary overweight men.

METHODS: Thirty eight males aged 24±9.4±3 years, with a BMI of 28.7±3.1 kg/m2, and body mass of 88.4±4.1 kg underwent a VO2max test pre- and posttraining. Total body fat and FFM was assessed by dual energy x-ray absorptiometry. Subjects, who were randomly assigned to HIIE (n=20) or control groups (n=18), exercised three times a week for 12 weeks under supervision. The HIIE group completed 20 minutes of exercise (8 s sprint, 12 s recovery) in each session, whereas controls performed no structured exercise for 12 weeks. Dietary intake was monitored through food diaries.

RESULTS: VO2max was significantly improved, P<0.05, by an increase of 15% in the HIIE group (34.2±4.9 to 39.4±4.9 ml.kg-1.min-1) and remained unchanged in the control group. Total FFM was significantly increased, P<0.05, by an increase of 1.2 kg (54.3±6.5 to 55.5±6.1 kg) and remained unchanged in controls (53.8±6.5 to 54.2±6.1 kg). FFM increased by 0.4 kg in the leg (18.6±2.5 to 19.0±2.4 kg) and 0.7 kg in the trunk (24.9±3.1 to 25.6±3.0 kg) and was unchanged in the arm. Total fat mass in the HIIE group was significantly reduced (29.8±7.1 to 27.8±6.9 kg; P<0.05) by 7%, whereas in the controls fat mass was unchanged (31.7±9.3 to 31.8±9.9 kg).

CONCLUSIONS: Twenty minutes of HIIE, three times a week for 12 weeks, led to a significant decrease in fat mass and a significant increase in FFM in overweight, young males.

1225 Board #6 May 30 9:30 AM - 11:00 AM
A Multidisciplinary Intervention Results in Sustained Improvements in Fitness and Metabolic Profile in Overweight Youth
Karissa L. Peyer1, R Randall Clark1, Jens Eckelhoff2, Aaron L. Carrel1, 1University of Wisconsin Hospital and Clinics, Madison, WI.
2University of Wisconsin School of Medicine and Public Health, Madison, WI.
(No relationships reported)

PURPOSE: To evaluate the impact of a clinical intervention on body composition, aerobic fitness, cholesterol, and insulin sensitivity in a clinic for overweight children.

METHODS: 79 children (age 10.56 ± 3.24 years, BMI z-score 1.5-3.48) were followed for 24 months at a Pediatric fitness clinic. All children were seen for initial visit (T0), at 12 months (T12), 24 months (T24), and often for addition follow-up visits between these time points. All children had height, weight, and blood pressure assessed and BMI z-score was computed. DXA and a submaximal treadmill test were used to assess body composition and aerobic fitness. Many children also had carbohydrate and lipid metabolism assessed. Children and parents attended appointments with physicians, registered dieticians, and exercise physiologists to assess lifestyle habits and establish goals for healthy change. Follow-up intervals were set on an individual basis and typically ranged from 6 weeks to 3 months. Changes from baseline were evaluated using the nonparametric Wilcoxon Signed Rank test. Spearman’s rank correlations were also performed to assess relationships between variables.

RESULTS: At T12, significant changes (mean ± SD) were seen in VO2max (1.39 ± 3.25 ml/kg/min, p = 0.001), %fat (-2.18 ± 2.79%, p < 0.001), BMI z-score (-0.09 ± 0.21, p < 0.001), and Total Cholesterol (-19.72 ± 44.42mg/dL, p = 0.01). There were no significant changes in fasting glucose, insulin or blood pressure. There were no significant differences between genders. All improvements remained significant at T24 [VO2max (1.32 ± 3.98 ml/kg/min, p = 0.006), %fat (-1.25 ± 2.78%, p = 0.006), BMI z-score (-0.13 ± 0.28, p < 0.001), and Total Cholesterol (-11.82 ± 22.77mg/dL, 0.025)]. Correlation analysis revealed a significant negative correlation (p<0.001) between changes in BMI z-score and VO2max levels from baseline to T12 (r = -0.67) and T24 (r = -0.71).

CONCLUSIONS: A personalized, multidisciplinary intervention focusing on lifestyle changes in nutrition and exercise for children yielded significant improvements in cholesterol measures, aerobic fitness, body composition and BMI for 2 years. Children who displayed positive changes in BMI z-score also saw the greatest improvement in VO2max. Further research should evaluate outcomes at longer follow-up intervals.
Body Mass Index and Parental Efficacy for Children's Exercise within a Youth Weight Management Program

David Bellar1, Charity L. Bryan1, Lisa Broussard1, Holly Howat1, Lawrence W. Judge2. 1University of Louisiana at Lafayette, Lafayette, LA. 2Ball State University, Muncie, IN.

(No relationships reported)

Childhood obesity is an alarming trend within the United States and other areas of the world. Greater understanding of the predictors of childhood obesity and overweight are necessary to effectively combat this growing problem.

PURPOSE: The present investigation was designed assess the efficacy of parental provision of exercise for children and its relationship to health and fitness in a group of overweight and obese youth.

METHODS: Fourteen parents and children (Male n=5, Female n=9, Age: 11.0±2.0yrs, Height 152.5±12.3cm, BMI 34.7±10.3) volunteered to participate in the present investigation. The participants were selected from the population of a local youth weight management program. After consent and assent were collected, the parents were asked to fill out a modified version of the Self Efficacy Scale for Exercise. The youth were tested for cardiovascular fitness via a progressive 20 meter shuttle run, body composition via two site skinfold testing (calf and tricep), body mass index, muscular endurance via curl up and push up tests, and flexibility through back savior sit and reach as well as trunk lift and shoulder flexibility testing.

RESULTS: In general the youth in the study were classified in the healthy fitness zone for the flexibility assessments, however, for all body mass or body composition assessments and tests of muscular endurance or aerobic capacity participating youth were below the healthy fitness standards. There was a significant negative correlation between the reported efficacy of provision of exercise by the parents and the body mass index of the children (r=0.522, p=0.05).

CONCLUSIONS: The results of this study suggest that parental efficacy may be a discriminating factor within a population of overweight and obese, low fitness level youth. As such, parental empowerment may be a key to health related fitness within this population.

May 30 9:30 AM - 11:00 AM

Effects of Family-based Behavioral Group Therapy and Exercise Training In Pre-pubertal Obese Children And Their Mother

Nathalie J. Farpourt-Lambert1, Albane M. Maggio1, Xavier E. Martin1, Sophie Bucher Della Torre2, Yacine Aggoun3, Maurice Beghetti1. 1University Hospital of Geneva, Geneva, Geneva. 2School of Dietetics HES, Geneva, Switzerland. (No relationships reported)

PURPOSE: To determine the effects of a family-based behavioral therapy program combined with an exercise training program on body fat and cardio-respiratory fitness in pre-pubertal obese children and their mother.

METHODS: This was a 6-month RCT including 50 pre-pubertal obese children (mean age 9.7 years, 95% CI 9.1-10.1) and their mother (40.5 years, 38.2-43.0) who were randomly assigned to an Intervention (I, n=25) or a Control group (C, n=25). The intervention consisted of 14 behavioral therapy group sessions (nutrition, physical activity, body image, motivation, positive reinforcement, social and parental skills) once a week for children and mothers separately. In addition, children exercised (swimming, ball games, resistance training) one hour twice a week, and mothers participated to a one-hour Nordic walking session per week. We assessed changes at 6 months in BMI, waist circumference (WC), total body and abdominal fat by dual-energy x-ray absorptiometry (DXA), and cardio-respiratory fitness (VO2max).

RESULTS: At baseline, children's characteristics were similar among groups. Mothers in the Intervention group had significantly (p<0.05) higher WC, total body and abdominal fat than Controls. At 6 months, using mixed linear regression, we observed significant changes in children's BMI (I-C treatment effect -0.67 g.cm-2), BMI Z-score (-0.15), WC (-1.33 cm), total body fat (-0.94%), abdominal fat (-2.08%), and VO2max (83.7 ml.min-1). In mothers, significant changes in BMI (I-C treatment effect -0.85 kg.cm-2), WC (-9.24 cm), total body fat -0.61%), and abdominal fat (-1.43%]) were shown.Changes in VO2max were not significant in mothers.

CONCLUSIONS: Family-based behavioral therapy combined with exercise training significantly reduces BMI and body fat in both pre-pubertal obese children and their mother. This is an interesting public health approach to promote behavioral changes and reduce the degree of adiposity at the family level. This study was funded by the Swiss National Science Foundation (#3200B0-120437) and the Geneva University Hospital Research and Development Fund.

May 30 9:30 AM - 11:00 AM

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David Bellar1, Charity L. Bryan1, Lisa Broussard1, Holly Howat1, Lawrence W. Judge2. 1University of Louisiana at Lafayette, Lafayette, LA. 2Ball State University, Muncie, IN.

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CONCLUSIONS: The results of this study suggest that parental efficacy may be a discriminating factor within a population of overweight and obese, low fitness level youth. As such, parental empowerment may be a key to health related fitness within this population.
METHODS: The Exercise is Medicine campaign calls for physicians to evaluate the exercise habits of their patients and Kaiser Permanente in Southern California (KPSC) was the first major healthcare system to begin using an exercise vital sign to record patient activity levels at every visit. Use of the "Exercise Vital Sign" (EVS) began in October of 2009, with every patient reporting the minutes per week of moderate or greater exercise they typically engage in. In addition, the role of physical activity in both the treatment and prevention of diabetes has been well established. It stands to reason that patients who report doing recommended amounts of regular exercise are likely to have improved control of their diabetes.

PURPOSE: To evaluate the correlation between self reported exercise level (using the EVS) and diabetes control as assessed by hemoglobin A1c (HbA1c) levels.

METHODS: Data were abstracted from the KPSC electronic medical records of 362,856 adults 18 years and older who had at least one HbA1c value during 4/1/2010 to 3/31/2011. Possion regression analyses were done to determine the association of the following predictors with HbA1c values >= 7.0: age, gender, race/ethnicity, body mass index (BMI), Charlson comorbidity index, and median exercise mm/wk.

RESULTS: Independent of all other predictors including BMI and disease burden, adults who were completely sedentary (0 min/wk) had 16% increased risk of HbA1c >= 7.0 compared to adults who were moderately active (150 min/wk; p < .001).

CONCLUSIONS: Based on data from the EVS, we conclude that self reported physical activity is strongly correlated with improved diabetes control. It is well known that improved diabetes control is a major factor in reducing complications and costs associated with diabetes. For this reason, it seems logical that all adult diabetic patients who report they are not doing any exercise should be targeted with interventions designed to increase their weekly levels of physical activity.

1232 Board #13 May 30 9:30 AM - 11:00 AM
Exercise Vital Sign Correlates with Diabetes Control
Robert Sallis, FACS\textsuperscript{5}, Eunis Ng\textsuperscript{2}, Karen Coleman\textsuperscript{2}, \textsuperscript{1}Kaiser Permanente Medical Center, Fontana, CA, \textsuperscript{2}Southern California Permanente Medical Group, Pasadena, CA.

(No relationships reported)

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1233  Board #14  May 30  9:30 AM - 11:00 AM

Effect Of Exercise Training On Neuromuscular Function Of Arm And Leg Muscles Of Diabetic Patients

Massimo Sacchetti1, Ilenia Bazzucchi1, Francesco Felici2, Susan Dewhurst1, Antonio Sgadari2, Giuseppe De Vivo1. 1University of Rome Foro Italico, Rome, Italy, 2Università Cattolica del Sacro Cuore, Rome, Italy. (Sponsor: Carl Foster, FACSIM)  
(No relationships reported)

Diabetes is associated to muscle weakness and physical disability. On the other hand, exercise training has the potential of counteracting the diabetes-associated derangement of neuromuscular function.

PURPOSE: To investigate the effect of exercise training on the neuromuscular function of arm and leg muscles in type 2 diabetic patients.

METHODS: Eight type 2 sedentary diabetic patients (D, 61.0±2.3) and eight neuromuscular healthy matched control subjects (H, 63.9±3.8) underwent a 16-week supervised combined aerobic and resistance exercise training program. Before and after training, maximal isometric (MVC) and isokinetic (15, 30, 60, 120, 180 and 240°s) muscle strength of the elbow flexors (EF) and knee extensors (KE) were assessed to investigate the torque-velocity relationship. Simultaneously, the EMG activity from the biceps brachii (BB) and the vastus lateralis (VL) muscles was recorded by means of array electrodes, in order to estimate the muscle fibre conduction velocity (MFCV).

RESULTS: After the training program, no significant changes in EF maximal torque values were noted in both groups. Differently, KE maximal torque values of D were significantly enhanced (+12,5%) and during isokinetic contractions at 15, 30 and 60 °s-1 (+17,1% on average). EMG data mirrored what found for torque, with an increase in MFCV in VL in D during MVC and during isokinetic contractions at 15 and 30 °s-1 (+ 11,2% on average; p<0.01).

CONCLUSIONS: Exercise training is more effective in KE than in EF muscles of diabetic patients, as shown by the shift toward higher values of the torque-velocity relationship and the enhancement of MFCV. This is in line with the more pronounced neuromuscular impairment of the lower than the upper extremities in type 2 diabetes.

1234  Board #15  May 30  9:30 AM - 11:00 AM

Compliance, Safety And Utility Of Smartphone Indicators During A 52 Week Randomized Controlled Trial Of Prescriptive Exercise In Rural Patients With Metabolic Syndrome

Robert J. Petrella, FACSIM1, Melanie Stuckey1, Kristin Sabourin1, Sherre Shapiro2, Brittany Ianzstadt2, John A. Petrella2, Claudio Munoz3, Robyn Fulkerson4. 1Western Ontario, London, ON, Canada. 2U Waterloo, Waterloo, ON, Canada. 3Gateway Rural Research Institute, Seaforth, ON, Canada. 4Sykes Assistance Services, London, ON, Canada.  
(No relationships reported)

PURPOSE: To determine whether remote clinical monitoring technologies can provide markers of intervention compliance, safety and efficacy outside the clinic setting.

METHODS: In a 52 week randomized trial of lifestyle intervention to modify risk factors for metabolic syndrome (Artemis), we used a Smartphone technology- intensive monitoring system linked to a central database in an underserviced rural setting. 75 participants were prescribed a lifestyle intervention and provided with Smartphones and Bluetooth-enabled blood pressure (BP) monitors, glucometers and pedometers. Smartphones transmitted pre-determined daily clinical data to a central database (Healthynannywhere®), BP twice daily; blood glucose (BG) twice daily and steps daily. A customized, proprietary decision support system (DSS) detected abnormal clinical data and life style patterns based on pre-determined clinical threshold algorithms. BP was grouped as normal, high-normal, pre-hypertensive, Stage 1, Stage 2; BG as normal, impaired glucose tolerance, diabetic; steps as sedentary, low active, somewhat active, active and highly active.

RESULTS: 68 participants (48 women) [56.8 (9.8)] years old completed the study and are reported 0-12, 13-24 and 25-52 weeks. No differences were observed for gender. Compliance with data transmission was high (81-94%) across all measures and did not change over time. Surprisingly, BP and BG were more compliant than daily steps transmission. Most clinical data were in the target therapeutic range over time. BP and BG highest 2 groups showed a decline (p<0.05) over the course of the study. 28-30% of patients achieved the target of 10,000 steps per day at each time point. % of patients in the sedentary, low active, somewhat active groups declined with time (p<0.05).

CONCLUSIONS: These findings show that clinical data transmission compliance was high and few patients showed clinically relevant alerts during a 52 week lifestyle intervention. High threshold alerts decreased over time while more patients became active. Smartphone monitoring of lifestyle interventions appears to be an important tool for monitoring safety and utility of lifestyle interventions in primary care.

1235  Board #16  May 30  9:30 AM - 11:00 AM

The Reliability of Behavioral Modification (Diet and Physical Exercises) on Metabolic Syndrome Primary Care

Franz H P Burin1, Okelesy Teixeira2, Fernando Moreto2, Erick P. de Oliveira2, Roberto C. Burin1, USP - PRONUT, São Paulo, Brazil. 2UNESP - Univ Estadual Paulista, Medical School, Botucatu, Brazil.  
(No relationships reported)

There is no curative model for the Metabolic Syndrome (MetS), being the primary prevention, such as the combat of sedentary behavior and food-intake inadequacy (lifestyle changes) the aim of the primary care system.

PURPOSE: To evaluate the effects of a protocol including dietary counseling and supervised physical exercises (LSMP) on MetS components.

METHODS: The longitudinal study included 131 subjects (55 ± 9 yrs old, 74% female and 68.7% under 60 yrs old) from a community-based sample that fulfilled the ethical and inclusion criteria of attending the 24 weeks LSMP and to all evaluations. The LSMP included a daily (5x/wk) sessions of supervised aerobic exercises (80 min, 65-80 % VO2max), weekly dietary counseling and assessments (baseline and end-study) of treadmill cardiorespiratory fitness (CRF, Balke protocol), dietary intake, anthropometry and blood chemistry. The ATP-NCEP (2003) criteria was used for the MetS diagnosis and the Statistica 6.0 software for the analyses of the data (p<0.05).

RESULTS: At baseline the MetS group (MSG=50.3%) differed from the non-MS (NMS) by the higher body mass index (BMI) and plasma uric acid (UA) and lower in CRF. Both groups responded to LSMP by increasing CRF, health-eating index, lowering the food-energy intake and plasma high sensitive C-Reactive Protein (CRP-hs). The 24.2% MetS reduction with LSMP was due to waist circumference (WC), blood pressure (BP) and HDL-c normalization whereas the appearance of 10.8% MS in the NMS group during the LSMP was associated with the increased levels of plasma glucose and triglycerides (TG) along with a decreased dietary-fiber intake. The predictive variables for the MetS control with LSMP were the higher increasing of HDL-c and the decreasing of BP whereas the predictive risk factors for the MetS appearance with LSMP were the increasing of BMI, plasma glucose, TG and UA, and the lower consumption of dietary fibre.

CONCLUSIONS: These data lead to the conclusion that the MetS treatment by LSMP is primarily due to lower energy intake (by increasing fibre consumption) and/or lower insulin resistance (by increasing CRF). Supported by CNPq and CAPES

1236  Board #17  May 30  9:30 AM - 11:00 AM

Effect Of Regular Exercise Training On Cardiorespiratory Fitness In Diabetes Mellitus: Meta-analysis

Juan Wang1, Zhengzhen Wang1, Xianbo Zhang2, 1Beijing Sports University, Beijing, China. 2Peking University, Beijing, China.  
(No relationships reported)

PURPOSE: Cardiorespiratory fitness is the core element of physical health, and it is not only closely related to the incidence but also directly associated with their mortality. Now there are many studies on exercise and Cardiorespiratory fitness in diabetes mellitus, but these studies had relatively small sample sizes and highly variable results. And few literature reviews focus on this. Therefore this article tries to find out the effect of regular exercise training on cardiorespiratory fitness in diabetes mellitus by using meta-analysis.

METHODS: Medline (1975 to Sep 2011) and SPORT Discus (1936 to Sep 2011) were searched for randomized, controlled trials evaluating effects of regular exercise interventions(not combined other intervention) of 4 weeks or more on cardiorespiratory fitness in diabetes mellitus. All satisfied trials were assessed by Jadad scales. And related data were extracted by two independent researchers. Then all the data were analyzed via software (Review Manage 5.0).
RESULTS: 1) there were 26 studies searched about exercise intervention on cardiorespiratory fitness in type 2 diabetes mellitus. Regular exercise can increase the VO2max about 14.1% in type 2 diabetes mellitus (SWD=1.01SD, p<.05). In the subgroups, Compared to the parallel controlled group, mellitus’s VO2max was different only in 60-79%VO2max intensity exercise group(p<.05) while not occurred in 40-59%VO2max or >80%VO2max intensity exercise group(p>.05). The VO2max of type 2 diabetes mellitus both increased in moderate exercise group and moderate plus resistance exercise group, and the former is more effective (p<.05); 2) there were only 4 studies satisfied the criteria in type 1 diabetes mellitus. After regular exercise, VO2max increased 8.6%, no significantly (SWD= 0.33SD, p>.05).

CONCLUSIONS: 1) for type 2 diabetes mellitus, regular exercise is benefit for improving cardiorespiratory fitness, both moderate exercise and moderate plus resistance exercise can, and it’s sure about 60-79%VO2max intensity exercise can improve the VO2max. 2) It’s not sure about regular exercise can improve cardiorespiratory fitness in type 1 diabetes mellitus.

1237 Board #18 May 30 9:30 AM - 11:00 AM
Additional Benefits of W-3 Oil Supplements on Metabolic Syndrome Care in Exercise Protocol Intervention
Erick P. de Oliveira, Lidiana C. Talon, Fernando Moreto, Viviane M R Acerra, Katia C P McLellan, Roberto C. Burini. UNESP - Univ Estadual Paulista, Medical School, Botucatu, Brazil.
(No relationships reported)

Metabolic Syndrome (MetS) is a cluster of diseases associated with sedentary and food inadequacy. Lifestyle modification programs (LSMP) including physical activity and nutrition-re-education are the aim of the primary care of MetS being the management of body adiposity and plasma lipids one of the goals. Dietary supplements of omega-3 polyunsaturated fatty acid (W-3 PUFA) have those properties.

PURPOSE: To compare the additional effect of dietary supplements of W-3 PUFA to a LSMP in treated MetS of free-living adults.

METHODS: In a prospective clinical trial, we studied 61 adults (50±13.8 years old), 85% of women, clinically screened to participate in a LSMP. The subjects were randomly assigned in two groups: LSMP (G1, n=26), including daily sessions (3x/wk) of supervised exercises of walking (3x/wk, 60-70% VO2max) and strength (2x/wk, 65-80% IRM) along with a weekly dietary counseling. The other group (G2, n=35) also under LSMP received W-3 PUFA (3g/day). Anthropometric measurements (waist circumference, body mass index, body fat percentage), dietary intake (24-hour recall), cardiorespiratory fitness (Balke protocol in treadmill, CRF), blood pressure (BP), and plasma biomarkers for MetS were performed at baseline (M0), and after 20 weeks (M1) of intervention. For statistical analysis it was used anova-two way, adjusted for gender, age, BMI and total caloric intake, and significance when p<0.05.

RESULTS: After 20 weeks both groups increased the CRF, but only G2 showed significantly decrease in waist circumference (1.3%) followed by MetS reduction (29%) mainly due to the normalization of BP (33,3%) and triglycerides (27,3%).

CONCLUSIONS: The dietary-supplements of W-3 PUFA potentiated the MetS treatment effects of LSMP by its effects on abdominal fat and some blood markers. Supported by CNPq, CAPES and FUNDAP

1238 Board #19 May 30 9:30 AM - 11:00 AM
Effect Of Exercise Training On The Inflammation Status Among People With Metabolic Syndrome.
Kathleen Broomall, Ulrik Wisløff, Stig A. Slørdahl. Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trond, trondheim, Norway.
(No relationships reported)

Metabolic syndrome is associated with chronic low-grade inflammation, a condition thought to play a key role in the pathogenesis of the syndrome. Among a number of pro-inflammatory cytokines, interleukin 18 (IL 18) seem to be the best marker for inflammation among people with metabolic syndrome.

PURPOSE: The aim of the study was to examine the effect of aerobic training versus strength training on circulating IL 18 and other pro-inflammatory markers in people with metabolic syndrome.

METHODS: Thirty-one inactive men and women (49.8 ± 9.1 years) with metabolic syndrome were randomized to either high intensity interval training (AIT, n=11), strength training (ST, n=10), or to a control group (n=10). Exercise training was carried out 3 times per week for 12 weeks. Serum insulin, high sensitive C-reactive protein (hs-CRP), interleukin 18 (IL 18), interleukin 6 (IL 6), and tumor necrosis factor-alpha (TNF-α) were measured before and after the intervention.

RESULTS: Serum IL 18 was reduced by 43% after AIT (p<0.001). Although AIT had no change in TNF-α from baseline, the levels were lower compared to ST (p=0.032) and control group (p= 0.039) after the intervention. Total body fat was reduced after AIT (from 33.9 ± 7.3% to 32.2 ±7.9%, p<0.001) and ST (from 31.2 ± 3.9% to 29.7 ± 3.4%, p=0.025). There were no changes in serum IL 6, insulin, or hs-CRP within or between the groups.

CONCLUSIONS: Both strength training and high intensity aerobic exercise reduces fat mass, however, only the latter intervention is associated with a more favourable inflammatory status among people with metabolic syndrome.

1239 Board #20 May 30 9:30 AM - 11:00 AM
Development of a Minimal Exercise Regimen With Maximal Benefits for Type 2 Diabetics
Kathleen Broomall1, Avi Milgrom1, Dan Carfi2. 1Miami University, Hamilton, OH; 2University of Cincinnati, Cincinnati, OH.
(No relationships reported)

PURPOSE: To examine the effectiveness of a novel, minimal exercise regimen based upon brief, strategically timed bouts of moderate intensity in attenuating postprandial glucose spikes as well its effectiveness in weight management over hours, days and years for type 2 diabetics. The regimen requires no exercise clothing or equipment; thus it can be readily integrated into a busy day in a “built environment” -- unlike other brief-interval regimens The underlying premise, documented in the literature, is that muscle contractions can shunt blood glucose from the blood stream into muscle using interval style muscle work.

METHODS: Blood glucose levels were mapped over two time scales: hours and years. The short-term studies were to preliminarily explore how the exercise regimen attenuates blood glucose spikes; thus metabolic cart data was gathered in addition to blood glucose. Specifically, the short term studies mapped blood glucose curves as well as fat and carbohydrate utilization from from sitting to standing.

1240 Board #21 May 30 9:30 AM - 11:00 AM
Glucose Tolerance: A Comparison Of Sitting vs. 0.5 MPH Walk On The Active Workstation
Ronald Cox, Chistina Ohlinger. Miami University, Oxford, OH.
(No relationships reported)

A growing body of literature suggests that striking differences in metabolic responses to nutritional challenge can be demonstrated when the postural condition of the individual is changed from sitting to standing.
Purposes: To describe the possible differences in glucose clearance, in young healthy individuals, in response to a glucose tolerance test performed under standard sitting conditions or while using an Active Workstation at very low speeds.

Methods: Nine students, eight females and one male (21±1 yrs) performed a series of glucose tolerance tests. After a minimum of an 8-hour fast a baseline glucose measurement (Accu-Chek®) was obtained. Subjects then ingested 75 gm of glucose solution (TruRight®) within a ten-minute period. In a counterbalanced manner, subjects either spent the two hours sitting or walking at 0.5 mph on an Active Workstation. During the session, a blood sample (finger stick) was obtained every 30 min for the next two hours.

Results: Table 1 shows the means ± SD for blood glucose for each time period under the two conditions. All subjects showed a lower blood glucose curve during walking. The levels at 90 and 120 min were significantly lower (pc 0.05) in the walking conditions.

Conclusions: These results support the impact of even very low levels of physical activity on metabolic response to glucose ingestion compared to sitting in healthy people. In fact, walking at a speed of 0.5 mph is a near proxy for standing. This result has implications for the standardization of glucose tolerance tests and reaffirms the potentially deleterious effects of sitting while offering support for the benefits of movement in normalizing blood glucose.

<table>
<thead>
<tr>
<th>Blood Glucose Levels: Sitting vs. Walk</th>
<th>Condition</th>
<th>Baseline</th>
<th>30 min</th>
<th>60 min</th>
<th>90 min</th>
<th>120 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting</td>
<td>85 ± 8</td>
<td>149 ± 27</td>
<td>556 ± 33</td>
<td>139 ± 22</td>
<td>224 ± 15</td>
<td></td>
</tr>
<tr>
<td>Walking 0.5 mph</td>
<td>86 ± 9</td>
<td>132 ± 23</td>
<td>16 ± 21</td>
<td>102 ± 18</td>
<td>106 ± 19</td>
<td></td>
</tr>
</tbody>
</table>

1241 Board #22 May 30 9:30 AM - 11:00 AM Dietary-fibre Adequacy Potentiates Physical Exercises In Metabolic Syndrome Management Lívia S. Gonçalves1, Marta S. Mecca1, Franz H P Burini2, Reinaldo C. Dalaneli1, Vanessa L. Peres1, Roberto C. Burini1, UNESP - Univ Estadual Paulista, Medical School, Botucatu, Brazil.1, USP - PRONUT, São Paulo, Brazil.1 (No relationships reported)

Lifestyle modification focusing on dietary and exercise behaviors is the preferred first-line treatment for the management of metabolic syndrome (MetS), its components and co morbidities. However attempts to modify diet by reducing food intake are often unsuccessful due to the low compliance. Adequate-to-high fibre intake appears as an alternative for limiting energy intake in a society with high energy-dense food consumption.

Purpose: To investigate the effects of fibre intake on exercised-MetS patients in a prospective dynamic cohort study.

Methods: The subjects that fulfilled all the inclusion criteria totalized 233 (mostly 35-60 years old and females). They all accomplished a protocol of lifestyle modification program (LISM) including supervised physical exercise of walking (3 Xwk: 60-70% maximal heart rate) and strength (2 Xwk: 65-80% of one repetition maximal) along with a weekly dietary counseling. A group of 131 subjects was studied on traditional LISM during 24 weeks (G1), another group of 72 subjects were randomized in either fibre (G2A = 25-30 g/day) and non-fibre (G2B) adequacy groups in a 20-weeks-later-intervention, and the remaining 50 patients also received similar treatment of fibre intervention (G3A) or only LISM (G3B) but in a shorter (10 weeks) experiment. The statistical analysis (paired Student’s t test) were used to compare moments (p<0.05).

Results: MetS varied from 40% to 50.4% (NCEP-ATP III, 2003 criteria) at the baseline and the recalled dietary fibre intake averaged 16.0 ± 7.1 g/day. There was a decreasing in MetS with the LISM alone lasting either 24 wk (-24.2%) or 20 wks (-15.5%) but not after 10 wks (+6%). These decreasing was optimized by dietary fibre interventions from 24% (G3A: 10 wks) to 36.4% (G2A: 20 wks). At the end of the experiment the increase of fibre intake varied from 7.2 g/d (G1) to 14.6 g/d (G2A) and 16.9 g/d (G3A), above the baseline values. The reduced obesity rate varied from 7% to 9% in the fibre-intervened groups.

Conclusions: The present data support the use of fibre adequacy as reducing factor for energy-dense food consumption and consequently body weight loss and then accelerating MetS decrease in a complementary physical exercise protocol. Supported by CNPq and FUNDAP

1242 Board #23 May 30 9:30 AM - 11:00 AM The Impact Of Breaking Sitting Time On Postprandial Response To Three Separate Meal Replacement Beverages. Meredith C. Peddie, Nancy J. Rehuer, FACSM, Murray Skeaff, Tracy L. Perry. University of Otago, Dunedin, New Zealand. (No relationships reported)

Purpose: The purpose of this study was to compare the effects of breaking continuous sitting with short regular exercise breaks or one continuous bout of exercise on postprandial serum glucose, insulin, and triglyceride responses to three meal replacement beverages.

Methods: Seventy participants (Mean (SD) VO2max 42.9 (10.3) ml kg min-1, Body mass index 23.6 (4.0)) completed three 9 h interventions. During the prolonged sitting intervention (SI), participants sat continuously for 9 h; in the exercise intervention (EX) participants sat for 15 min, walked on the treadmill for 30 min, then sat continuously for 8 h and 15 min; in the breaking sitting time intervention (BRK) participants regularly interrupted their sitting with eighteen 1 min 40 s bouts (total of 30 min) of exercise. In each intervention participants were fed a MRB at 60, 240 and 420 min. Each MRB contained 31.4 ± 6.6 g fat, 36.8 ± 7.7 g protein 76.4 ± 16.1 g CHO and 3105 ± 652 kJ energy. Blood samples were obtained at baseline and hourly for 3 h after MRB consumption.

Comparisons between interventions were made using mixed model regression.

Results: The triglyceride AUC in BRK was 8% (95% CI 0.5 to 16.0% p=0.03) greater compared to SI in response to the 2nd MRB. There were no differences between conditions in response to the 1st or 3rd MRB. The glucose AUC in BRK was 5.8% (95% CI 2.5 to 9.1% p=0.04) less than SI in response to the 1st MRB. These differences were maintained in response to the 2nd MRB, but where no longer apparent in response to the 3rd MRB. The insulin AUC in BRK was 11.2% (95% CI 1.8 to 20.7% p=0.01) less than SI in response to the 1st MRB. In response to the 2nd MRB BRK was 41.9% (95% CI 15.4 to 68.3% p=0.02) less than SI. The response to the 3rd MRB was similar to the 1st MRB.

Conclusions: Breaking sitting time reduces postprandial insulin responses throughout the day. Health promotion guidelines should promote regular physical activity breaks during periods of prolonged sitting, particular for those at risk of insulin resistance.

1243 Board #24 May 30 9:30 AM - 11:00 AM Chronic Exercise Training Effects on Fatigue in Multiple Sclerosis: A Meta-Analysis Tina A. Mattila, Megan Nickrent, Lara A. Pilutti, Robert W. Motl, Steven J. Petruzzello, FACSM. University of Illinois at Urbana-Champaign, Urbana, IL (No relationships reported)

Fatigue is a common, disabling, and poorly managed symptom of multiple sclerosis (MS). Chronic aerobic exercise training may be an effective behavioral strategy for reducing fatigue in persons with MS.

Purpose: Provide a quantitative review of research examining the effect of exercise training on fatigue in MS.

Methods: Electronic databases (Web of Science, PubMed, PsyInfo, Medline, Google Scholar, and Current Contents Plus) were searched for articles published up to September 2011 by using the key words exercise, fatigue, tiredness, energy, mood, lassitude, physical activity, rehabilitation, and fitness in conjunction with MS. Manual search of bibliographies of the retrieved papers was also done and study authors were contacted about additional studies. Thirty-five journal articles were located and reviewed, and 25 provided enough data to compute effect sizes (ES) and include in the meta-analysis. The meta-analysis was conducted with Comprehensive Meta Analysis using a random effects model and the overall ES was expressed as Hedge’s g.

Results: Twenty-five ESs were retrieved from the 25 studies with 606 MS participants and yielded a weighted mean ES of 0.55 (95% CI = 0.37, 0.78). The weighted mean ES was heterogeneous, Q = 50.71, df = 24, P = 0.001, supporting a search for moderator variables.

Conclusions: The cumulative evidence supports that exercise training is associated with a fairly sizable reduction in fatigue among persons with MS.
The positive effects of regular exercise on the physiological well-being of HIV positive (+) persons have been well documented. Although evidence exist for HIV- persons to retain muscular strength and improve work-related performance through regular exercise without compromising their immune capacities, limited research has been done to assess the effect of exercise on non-physiological parameters such as pain, functional limitations and social functioning which influence overall quality of life (QoL). Aerobic exercise results in several health benefits and consequent QoL improvements in HIV negative populations. However, it is uncertain how aerobic exercise would influence the QoL (self-perceived physical and mental well-being) of HIV+ persons.

PURPOSE: To determine the effect of an aerobic exercise intervention on the QoL in HIV+ persons.

METHODS: Twenty eight HIV+ persons were randomised into two groups (aerobic intervention and control, n=14 each). The intervention group was exposed to a 12 week supervised aerobic intervention, while the control group was exposed to a supervised stretching program to limit drop-out without inducing physiological adaptation. Participants were assessed for their aerobic capacity, immunological status (CD4 and viral load) and QoL score before and after the intervention. Significance between pre- and post intervention results were set at p < 0.05.

RESULTS: Following the intervention, a significant improvement (p = 0.02) in aerobic capacity were seen for the intervention group, while their CD4 counts and viral loads remained unchanged. Interestingly, both groups displayed significant improvements in their self-perceived physical and mental well-being (p = 0.003 and p = 0.002 for the intervention and control group respectively). Based on research in other population groups, the improved QoL in the control group is speculatively attributed to a placebo effect achieved through the personal attention received during exercise supervision.

CONCLUSIONS: Aerobic exercise leads to an improved aerobic capacity without compromising the immune capacities of HIV+ persons. Supervised exercise seems to improve QoL for HIV+ persons, irrespective of the type and intensity of the exercise and should therefore be promoted in the holistic disease management of HIV+ persons.

1245 Board #26 May 30 9:30 AM - 11:00 AM Effects of Self-Selected and Imposed Intensity Acute Exercise on Psychological and Cortisol Responses

Kyoko K. Wardwell, Brian C. Focht, FACSM, Courtney A. DeVries, Ann A. O’Connell, Janet Buckworth, FACSM. The Ohio State University, Columbus, OH.

(NO relationships reported)

PURPOSE: The primary purpose was to examine psychological responses to self-selected and imposed-intensity acute exercise in inactive women with high levels of stress. The secondary purpose was to examine potential psychological mechanisms (HPA-axis response and self-efficacy) for changes in psychological states.

METHODS: Nineteen participants (age = 23.58 ± 5.30 yr) completed 3 trials of treadmill exercise at self-selected intensity, 10% above and 10% below relative self-selected intensity. Exercise duration was determined to expend 150 kcal. Affective responses and salivary cortisol were measured prior to, during, and following exercise. Self-efficacy was also measured during and post-exercise. Future exercise intention was measured post exercise.

RESULTS: Affect and self-efficacy improved significantly over time at all exercise intensity conditions (all variables were p < .005). Moreover, positive engagement was higher at self-selected than imposed intensity during and post exercise (p < .05). No significant associations were observed between affect, self-efficacy and cortisol levels. However, affect and self-efficacy did significantly predict future exercise intentions.

CONCLUSIONS: Acute bouts of exercise at intensities proximal to and lower than ventilatory threshold are associated with positive affective responses during and after exercise in women with high levels of stress. Self-selected intensity may be effective for eliciting more favorable experiences during and following acute bouts of exercise, and to promote future intentions for exercise. Findings provide partial support for self-efficacy during exercise as a potential mechanism for positive affective responses, especially at self-selected intensity.

1246 Board #27 May 30 9:30 AM - 11:00 AM Regular Exercise Attenuates Oxidative Stress in Aging Rat Liver: Apoptosis and Fibrosis Signal Pathway Toward Anti-Aging Medicine

Kai-Wen Chang1, Chi-Chang Huang1, Wan-Teng Lin1, 1National Taiwan Sport University, Taoyuan County, Taiwan, 2National Yang Ming University, Taichung, Taiwan.

(NO relationships reported)

Regular exercise is known to exhibit various health benefits in reducing risks of age-related diseases such as cardiovascular diseases, type 2 diabetes and cancer. However, there is no report about the protective effects of exercise training on liver senescence.

PURPOSE: The purpose of this study was to investigate whether a 12-week swimming exercise training can suppress senescence-oxidative stress markers of liver tissues.

METHODS: Twenty-three male Sprague-Dawley rats were divided into the following four groups: (1) vehicle control (n = 6), (2) aging (n = 6), (3) swimming exercise (n = 5), and (4) aging + swimming exercise (n = 6). Rats in groups A and AS were intraperitoneal injection with D-galactose (150 mg/kg/day) for 12 weeks to induce aging. Rats in groups SE and ASE were subjected to swimming exercise for 60 min/day × 5 days/week for 12 weeks.

RESULTS: The results show that apoptosis index cleaved Caspase 3 and cleaved PARP were significantly lower in C and ASE than in A group (P < 0.05); apoptosis protective protein Bcl-2 is significantly higher than A group (Pc < 0.05). In ASE group through increasing PI3K-Akt signaling activities and inhibiting apoptosis and fibrosis pathway activities compared with aging group, be a major mechanism of anti-aging.

CONCLUSIONS: These results suggest that a 12-week swimming exercise may suppress apoptosis and fibrosis markers in the liver tissues of D-galactose induced aging rats. This study was supported by a research grant from the National Science Council, Taiwan (NSC99-2410-H-029-059-MY2).

1247 Board #28 May 30 9:30 AM - 11:00 AM Exercise Training Counterbalances Chronotropic Incompetence and Delayed Heart Rate Recovery in Systemic Lupus Erythematosus

Fabiana Benatti, Renata Miossi, Ana Lúcia de Sá Pinto, Fernando Lima, Eduardo Borba, Danilo Prado, Bruno Gualano, Elcio Botafu, Hamilton Roschel. University of São Paulo, São Paulo, Brazil.

(NO relationships reported)

PURPOSE: To evaluate the efficacy of a three-month exercise training program in counteracting the chronotropic incompetence and delayed heart rate recovery in patients with systemic lupus erythematosus.

METHODS: A 12-wk, randomized trial was conducted. Twenty four inactive SLE patients were randomly assigned into two groups: trained (T, n=14, three-month exercise program) and non-trained (NT, n=10). A gender-, BMI-, and age-matched healthy control group (C, n=8) also underwent the exercise program. Subjects were assessed at baseline (PRE) and 12 weeks after training (POST). Main measurements included the chronotropic reserve (CR) and the heart rate recovery (HRR) as defined by the difference between HR at peak exercise and at both first (HRR1) and second (HRR2) minutes after the exercise test.

RESULTS: Neither the non-trained SLE (NT) patients nor the healthy control group (C) presented any change in the chronotropic reserve (NT PRE: 72.1±11.1, POST: 75.6±19.2 %, p=0.96; C PRE: 93.5±4.9, POST: 95.9±10.4 %, p=0.99) or in HRR1 (NT PRE: 26.6±11.8, POST: 26.7±10.7 %, p=1.0; C PRE: 33.8±6.6, POST: 38.2±10.0 %, p=0.95) and HRR2 (NT PRE: 38.8±13.5, POST: 52.0±15.7 %, p=0.99). The exercise training program was effective in promoting significant increases in chronotropic reserve (T PRE: 79.4±13.5, POST: 95.4±9.6 %, p=0.003) and in HRR1 (T PRE: 23.1±9.6, POST: 41.0±10.7 %, p=0.006) (POST T vs. NT, p=0.02; ES=1.12) and HRR2 (T PRE: 39.0±10.5, POST: 57.3±12.4 %, p=0.007) (POST T vs. NT, p=0.01, ES=1.11) in the SLE trained group (T) when compared with the NT group. Moreover, the heart rate response in SLE patients after training achieved parameters comparable to the healthy control subjects, as evidenced by the ANOVA and by the Z-score analysis (p<0.05, T vs. C). SLEDAI scores remained stable throughout the study.

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CONCLUSIONS: A 3-month exercise training program was safe and capable of reducing the chronotropic incompetence and the delayed heart rate recovery observed in physically inactive SLE patients.

Supported by Fapesp (11/08302-0)

Board #29  May 30  9:30 AM - 11:00 AM

Parasympathetic Tone And Its Adaptation To Aerobic Training (Fitwalking®) In HIV Patients On Anti-Retroviral Therapy

Gianpietro Mera1, Antonio La Torre1, Matteo Bonato1, Gasparr Pavcl1, Simona Bossolasco2, Laura Galli1, Paola Cinque1. 1University of Milan, Milan, Italy. 2San Raffaele Scientific Institute, Milan, Italy.  

Recent evidences showed that in HIV patients Highly Active Antiretroviral Therapy (HAART) and HIV per se may affect parasympathetic function. This may increase the cardiovascular risk and contribute to HIV associated lipodystrophy. Such impairment may be reversed by a regular physical activity, which is known to increase vagal tone. PURPOSE: To evaluate vagal tone and its change after 3 months of aerobic training in HIV patients on HAART.

METHODS: 12 non-hypertensive and non-smoker patients (F/M 2/10; 47± 5 yrs; 71± 14 kg) with HIV infection (H) on HAART were enrolled. A group of 12 control (C) subjects (F/M 3/9; 48± 12 yrs; 76± 13 kg), matched for gender, and anthropometric features, was enrolled for baseline comparisons. Heart rate variability (HRV) indexes of parasympathetic tone in time (RMSSD, pNN50) and frequency (High Frequency [HF] in absolute and normalized units [nu]) domains, and a HRV index of sympathovagal balance (LF/HF ratio) were calculated in basal condition in H and C subjects, both in supine and standing position for 5 min each, by a HR monitor. The H group was then trained by walking at 60-70% of maximal HR 3 times/week for 2 weeks, and the HRV measures were thereafter repeated. A 6-min walking test (6MWTT) was executed before and after the training.

RESULTS: In basal condition, despite similar values in supine position between H and C subjects, HIV patients showed a lower parasympathetic tone during standing, which was significant in the linear indexes (RMSSD: H 16.7±5.1 vs C 25.3±10.5 ms [p<0.05]; pNN50: H 1.4±1.3 vs C 5.4±5.3% [p<0.05]; HF: H 180±207 vs C 196±139 ms2; LF/HF: H 21.6±23.5 vs C 27.0±16.2), and a higher sympathetic activation (HF/LF: H 9.2±7.0 vs C 4.1±2.7 [p<0.04]) compared to C subjects. Fitwalking® training significantly improved the distance covered by 6MWTT (from 667±50 to 802±160 m, p<0.01) and the physical training score (from 451±60 to 538±121 I, p<0.01). However, standing values of HRV indexes did not significantly change after training in H patients (RMSSD 15.2±6.6 ms, pNN50 1.1±1.7%, HF 100±93 ms2, LF/HF 9.7±7.5; pns vs pre-training for all comparisons).

CONCLUSIONS: 12-weeks aerobic training improved cardiovascular fitness in HIV patients, but did not affect the heart parasympathetic control, which remained reduced compared to healthy subjects.
CONCLUSIONS: Between groups on any of the domains of muscular fitness and quality of life.

METHODS: 586 PD patients were randomly assigned to the ParkFit Program or an active control group (ParkSafe Program). The level of physical activity was measured at baseline and at 6 months using a standardized interview-based 7-day recall (LAPAQ, primary endpoint); an ambulatory activity monitor (secondary endpoint) and an activity diary (secondary endpoint). Results were analysed according to the intention-to-treat concept.

RESULTS: 562 patients (96%) completed both baseline and 6 months assessments. In the ParkFit group, participants increased their time spent to physical activities with 7% as assessed with the LAPAQ; patients in the control group became 1% less active. The difference between both groups was not statistically significant. When we specified the nature of the activities, patients in the ParkFit group increased their ‘outdoor and sports activities’ (+32%), while their time spent to household activities decreased (-14%). In the control group these differences were less than 4%.

CONCLUSIONS: This short-term outcome of the ParkFit trial suggests that patients with PD can increase their outdoor activities with a specific multifaceted program. This increase seems to be accompanied by a decrease in time spent to household activities. At the congress we will present the results of the ParkFit trial after 24 months intervention and the potential health consequences of a change in lifestyle. (Funded by ZonMw (The Netherlands Organization for Health Research and Development (75020012)); The Michael J Fox Foundation for Parkinson’s research; VGZ; Glass Smith Kline; and National Parkinson Foundation; ClinicalTrials.gov number, NCT00748488.)

**Board #32**

**May 30 9:30 AM - 11:00 AM**

**Efficacy Of A Multifaceted Intervention Program To Increase Physical Activity In Patients With Parkinson’S Disease; The ParkFit Trial**

Marlies van Nimwegen, Arlène D Speelman, Sebastiaan Overeem, Bart P. van de Warrenburg, Katrijn Smulders, Manon Donjé, George F. Born, Frank J.G. Backs, Bastiaan R. Bloem, Marten Munneke, UMC St Radboud, Nijmegen, Netherlands. 2Hanse University, Groningen, Netherlands. 3University Medical Center Utrecht, Utrecht, Netherlands.

(No relationships reported)

**PURPOSE:** Many patients with Parkinson’s disease (PD) lead a sedentary lifestyle. Simply informing patients about the health benefits of physical activity is insufficient to change their sedentary lifestyle. We developed and evaluated a multifaceted behavioural program (ParkFit) aiming to increase the level of physical activity undertaken by patients with PD.

**METHODS:** 586 PD patients were randomly assigned to the ParkFit Program or an active control group (ParkSafe Program). The level of physical activity was measured at baseline and at 6 months using a standardized interview-based 7-day recall (LAPAQ, primary endpoint); an ambulatory activity monitor (secondary endpoint) and an activity diary (secondary endpoint). Results were analysed according to the intention-to-treat concept.

**RESULTS:** 562 patients (96%) completed both baseline and 6 months assessments. In the ParkFit group, patients increased their time spent to physical activities with 7% as assessed with the LAPAQ; patients in the control group became 1% less active. The difference between both groups was not statistically significant. When we specified the nature of the activities, patients in the ParkFit group increased their ‘outdoor and sports activities’ (+32%), while their time spent to household activities decreased (-14%). In the control group these differences were less than 4%.

**CONCLUSIONS:** This short-term outcome of the ParkFit trial suggests that patients with PD can increase their outdoor activities with a specific multifaceted program. This increase seems to be accompanied by a decrease in time spent to household activities. At the congress we will present the results of the ParkFit trial after 24 months intervention and the potential health consequences of a change in lifestyle. (Funded by ZonMw (The Netherlands Organization for Health Research and Development (75020012)); The Michael J Fox Foundation for Parkinson’s research; VGZ; Glass Smith Kline; and National Parkinson Foundation; ClinicalTrials.gov number, NCT00748488.)

**Board #33**

**May 30 9:30 AM - 11:00 AM**

**Changes in Sedentary Time and Physical Activity of Livestrong® Cancer Survivor Program Participants**

Sarah Hågers-Greteman, Nicklaus Redenius, Jeremy Frost, John Schuna, John, Riggs Kåka, FACSMD, Gary Liguori, North Dakota State University, Fargo, ND. 2Cancer Survivor Center, Aspen, CO.

(No relationships reported)

**PURPOSE:** The purpose of this investigation was to identify changes in sedentary time (SED) and physical activity (PA) of cancer survivors enrolled in a post-treatment, 12 week, Livestrong® group exercise program.

**METHODS:** Eleven cancer survivors (1 Male and 10 Females; 51.8±9.7 yrs, BMI=26.6±4.1), representing a variety of cancer and treatment backgrounds, volunteered and wore armband activity monitors (BodyMedia® SenseWear) for seven consecutive days. Data collection occurred during the first and sixth week (midpoint) of the Livestrong® Program, and each minute of activity monitor wear time was classified as sedentary (SED), moderate (MOD), or vigorous (VIG). Minutes from MOD and VIG were then combined into a moderate-vigorous (MV) category. Linear mixed model analyses were used to compare weekly time spent in SED, MOD, VIG, and MV between weeks 1 and 6 with an adjustment for activity monitor wear time (time-varying covariate).

**RESULTS:** Across both assessment periods, participants averaged >15 h•day-1 of non-sleep activity monitor wear time with a weekly total of (mean ± SE) 6673.6 ± 734.8 min•week-1 (week 1 = 6853.8 ± 572.9, week 2 = 6493.4 ± 856.8). No significant differences were observed in weekly minutes (mean ± SE) from week 1 to week 6 for SED (6484.5 ± 155.6 vs. 6114.6 ± 246.3, respectively), MOD (366.5 ± 67.7 vs. 373.8 ± 51.4, respectively), MV (369.3 ± 68.6 vs. 378.7 ± 51.5, respectively) or VIG (27.2 ± 1.3 vs. 4.9 ± 1.9, respectively).

**CONCLUSIONS:** Results indicated no significant difference in weekly time spent in SED or any PA category between week 1 and week 6. Time spent in both MOD and VIG was well above the 150 minutes per week CDC recommendation for PA for adults without chronic conditions. However, VIG activity averaged less than 5 minutes per week. Due to the short time span and small sample, it is difficult to evaluate the overall efficacy of the Livestrong program. However, these preliminary results are promising in that MOD PA is well above the national recommended threshold and SED time appears to be decreasing, though not significantly.

**Board #34**

**May 30 9:30 AM - 11:00 AM**

**The Effects Of Exercise Training From Different Cancer Treatments In Cancer Survivors**

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(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the effects of exercise training on muscular fitness and quality of life in cancer survivors undergoing differing clinical treatments: surgery alone, chemotherapy following surgery, radiotherapy following surgery, or chemotherapy and radiotherapy following surgery.

**METHODS:** This study recruited four groups of female cancer survivors based on the type of clinical treatments they had received: surgery alone (S, n=10), surgery and chemotherapy (SC, n=10), surgery and radiotherapy (SR, n=10), surgery and chemotherapy and radiotherapy (SCR, n=10). The exercise sessions lasted for 60 minutes including a 10-minute warm-up, 40 minutes of aerobic exercise, resistance training, and 10 minutes cool-down, 3 days per week for 6 months. Exercise intensity ranged from 40% to 60% of heart rate reserve depending upon the participant’s health status. The assessments and reassessments of muscular fitness (handgrip, peak torque of shoulder, elbow, and knee flexion and extension using Biodex S4 Pro) and quality of life were performed before and after the 6-month exercise training.

**RESULTS:** Cancer survivors in 4 groups following the 6-month exercise intervention showed significant (p < .05) improvements in shoulder flexility (+22.6–38.0%) and extension (+28.6–35.0%), elbow flexibility (+16.7–43.0%) and extension (+20.7–35.1%), and knee flexibility (+12.2–27.5%) and extension (+8.6–33.0%). In addition, handgrip was improved significantly (p < .05) in SC (+6.3%), SR (+9.8%), and SCR (+7.7%) groups, but not in the S group. Psychologically, all 4 groups showed significant (p < .05) improvements in total (+9.6–18.8%), and in health (+13.8–21.3%), social (+7.9–20.5%), psychological (+9.3–11.3%), and family (+6.9–16.4%) quality of life. Moreover, no significant differences were observed between groups on any of the domains of muscular fitness and quality of life.

**CONCLUSIONS:** The current study suggested that moderate intensity exercise intervention is a safe and efficacious means to augment muscular fitness and improve the quality of life of cancer survivors. Moreover, the muscular fitness and quality of life of cancer survivors improved as a result of the exercise intervention in this study, regardless of the type of treatments.

**Board #35**

**May 30 9:30 AM - 11:00 AM**

**Randomized controlled trial Of Colorectal Cancer Exercise Program for Colorectal Cancer Patient After Surgery**

Ki-yong An, Mi kyung Lee, Dong il Kim, Dong hyun Kim, Ji hee Min, Nam-kyu Kim, Justin Y. Jeon. 1Yonsei University, Seoul, Korea, Republic of. 2Yonsei University Severance Hospital, Seoul, Korea, Republic of.

(No relationships reported)

Recently, incidence of colorectal cancer is remarkably increasing in Korea. Exercise and physical activity have positive effects in colorectal cancer patients and they are revealed in many previous studies. Specially, the patients in recovery after surgery need exercise, so many surgeons recommend to walk for patients after surgery. However, except walking, there is not detail exercise manual. Also, among many previous studies, there is no exercise intervention study has colorectal cancer patients immediately after surgery for subjects.

**PURPOSE:** The purpose of this study is to examine the effect of colorectal cancer exercise program on recovery and physiological and psychological variables in colorectal cancer inpatient after surgery.
METHODS: Subjects in exercise group participated supervised exercise program 1–2 times per day on colorectal patients undergoing laparoscopic surgery during hospitalization. Supervised exercise program is mainly composed of stretching, core exercise on the bed and walking. And subjects in conventional group used conventional protocol. Anthropometric measurements and fitness test assessed at pre-surgery, discharge from hospital.

RESULTS: The result showed that subjects in exercise group decreased hospital stay during hospitalization. Subjects between both group have no significant difference in anthropometric measurements and fitness level variation.

CONCLUSIONS: The finding demonstrated exercise program for colorectal cancer inpatients have a positive effect in recovery variables in colorectal cancer patients after surgery.

1255 Board #36 May 30 9:30 AM - 11:00 AM
Effect Of Exercise On Bone Mass Density In Women With Postmenopausal Osteoporosis: A Case-control Study
Mariana Broccatelli¹, Antonio Sgadari², Simona De Bellonia², Roberto Bernabei², ¹University of Study “Foro Italico”, Rome, Italy. ²Catholic University of Sacred Heart, Rome, Italy. (No relationships reported)

Osteoporosis is a common disease with a spectrum ranging from asymptomatic bone loss to disabling hip fracture. Most guidelines suggest regular weight-bearing exercise, and combined (aerobic and resistance) training to prevent and treat osteoporosis. However, a recent review concluded that physical exercise (PE) slightly improves bone density and does not reduce the risk of having a fracture in postmenopausal women. It has been hypothesized that this paucity of effect may be due to relatively short duration of interventions, poorly standardized exercise protocols and high rate of loss to follow up.

PURPOSE: To assess whether a combined exercise program (2 times/week callisthenic exercises plus 3 times/week aerobic and resistance training) influenced BMD in 155 women with postmenopausal osteoporosis.

METHODS: Forty-seven women with either lumbar or femoral osteoporosis, exercising at the University Hospital Fitness Facility for at least one year were identified as cases (EXE). One hundred and eight sedentary controls, out from a pool of 5,434 attending the Osteoporosis Outpatient Clinic, were selected according to the following matching criteria: female gender, age ± 1.5 years, duration of the observation period ± 3 months, initial BMD value ± 5% (SED). Main outcome was percent change in BMD. Comorbidities, medications, risk factors for osteoporosis, level of physical activity, dietary intake of macronutrients as well as of Ca, K, P were recorded.

RESULTS: Baseline characteristics were similar between EXE and SED groups: mean (±s.d.) age was 64.6±4.2 vs. 68.8±6.4 years (n.s.), BMD at femoral neck 0.58±0.067 vs. 0.59±0.063 g/cm² (n.s.), and BMD at lumbar spine 0.72±0.067 vs. 0.73±0.074 g/cm² (n.s.). After an average follow-up of 36.5±13.1 months, BMD was increased in the EXE group by 2.23% at the femoral neck and by 3.65% at the spine, while it was decreased in the SED group (2.59% and 0.65%, respectively) (p<0.01 at both sites).

CONCLUSIONS: Our results showed that sedentary postmenopausal women had a significant decline in BMD over a 3-year period, while women undergoing a combined PE program increased their BMD both at the femoral neck and the lumbar level.


1256 Board #37 May 30 9:30 AM - 11:00 AM
Physical Exercise In Female Fibromyalgia Patients: Effects On Pain, Functional Capacity And Symptomatology
Ana Carbonell-Baeza¹, Virginia A. Aparicio², Inrocudulada C. Alvarez-Gallardo³, Alejandro Romero², Clelia M Martinis-Pereira, Ana M. Caevas², Pedro Femina², Francisco B Ortega², Pablo Tercedor², Jonatan R. Ruiz², Manuel Delgado-Fernández², ¹University of Cadiz, Cadiz, Spain. University of Granada, Granada, Spain. ²University of Granada, Granada, Spain. ³Universidade Federal Da Paraíba, Joao Pessoa, Brazil. ⁴University of Granada., Granada, Spain. Karolinska Institutet, Unit for Preventive Nutrition., Huddinge, Sweden. (No relationships reported)

Exercise interventions have been extensively used for the management of fibromyalgia, but it is unclear which mode of exercise is more suitable for this population.

PURPOSE: To compare the effects of three different physical interventions (i.e. multidisciplinary, Biodanza and Taichi) on women with fibromyalgia.

METHODS: A total of 146 women (51.6±7.0 years) volunteered to participate in the study and were allocated in 4 groups: control (n=34), multidisciplinary(n=41), Biodanza (n=37) and Taichi (n=38). Multidisciplinary and Taichi interventions were carried out 3 times/week and Biodanza 1 time/week over three months. The following variables were assessed before and after the interventions: tender points, functional capacity (i.e. the handgrip strength, 6 minutes walk, 8 feet up & go, chair sit and reach and chair stand tests) and the fibromyalgia impact questionnaire (FIQ). One-way analysis of covariance (group as fixed factor, change score (posttest-pretest) as dependent factor and pretest score as covariate) was performed.

RESULTS: The Taichi group presented greater improvements on the 8 feet up & go test than the multidisciplinary (Change score: -2.1±0.2 vs. -1.1±0.2, p=0.006) and the control groups (-2.1±0.2 vs. -0.5±0.02, p<0.001). The multidisciplinary and Taichi groups showed greater improvements than the control group on chair sit and reach test (7.4±2.1 vs. -3.0±2.2, p<0.005 and 9.9±2.3 vs. -3.0±2.2, p=0.001 respectively). The FIQ total score improved in the multidisciplinary (-8.8±2.3 vs. 4.7±2.3, p<0.001), the Biodanza (-12.7±5.2 vs. 4.7±2.3, p<0.001) and the Taichi (-7.4±2.5 vs. 4.7±2.3, p<0.003) groups compared with the control group. The Biodanza group presented a greater decrease on number of tender points than the Taichi group (-1.4±0.4 vs. 0.1±0.4, p<0.044).

CONCLUSIONS: The multidisciplinary, Biodanza and Taichi interventions improve the symptomatology in female patients. Taichi intervention improves the dynamic balance more than multidisciplinary and Biodanza interventions. Taichi and multidisciplinary interventions improve the lower body flexibility.

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1257 Board #38 May 30 9:30 AM - 11:00 AM
Heavy, Explosive Strength Training For Postmenopausal Women With Osteoporosis: A Pilot Study
Mats P. Mosti, Nils Kaehler, Astrid K. Stunes, Jan Hoff, Unni Syversen. Norwegian University of Science and Technology, Trondheim, Norway. (No relationships reported)

Current exercise guidelines recommend weight-bearing activities and strength training for patients with osteoporosis. It is still unclear what type of strength training that is most beneficial for improving physical capacity and bone mass in these patients. PURPOSE: The present study investigated the effects of a heavy, explosive strength training programme on physical capacity, bone mineral density (BMD) and content (BMC) in postmenopausal women diagnosed with osteoporosis or osteopenia.

METHODS: Twentyone women with osteoporosis or osteopenia (t-score < -1.5 in hip or spine) were randomized to a training group (TG, n=10) or control group (CG, n=11). The TG underwent 12 weeks of supervised strength training in a squat machine, at an intensity of approximately five repetitions maximum, with emphasis on explosive initiation of the concentric part of movement. The CG was encouraged to do non-supervised training in line with current exercise guidelines. Measurements included one repetition maximum (1RM), rate of force development (RFD), serum markers of bone formation (procollagen type I N-terminal propeptide (PINP)) and bone resorption (fragments of type I collagen C (CTX)) and BMC. BMD, BMC and bone area measured by Dual X-ray absorptiometry. Nonparametric statistics were used. RESULTS: One participant was excluded in the TG and four participants withdrew (one in the TG and three in the CG). 1RM and RFD were significantly increased in the TG with 154±75% and 52±46% respectively (p<0.05). BMC at the lumbar spine and femoral neck increased with 2.9±2.8% and 4.9±5.6%, respectively (p<0.05), while bone area increased with 2.4±2.0% and 5.2±5.1%, respectively (p<0.05). The 1RM and lumbar spine BMC improvements differed significantly from the CG (p<0.05). There was also a tendency to improved ratio of PINP/CTX (21%, p=0.09) in the TG. No significant changes were observed in the CG.

CONCLUSIONS: Heavy, explosive strength training appears to be safe and give beneficial effects on muscle strength, RFD and BMC in postmenopausal women with osteoporosis. These findings should be further investigated in a larger trial of longer duration.
Growing evidence indicates that physical exercise can prevent or improve bone loss. However, the standard of the deficient exercise is lacking.

PURPOSE: To observe the change of energy expenditure (EE), body composition (BC), BMD and muscle strength before and after 1 year of postmenopausal women, to explore the relationship between the indexes and bone mass, and to determine the best exercise to maintain bone mass.

METHODS: 62 compliant women, aged 50-60y, with BMD T-score < -1, were divided into exercise group (EG, n=32) and control (CG, n=30). EG exercised 3-4 times weekly for 1 year. PA and EE were determined by accelerometer. BMD and BC were measured by DXA. Hip's muscle strength was described by isokinetic peak-torque. Exercise intensity was assessed by portable metabolic test system. Paired and independent sample T tests were used within and between groups.

RESULTS: 1. EG were higher than CG in walking, physical activity (PA) and total dietary energy expenditure (TDEE) (all P<0.01). And difference was mainly caused by walking EE, which should be considered effective PAEE.

2. PA time of 3-6MET in EG was more than CG (P<0.01). During the exercise, mean heart rate was 117.5±9.4 bpm, maximum intensity 57.0±9.7 MET, exercise time 50min, and EE 312±74.2 Kcal. Moderate intensity exercise is adequate stimulus for maintaining EG bone mass.

3. After 1 year, EG decreased in weight, BMI and %F (all P<0.01), and increased in LBM% (P<0.01). For both groups, weight, BMI, %F, muscle mass and TDEE was correlated with whole body BMD (r=0.486, 0.475, 0.434, 0.386, 0.366, all P<0.01), and LBM% was negatively associated with BMD (r=-0.481, P<0.01). The BC optimization was important feature.

4. After 1 year, peak-torque values for hip flexion (90°/s, 180°/s) and extension (180°/s) in EG observably elevated (all P<0.01). BMD at main sites in EG were higher than CG (P<0.01-0.05). For EG, 1 year exercise effectively increased muscle strength, which was the primary cause of maintaining bone mass.

CONCLUSIONS: 1. Exercise can effectively maintain bone mass by improving muscle mass and strength.

2. Exercise of 3-4 times weekly, 50 min/time, and 3-6MET's moderate intensity is suitable for postmenopausal women to maintain bone mass.

3. Lower than 860 kcal PAEE can be considered as standard of exercise for postmenopausal women maintaining bone mass.

Individuals who suffer a spinal cord injury (SCI) experience pain as a secondary result of the injury. Pain can be difficult to treat as the experience is unique to each individual. If not treated effectively, pain can elevate levels of depression, anxiety, stress, and social isolation.

PURPOSE: To determine if exercise helps alleviate aspects of pain associated with SCI.

METHODS: Six subjects participated in 8 weeks of twice weekly exercise. Participants were required to complete 12 minutes of wheelchair propulsion and 50 minutes of resistance training. Resting heart rate (HR), blood pressure (BP), cardiorespiratory fitness, muscular strength, pain, depression, anxiety, stress, and perceived social support were assessed. Descriptive statistics were computed to determine changes in resting HR and BP. Subjects performed 6 minutes of arm ergometry and cardiorespiratory fitness was measured by changes in the rate of perceived exertion (RPE) and HR for the same workload. RPE and HR were taken each minute; a dependent t-test was used to determine changes in these variables. During the 12 minute bout, HR, number of completed laps, and the RPE given for each lap around the track were reported; repeated measures of analysis of variance was used to compare any change in these variables. Muscular strength was determined by the subject’s one repetition maximum (1-RM). Self report questionnaires were used to measure pain, depression, anxiety, stress, and perceived social support. A dependent t-test was used to determine changes in the measures of the 1-RM and questionnaire scores. For all statistical analyses the confidence interval was set at p<0.05.

RESULTS: The group experienced improvement in measures of cardiorespiratory fitness as seen in a decreased resting HR (p = .043), lower RPE at the fifth and sixth minute of arm ergometry (p = .042), lower RPE between each minute of arm ergometry (p = .029), and a lower RPE observed during the 12 minutes of wheelchair propulsion (p = .010). An increase in muscular strength for the chest press (p = .047) and deltoid press (p = .03) was observed. No significant differences were observed in the measures of pain, depression, anxiety, stress, and perceived social support.

CONCLUSIONS: Participation in weekly exercise improves physical functioning among individuals with SCI.

The effect of low back strengthening on balance performance in patients with lumbar sacralization

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Lumbosacral transitional vertebra (LSTV), commonly found between the fifth lumbar vertebra and the first sacral vertebra, of which the transverse processes fuse to different extent. The changes in spinal dynamics of LSTV may result in early disc degeneration, trunk instability and consequent low back pain (LBP). The patients with chronic LBP tend to show increased inhibition of quadriceps activity. However, it is unclear whether low back strengthening exercise improve the quadriceps strength in LBP patients with LSTV.

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PURPOSE: To investigate the low back strengthening effects of the LBP patients with LSTV on quadriceps isokinetic strength.

METHODS: Thirty LBP patients with LSTV were recruited and divided into two groups randomly assigned as Group A, the extensor-flexor group (age, 26.4 ± 11.2 years; body height, 171.9 ± 11.0 cm; body weight, 66.1 ± 13.5 kg) and Group B, the flexor-extensor group (age, 26.1 ± 10.2 years; body height, 170.6 ± 8.4 cm; body weight, 66.0 ± 16.7 kg). Two sessions of the training program were prescribed including the extension session and the flexion session each for 3 weeks, and the order of the two training programs was reversed between the two groups. The isokinetic strength of the knee extensor, measured by the Cybex, were compared between the two groups. Pain of low back and knee were evaluate by the visual analogus scale (VAS).

RESULTS: Quadriceps strengths were significantly improved in all 3 angular velocities of both right and left legs, particularly after extensor training. Low back extensor training was more efficient than flexor in pain control of the knee pain.

CONCLUSIONS: Low back strengthening training for LBP patients with lumbar sacralization may improve quadriceps isokinetic strength and low back/knee pain scale, particularly after extensor strengthening.

1262 Board #43 May 30 9:30 AM - 11:00 AM
Low Normalized Leg Strength in Obesity Predicts Habitual Physical Activity and Endurance in Knee Osteoarthritis
(No relationships reported)

Adults with knee osteoarthritis (OA) face multiple challenges with beginning exercise or participating in regular daily physical activity, especially if they are obese. It is unclear how normalized muscle strength relates to endurance time or habitual physical activity.

PURPOSE: To determine the associations between muscle strength, endurance time and habitual physical activity in obese and non-obese persons with knee OA.

METHODS: Participants with knee OA (68±7 yrs) who sought participation in an exercise program were stratified into obese (n=20; body mass index [BMI] 34±4 kg/m2, 49±9% body fat) and non-obese (n=20; BMI 25±3 kg/m2, 34±10% body fat). Maximal strength testing of the knee extensors and flexors, and maximal walking endurance tests were performed. Body fat was determined using the BODPOD. The Western Ontario McMaster Osteoarthritis (WOMAC) Index survey was administered to assess knee function with OA pain. Activity monitors were worn for 7 days to record daily activity. Regression analysis determined the contributions of normalized leg strength scores on treadmill endurance time, and average daily steps.

RESULTS: Walking endurance time was 31% lower in the obese group (p<0.001). Average WOMAC knee pain was similar between groups (5.2-5.5 points). Average daily steps taken were 3246±1131 and 4248±1365 steps, in the obese and non-obese groups, respectively (p<0.05). The time spent performing moderate daily activity was 30 minutes less in the obese group (p<0.05). WOMAC scores were not different between groups (33.2 vs 28.8 points). Maximal normalized leg press, leg curl and leg extension strength values were less in the obese group (p<0.05). After accounting for age and sex, normalized leg strength values were contributors to the variance of the models predicting walking endurance time (model R²=0.514-0.561, R² change range 0.218-0.265) and in habitual physical activity (R²=0.198-0.230, change range 0.104-0.136; all p<0.001).

CONCLUSIONS: Walking endurance and habitual physical activity were consistently predicted by leg strength in knee OA. Targeted resistance exercise may improve muscle strength and foster improvements in endurance and increased habitual physical activity in obese individuals, both of which would facilitate weight loss. Supported by NIH NIAMS RO3AR059786

1263 Board #44 May 30 9:30 AM - 11:00 AM
Efficacy And Effectiveness Of Exercise On Tendon Regions In Adults With Fibromyalgia: A Meta-analysis
George A. Kelley, FACSM, Kristi S. Kelley. West Virginia University, Morgantown, WV.
(No relationships reported)

PURPOSE: Fibromyalgia is a major public health problem affecting an estimated 200 to 400 million people worldwide. The purpose of this study was to determine the efficacy and effectiveness of randomized controlled exercise intervention trials (aerobic, strength training or both) on tendon regions (TP) in adults with fibromyalgia.

METHODS: Meta-analysis using random effects models and 95% confidence intervals (CI) with results partitioned according to per-protocol and intention-to-treat analyses.

RESULTS: Statistically significant reductions in TP were observed based on per-protocol analyses (8 studies representing 322 participants) but not intention-to-treat analyses (5 studies representing 338 participants) (per-protocol, g =-0.68, 95% CI =-1.16, -0.20; intention-to-treat, g =-0.24, 95% CI =-0.62, 0.15). Changes were equivalent to relative reductions of 10.9% and 6.9%, respectively, for per-protocol and intention-to-treat analyses.

CONCLUSIONS: Exercise is efficacious for reducing TP in women with FM. However, a need exists for additional well-designed and reported studies on this topic.

1264 Board #45 May 30 9:30 AM - 11:00 AM
Case review for 12 Weeks Of High-intensity Interval Training (HIT) in a Spinal Cord Injured Man
Christopher R. Harnish, Jonathan A. Daniels, Allison F. Keeley, David R. Gater, Hunter Holmes McGuire VAMC, Richmond, VA. (Sponsor: Edmond Acevedo, FACSM)
(No relationships reported)

Exercise may play an important role in managing the metabolic health consequences of SCI but little is known about the impact of arm crank ergometer (ACE) HIT or how to adapt it for individuals with SCI.

PURPOSE: To review the outcome of 12 weeks of periodic HIT in a man with chronic traumatic SCI.

METHODS: One 42 yo man (180 cm tall, 68.4 kg and 30.6% Fat) with C8/T1 AIS A SCI took part in 12 weeks of 3 days.week-1 ACE interval training. A continuous 2 min stage VO2Peak test was completed before, 6 and 13 weeks after training. During the first training session and at week 4, 8 and 12 a 30 min time trial (TT30) test was performed on a Monark 881E ACE to assess performance improvement; heart rate (HR) and mean power (W) were determined. Training was conducted on a LODE ACE and consisted of a combination of HIT that included three 5 min at ~70% Peak Power (WPeak) and 5 min recovery (HIIT5); four times 2.5 min at ~85% WPeak and 5 min recovery (HIIT2.5); ten times 1 min at ~110% WPeak and 2 min recovery (HIIT1). HR zones were set as <75% HRPeak (Z1), 75-89% (Z2), and 90+% (Z3) and HR was measured and stored for all training. HR training impulse (TRIMP) scores were calculated as: Z1 minutes + (Z2 minutes * 2) + (Z3 minutes * 3) and used to monitor overall training efficacy. DXA was used to estimate body fat pre and post training.

RESULTS: 33 sessions that included 8 HIT5, 10 HIT2.5, and 5 HIIT1 sessions were completed. WPeak and VO2Peak improved about 45% and 52%, respectively, by week 6 without further improvement at week 12. TT30 wattage improved 32% at week 4, 47% at week 8, and 56% at week 12. HR TRIMP scores decreased in the first 6 weeks as mean session wattage increased before showing a parallel increase for the remaining 6 weeks.

CONCLUSIONS: Persons with SCI exhibit widely varying exercise responses, regardless of level of injury. This case report demonstrates that even high-level paraplegics can achieve exceptional training outcomes and that ACE HIT may provide an effective training method for SCI. As with able-bodied persons, maximal performance plateau early, while submaximal performance may show longer term improvement. The latter supports the use of submaximal training assessment important in the long-term training monitoring for SCI. HR TRIMP data provides a useful means for monitoring and periodizing training in paraplegia with a normal HR response.

1265 Board #46 May 30 9:30 AM - 11:00 AM
Comparative Study Of The Effects Of Tai Chi And Strength Training On Osteoarthritis In Older Adults
Abhinandan Batra, Yong Tai Wang, FACSM, Elisabeth Burgess, Ann Pearman. Georgia State University, Atlanta, GA.
(No relationships reported)

PURPOSE: Osteoarthritis (OA) is a degenerative joint disorder and one of the leading causes of disability in elderly. Tai Chi is seen to be effective in relieving symptoms of OA knee joint. The main aim of this study was to design a Tai Chi program and/or a strength training program for the older adults with knee OA and to compare the effects of these programs on the range of motion, gait, pain and balance.
METHODS: Twenty participants age 55 and over were divided into two groups (Tai Chi and Strength training) based on predetermined criteria (Age, Grade of OA, balance). Both groups received respective form of exercises twice a week for 2 months. Both groups were assessed before and after intervention on WOMAC, Berg balance scale, ROM and Manual muscle testing Independent and paired t test were employed to determine the differences within each group and between two groups with significance level at p<.05.

RESULTS: Mean ages of the participants in both strength training and Tai Chi group were 82.8±10.6 years and 82±11.35 years respectively. Both the groups showed statistical significant improvement in WOMAC scores and balance. WOMAC score decreased for strength training group (52 to 40.5) and Tai Chi group (52.28 to 38.57). Balance score on the Berg balance scale improved for strength training group (36.75 to 46 at pc.05) and Tai Chi group (39.14 to 47.42 at pc.001). Significant increase in strength of lower limb muscle was seen in strength training group with no change in Tai Chi group. Though significant changes were seen within the group analysis, no such difference was found on comparing strength group to Tai Chi group.

CONCLUSIONS: Both groups demonstrated improvement in symptoms related to OA that both forms of exercise are effective and in improving symptoms related to OA but no evidence was found depicting Tai Chi to be better form of exercise than strength training.

1266 Board #47 May 30 9:30 AM - 11:00 AM Physical Activity, Sedentary Time, And Bone Health In Younger And Older Females

Suori Ishikawa, Youngdeok Kim, Minsoo Kang, FACSM, Don Morgan, FACSM. Middle Tennessee State University, Murfreesboro, TN.

(Please note: No relationships reported)

Recent studies have contributed on the impact of physical activity (PA) and sedentary behavior (SB) on metabolism and cardiovascular health in adults. Little is known, however, regarding the extent to which PA and SB impact bone mineral content (BMC) and bone mineral density (BMD) in females across the lifespan.

PURPOSE: To examine the impact of PA and SB on bone health in females from adolescence to old age.

METHODS: Data from 2,245 females aged 12 years and older collected as part of the 2007-2008 National Health and Nutrition Examination Survey (NHANES) were included in this analysis. Based on self-report, participants were categorized into three PA categories: sufficient moderate-to-vigorous recreational physical activity (S-MVPA), insufficient MVPA (I-MVPA), and no MVPA (N-MVPA). S-MVPA was defined as ≥150 minutes per week of moderate recreational PA (RPA) or an equivalent amount of vigorous RPA for adults (≥19 years of age) or ≥60 minutes per day of MVPA for adolescents (12 to 18 years of age). Values of BMC (g) and BMD (g/cm2) of total femur and total spine were measured by dual energy x-ray absorptiometry. Categories of PA and self-reported minutes of SB (i.e., sitting or reclining, excluding sleeping) were used to predict BMC and BMD of the femoral and spinal regions in four age groups [i.e., adolescents (12-18 years), young adults (19-39 years), middle-aged adults (40-64 years), and older adults (>64 years)] after controlling for nutritional intake and body mass index (BMI). SAS 9.2 SURVEYREG procedures with ESTIMATE statement were used to account for the multistage and complex nature of the NHANES sampling scheme.

RESULTS: Female adolescents in the S-MVPA category displayed significantly greater femoral BMC, femoral BMD, spinal BMC, and spinal BMD compared to those in N-MVPA category (b=3.01, 0.07, 4.72, and 0.04, respectively, p<.05). In older adults, SB was also a significant predictor of femoral BMC and BMD (b=-0.004 and -0.0001, respectively, p<.05), such that an increase in SB resulted in lower femoral BMC and BMD.

CONCLUSIONS: These findings suggest that engaging in S-MVPA during adolescence and reducing sedentary time in the elderly may contribute to improved bone health in females.

1267 Board #48 May 30 9:30 AM - 11:00 AM Pilates is More Effective than Common Exercise Program for Treatment of Forward Head Posture


(No relationships reported)

BACKGROUND: Forward head posture (FHP) is defined as the anterior positioning of the cervical spine, which is one of the most common postural problems in modern society. Recently, Pilates has been reported to be effective exercise for correcting postural problems.

PURPOSE: To compare the effects of Pilates and common exercise program on improvements in craniovertebral angle (CVA), cervical range of motion (cROM), pain, and muscle fatigue in FHP

METHODS: Twenty eight sedentary women with FHP, aged between 20 and 39, participated in this study. They were randomly divided into two groups; Pilates exercise group (PG, n=14) and common exercise group (CG, n=14). Pilates exercise program consisted of ancient Pilates focused on FHP-related major muscle group. Common exercise program consisted of stretching and resistance exercise. The visual analog scale (VAS) was used to scale knee pain. Cybex NORM was used to measure isometric strength of low back flexor, extensor and isokinetic strength of quadriceps at 60°/sec, 120°/sec and 180°/sec. Two-way ANOVA with repeated measures in the 1st session tested the significance of main and interaction effects between training group factor and pre-post training factor. The training effects in the 2nd session were analyzed by prescription.

RESULTS: PG significantly increased CVA (65.6±5.43° vs. 70.0±4.78°, p<.002), and PG did not change in CG. PG also significantly increased 5 of 6 cROM items: flexion (35.1±6.39° vs. 46.6±4.83°, p<.004), extension (50.1±4.17° vs. 57.0±5.83°, p<.037), R. sideflexion (29.5±3.12° vs. 34.0±3.78°, p<.006), R. rotation (51.5±10.63° vs. 57.8±5.81°, p<.045), L. rotation (51.7±6.6° vs. 57.0±7.3°, p<.033). PG did not change in CG and cROM items. Among sEMG factors, only SCM was significantly increased in PG (27.27±11.26 Hz vs. 43.51±17.29 Hz, p<.009), but not in CG. VAS and NDI were significantly decreased in both groups.

CONCLUSIONS: These results indicate that Pilates is more effective to improve CVA, cROM, and, in part, muscle fatigue than common exercise (a combination of stretching and resistance exercise). It suggests that Pilates can be recommended as an appropriate exercise for FHP treatment, and may be extended for other patients with neuromusculoskeletal problems.

1268 Board #49 May 30 9:30 AM - 11:00 AM Low Trunk Strengthening Effects on Patellofemoral Pain Syndrome

Chiping Lai1, Guosheng Li1, Chingya Hung1, Jooping Li1, Chenghsia Lai1, Shihwei Chou1, 1Taipei Physical Education College, Taipei, Taiwan. 2Chang Gung Memorial Hospital, Taoyuan, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)

(No relationships reported)

Patellofemoral pain syndrome (PFPS) is a common knee problem. Quadriceps strengthening has been suggested to treat patients with PFPS. The quadriceps muscle was inhibited after lumbar paraspinial fatiguing exercise in the absence of quadriceps fatigue.

PURPOSE: To investigate low back strengthening effects on the patients with PFPS in terms of (1) low trunk isometric strength, (2) quadriceps isokinetic strength, and (3) knee pain scale.

METHODS: Eighteen knees of sixteen patients with PFPS were randomly divided into two groups, group A (extensor-flexor, 9 knees of 8 patients) and group B (flexor-extensor, 9 knees of 8 patients). In the 1st 3-week session of training group A started low trunk extensors strengthening and group B did flexor and in the 2nd 3-week session, the training programs were shifted between groups. The visual analog scale (VAS) was used to scale knee pain. Cybex NORM was used to measure isometric strength of low back flexor, extensor and isokinetic strength of quadriceps at 60°/sec, 120°/sec and 180°/sec. Two-way ANOVA with repeated measures in the 1st session tested the significance of main and interaction effects between training group factor and pre-post training factor. The training effects in the 2nd session were analyzed by prescription.

RESULTS: After the 1st session of training, interaction effects were significant (p<.05), indicating extensor training significantly increase low trunk extensor strength and vice versa. No interaction effects occur in isokinetic strength of the quadriceps between two groups at all three angular velocities. The VAS of knee pain appeared to be improved more in group A than B (51.83% vs. 36.07%). After the 2nd session, group B increased low trunk extensor strength and group A increased flexor strength. Isokinetic strength of the quadriceps in group B was improved more than group A at all three angular velocities. Extent of knee pain relief in group B seemed to be more than group A.

CONCLUSIONS: Low trunk strengthening training increases specific strength of either extensor or flexor muscles. However, extensor strengthening seemed to be more effective in patellofemoral pain relief and quadriceps strength enhancement.
METHODS: The teenage years are one of the most critical stages of bone mineral acquisition. Maturation may also be related to changes in cardiovascular fitness. However, little is known about the relations among menarcheal status, cardiovascular fitness and bone health during this timeframe.

RESULTS: The third order polynomial was found to be most suitable for the regression polynomial. When it was applied to individual female Korean athletes with respect to the regression evaluation, positive scores were obtained for nearly all athletes and an overall delay in menarche was seen. Delayed menarche was not seen, however, in archery athletes. A strong delay in menarche was thus found in Korean athletes.

CONCLUSIONS: (No relationships reported) It was found that 80% had moderate or greater menstrual pain and a close relation with menstrual abnormalities, suggesting that delayed menarche may be a barometer for menstrual abnormalities. The demonstration of delayed menarche in Korean female athletes from the above suggests the validity of the delayed menarche evaluation.

PURPOSE: To longitudinally examine relationships between HRPF tests in young children,

MAY 30  11:00 AM - 12:30 PM
Longitudinal Relationships Between Health-related Physical Fitness Test Item Performances In Elementary-aged Children
Loran D. Erdmann, Cathy S. McMillan. Western Illinois University, Macomb, IL. (Sponsor: Michael P. Godard, FACSM)
(No relationships reported)

Longitudinal study of health-related physical fitness (HRPF) in children is limited.

PURPOSE: To examine odds ratios and sex differences in staying in the at-risk groups among middle school children across a 31-month period.

RESULTS: Odds ratios of staying in the at-risk groups at the follow-up in fitness measures ranged from 2.6 (95% CI: 1.3-5.1) to 20.4 (95% CI: 7.7-84.7) for those initially in the at-risk groups relative to those who were in the HFZ groups at baseline. Across the 31 months the numbers or percentages of boys in the at-risk groups decreased in %BF (23 vs. 19, -17%), BMI (28 vs. 24, -14.3%), PACER (39 vs. 31, -20.5%), and curl-up (12 vs. 9, -25%); and remained no change in push-up (31 vs. 31, 0%) and sit and reach (15 vs. 15, 0%). In a sharp contrast with boys, the numbers of girls in the at-risk groups increased in %BF (18 vs. 23, +27%), BMI (29 vs. 35, +20.7%), PACER (24 vs. 39, +62.5%), and push-up (38 vs. 51, +34.2%); and decreased in curl-up (24 vs. 11, -54.2%) and sit and reach (47 vs. 29, -38.3%).

CONCLUSIONS: (No relationships reported) Children of roughly 11 years old who are at risk in fitness levels are much more likely to be in the at-risk groups later relative to those who are in the HFZ groups at baseline. In addition, during the middle school period more girls tend to become at risk in fitness levels, whereas numbers of boys in the at-risk groups tend to decrease.

MAY 30  11:00 AM - 12:30 PM
Construction of Delayed Menarche Evaluation in Korean Female Athletes
Katsunori Fujii, FACSM. Aichi Institute of Technology, Toyota, Japan. (No relationships reported)

METHODS: The subjects were 150 second grade female students at a physical education high school in the suburbs of Pusan, South Korea. A questionnaire survey of these girls was conducted, from which their date of birth, age at menarche, and athletic activities in elementary, junior high school, and high school were obtained. In addition, health check records were examined retrospectively, and longitudinal growth data for height were obtained from the 1st grade of elementary school (7 years old) until the second year of high school (17 years old). One hundred twenty-four girls for whom all data were available were selected. Next, the same survey as above was also done for second grade students at a general high school in the same area, as a control group. Three hundred forty-five non-athletes for whom all data were available were selected. In the analysis, first the wavelet interpolation method was applied to the longitudinal height growth data for the athlete and control groups, and age at MPV was determined from the velocity curve.

RESULTS: The order polynomial was found to be most suitable for the regression polynomial. When it was applied to individual female Korean athletes with respect to the regression evaluation, positive scores were obtained for nearly all athletes and an overall delay in menarche was seen. Delayed menarche was not seen, however, in archery athletes. A strong delay in menarche was thus found in Korean athletes.

CONCLUSION: (No relationships reported) It was found that 80% had moderate or greater menstrual pain and a close relation with menstrual abnormalities, suggesting that delayed menarche may be a barometer for menstrual abnormalities. The demonstration of delayed menarche in Korean female athletes from the above suggests the validity of the delayed menarche evaluation.

1269 Board #50  MAY 30  11:00 AM - 12:30 PM
Odds Ratios and Sex Differences in Staying in at-Risk Fitness Categories among Middle School Children
Traci D. Zilifro, Wenhao Liu, Randall A. Nichols. Slippery Rock University, Slippery Rock, PA. (No relationships reported)

Fitness tracking statistics such as Pearson or Spearman rank correlations, kappa values, and percentage agreements in percentiles provide little guidance for intervention for adolescents because they just describe the stability of relative rank/position and fail to address the overall change in test scores relative to Fitnessgram Healthy Fitness Zone (HFZ). Fitness tracking studies providing more meaningful information are needed.

PURPOSE: To examine odds ratios and sex differences in staying in the at-risk groups among middle school children across a 31-month period.

METHODS: Physical activity data were collected in 6th through 8th grade from 676 girls who participated in the national health and nutrition examination survey (NHANES) 1999-2004. The participants were categorized into an at-risk group (not in HFZ) and a HFZ group (in HFZ) at the baseline and the follow-up for each fitness measure. Odds ratios and sex differences in staying in the at-risk groups across the 31-month period was examined with crosstabs.

RESULTS: Odds ratios of staying in the at-risk groups at the follow-up in fitness measures ranged from 2.6 (95% CI: 1.3-5.1) to 20.4 (95% CI: 7.7-84.7) for those initially in the at-risk groups relative to those who were in the HFZ groups at baseline. Across the 31 months the numbers or percentages of boys in the at-risk groups decreased in %BF (23 vs. 19, -17%), BMI (28 vs. 24, -14.3%), PACER (39 vs. 31, -20.5%), and curl-up (12 vs. 9, -25%); and remained no change in push-up (31 vs. 31, 0%) and sit and reach (15 vs. 15, 0%). In a sharp contrast with boys, the numbers of girls in the at-risk groups increased in %BF (18 vs. 23, +27%), BMI (29 vs. 35, +20.7%), PACER (24 vs. 39, +62.5%), and push-up (38 vs. 51, +34.2%); and decreased in curl-up (24 vs. 11, -54.2%) and sit and reach (47 vs. 29, -38.3%).

CONCLUSIONS: (No relationships reported) Children of roughly 11 years old who are at risk in fitness levels are much more likely to be in the at-risk groups later relative to those who are in the HFZ groups at baseline. In addition, during the middle school period more girls tend to become at risk in fitness levels, whereas numbers of boys in the at-risk groups tend to decrease.
METHODS: HRPF test data were collected annually from one school district, over an 18-year period, and included: 1-mile run/walk (MR, in elapsed time); double-leg sit-and-reach (SU); pronated-grip pull-up (PU); and 1-min sit-up (SU). Data were retained from 167 boys and 165 girls who were (a) baseline tested as 5- or 6-year-old kindergartners, (b) subsequently tested in each of grades 1, 2, 3, 4, and 5; and (c) had complete data at all grades. Pearson’s r values were used to examine relations of MR to SR and SU performances, as well as relations of SR to SU performances. Spearman’s rho correlations were used to examine relations of PU to MR, SR, and SU performances, as PU data were nonparametric. All analyses were sex- and-grade specific. P values < .05*, .01**, and .001*** are reported.


CONCLUSION: For boys and girls across the elementary grades, there are weak to moderate significant inverse correlations in MR times to both SU and PU performances and weak to moderate positive correlations of MR to SU performances. Although SR performance is significantly related to other HRPF test performances at some grades for both genders, the strength of these relations is only very weak to weak. For these HRPF test item pairs, generally the relational direction remains consistent and the relational strength changes little as young children progress through elementary school.

1273 Board #54 MAY 30 11:00 AM - 12:30 PM
Physical Self-Perception and Physical Fitness in Adolescents With and Without Autism Spectrum Disorders
Chien-Yu Pan1, Chia-Hua Chu2, Chia-Liang Tsai2, Kai-Wei Hsieh2, Ya-Lin Li3, Shih-Tse Huang1. 1National Kaohsiung Normal University, Kaohsiung, Taiwan. 2National Cheng Kung University, Tainan, Taiwan. 3Shizuoka Sangyo University, iwata, Japan. (No relationships reported)

Physical self-perception (PSP) exerts a crucial role during adolescence. Research has demonstrated that positive associations of PSP with physical fitness (PF) (Carraro, Scarpa, & Ventura, 2010). However, social and behavioral deficits and sometimes motor skill difficulties demonstrated by individuals with autism spectrum disorder (ASD) could limit opportunities for them to successfully participate in physical activity, and therefore, may put them at risk for being physically inactive and unfit.

PURPOSE: (a) To compare PSP and PF in adolescents with and without ASD, and (b) to assess the relationship of PSP with PF within each group.

METHODS: Thirty-one males with ASD and 36 males without ASD aged 12-18 (14.68±1.55 yrs) participated. The PSP was assessed with a questionnaire originally developed by Whitehead (1995) and translated into Chinese with a high degree of reliability and validity (Hagger, Biddle, Chow, Stamblouka, & Kavussanu, 2003). The BROCKPORT Physical Fitness Test was used for PF measures. Independent t tests were used to compare group differences in PSP and PF. Pearson product-moment correlation coefficients were calculated to evaluate the relationships of PSP with PF within each group. Significance was set at p<0.05.

RESULTS: Findings indicate that (a) adolescents with ASD perceived significantly poorer scores on physical condition (t=2.47, p<0.05), sport competence (t=2.05, p<0.05), and general self-worth (t=1.53, p<0.05), (b) adolescents with ASD demonstrated significantly poor scores on 20-m PACER (t=2.31, p<0.01), isometric push-up (t=-1.62, p<0.01), and back-saver sit-and-reach (t=2.80, p<0.01), (c) for adolescents with ASD, physical condition was associated with 20-m PACER (r=0.58, p<0.01); sport competence was associated with sit-up (r=0.37, p<0.05), and (d) for adolescents without ASD, physical condition (r=0.51, p<0.01) and sport competence (r=0.41, p<0.05) were associated with 20-m PACER; attractive body was associated with sit-up (r=0.35, p<0.05); general self-worth was associated with sit-and-reach (r=0.39, p<0.05).

CONCLUSION: Adolescents with ASD perceived less favorable PSP than adolescents without ASD. PSP and PF indicators were related, despite incomplete overlap between the two variables in each group. Supported by Taiwan NSC grants 99-2410-H-017-036-MY2.

1274 Board #55 MAY 30 11:00 AM - 12:30 PM
Faster Heart Rate Recovery and Higher Short-term Muscle Power in Physically Active Preschool Children
Leigh Gabel, Nicole A. Proudfood, Joyce Obeid, Brian W. Timmons. McMaster University, Hamilton, ON, Canada. (No relationships reported)

Aerobic fitness has a protective effect on metabolic and cardiovascular health and is positively related to physical activity in youth and adults. There is a paucity of literature examining fitness in preschool children (3- to 5-year olds); thus, little is known about the relationships between physical activity and fitness in this young age group.

PURPOSE: To investigate the relationships between physical activity patterns and fitness (aerobic and short-term muscle power) in a sample of preschool children.

METHODS: Ninety-six preschoolers (4.4 ± 0.9 years; 50 female) participated in the study. Children performed a maximal treadmill assessment (Bruce Protocol) with heart rate (HR) monitored throughout the test and into 1-min of recovery (HR60secpost). Aerobic fitness was assessed by heart rate recovery (HRR = HRmax - HR60secpost). Short-term muscle power was determined by peak power output using a modified 10-sec Wingate cycling protocol. Physical activity patterns were assessed by the duration and frequency of bouts of moderate-to-vigorous physical activity (MVPA) using accelerometer for seven consecutive days with 3-second epochs. Only children who achieved a HRmax of ≥180 bpm on the treadmill test and who wore the accelerometer for ≥3 days for ≥5 hours/day were included in analyses. Pearson correlation coefficients were used to assess the relationships between physical activity and fitness. Both physical activity and short-term muscle power were significantly related to age; thus, partial correlations controlling for age were used.

RESULTS: Average HRmax on the treadmill test was 195 ± 7 bpm with a HRR of 63 ± 14 bpm. HRR was positively related to the frequency of bouts of MVPA (r=0.29, p<0.01). Average peak power on the modified Wingate test was 4.6 ± 1.5 Watts/kg and was positively related to the duration of bouts of MVPA (r=0.23, p=0.03).

CONCLUSIONS: Preschool children who engage in more frequent bouts and longer duration of bouts of MVPA have faster HRR and higher short-term muscle power, respectively, compared to preschoolers who engage in less frequent and shorter duration of bouts of MVPA.

1275 Board #56 MAY 30 11:00 AM - 12:30 PM
Characteristics of Physical Fitness According to the Level of Obesity Index among Young Children
Kosho Kasuga1, Takahiro Nakano2, Kazuo Oguri2, Keisuke Fukutomi1. 1Gifu University, gifu, Japan. 2Nagoya Gakuen University, seto, Japan. 3Shizuoka Sangyo University, iwata, Japan. 4Gifu Sports Science Training Center, gifu, Japan. (Sponsor: Kiyoji Tanaka, FACSM) (No relationships reported)

Many reports have shown that the prevalence of obesity in Japanese children, including infants, has been increasing. The number of children diagnosed with infant metabolic syndrome is also on a rise. Moreover, in recent years, there has been an increase in the number of lean children in Japan.

PURPOSE: The purpose of this study is to examine the characteristic of physical fitness according to level of obesity index among young children (age, 3-6 years) by using a large dataset.

METHODS: This study included 5640 young children (2840 boys and 2800 girls). We administered physical fitness tests comprising 7 exercises to gauge the physical fitness status of these children. A T-score was calculated on the basis of the mean and standard deviation according to sex and age; this score was used as an individual score of physical fitness. The children were divided into 7 groups based on their obesity index. Further, the extent of differences among children with different obesity index was examined for each type of exercise. To conduct a statistical analysis of the data, one-way ANOVA and multiple comparisons (Tukey’s HSD test) were employed.

RESULTS: Statistical analysis showed a significant difference among the groups for all the exercises. The children in the “+20% or more” group had the lowest scores in 25-m run, standing long jump, and upright hand standing time. The children in the “+15% or less” group had the lowest scores in softball throw, sitting trunk flexion, side-step, grip strength, and overall physical fitness.

CONCLUSIONS: The physical fitness of obese (+20% or more) and lean (-15% or less) children was found to be poor. The poor physical fitness in lean children may be due to low muscle mass and underdevelopment because of the lack of any physical activity. Moreover, their low energy expenditure may result in a low appetite, which can lead to poor nutrition. In contrast, the severely obese children (+20% or more) may be underdeveloped due to the lack of any physical activity and consumption of an excessive and unbalanced diet. However, the mildly obese (up to +15%) are not physically underdeveloped at infancy, and do not need extreme obesity prevention measures. It is important for them to adopt a “play a lot, eat a lot” lifestyle.
1276 Board #57 MAY 30 11:00 AM - 12:30 PM
The Relationship Between The Development Of Physical Fitness And Lifestyle Behavior In Young Children
Takahiro Nakano$^1$, Kosho Kasuga$^2$, Kazuo Oguri$^1$. $^1$Nagoya Gakuen University, Aichi, Japan. $^2$Gifu University, Gifu, Japan. (Sponsor: Kiyoi Tanaka, FACSM)

Recently, the decline in children’s physical fitness has become a big problem in Japan for not only older children but also young children. Childhood is very important period for acquisition of basic lifestyle behavior. Many studies have shown a relationship between physical fitness and lifestyle behavior. However, few studies have examined the relationship between the development of physical fitness and lifestyle behavior. Such studies have been particularly rare in young children.

PURPOSE: The purpose of this study was to examine the relationship between the development of physical fitness and lifestyle behavior in young children using longitudinal data.

METHODS: The subjects of this study were 311 young children. We measured seven parameters related to physical fitness: grip strength, upright hand standing time, sitting trunk flexion, 25-meter run, standing long jump, side step, and softball throw. As well, we administered a questionnaire about daily lifestyle behavior. We calculated the development of physical fitness using two-years longitudinal data for the same young children, and calculated the correlation coefficient between the amount of development and daily lifestyle behavior. Further, we examined differences in lifestyle behavior between groups whose physical fitness developed well or did not, using a chi-square test and independent t-test.

RESULTS: The lifestyle behaviors related to several physical fitness items were “Bedtime,” “TV viewing time,” “video-game playing time,” “active play with body movement” and “active play with family”. Significant differences were confirmed between the high-development group and the low-development groups in 7 items, including “TV viewing time,” “video-game playing time,” “number of friends usually playing together,” and “keeping a regular lifestyle”.

CONCLUSION: Relationships between young children’s physical fitness and several lifestyle behaviors were confirmed. It is suggested that physical fitness is easy to develop in children who have a regular lifestyle and a lot of friends to play with. In addition, it is suggested that the development of young children’s physical fitness is promoted by improving lifestyle behaviors such as TV viewing time and video-game playing time.

1277 Board #58 MAY 30 11:00 AM - 12:30 PM
Use Of Exergaming For Obtaining Moderate And Vigorous Physical Activity In Children
Magdalene Horton, Larry Kennard, Scott E. Coutler, FACSM. University of Massachusetts Boston, Boston, MA.

There are a growing number of PA programs that now include interactive video games (exergames) as part of an activity routine; however, it is unclear, if these games are a viable alternative for children obtain moderate and vigorous PA (MVPA).

PURPOSE: The purpose of this study was to examine the energy cost of children playing exergames. A secondary purpose was to see how the energy cost of exergames compares to other commonly performed activities.

METHODS: Fifty-three boys and 50 girls (mean±SD; age 11.5±1.7 yrs, BMI%ile, 68.6±28.4 %) performed 30-min of lying rest. Each participant was then randomly assigned to perform one of three activity routines consisting of six activities. Participants were familiarized with all activities prior to testing. Exergames included were: Nintendo Wii, Floor-based LightSpace, Wall-based LightSpace, Dance Dance Revolution, SportWall, and Cybex Trazer. Oxygen consumption was measured using a Cosmed Kib. Measured METs (measured activity VO2/measured resting VO2) were calculated for each activity. Data were also examined for differences between genders, age groups (8-9, 10-11, and 12-15 yrs) and BMI (normal weight [<85% for age and sex], overweight (85%-95% for age and sex), and obese (>95% for age and sex)).

RESULTS: On average, the mean METs for playing the Nintendo Wii were 2.5 METs. All other exergames had a mean MET value of at least moderate intensity (range; 3.4-5.3 METs). In general, there were no differences between gender, age, or BMI categories, except for: Nintendo Wii (overweight, 3.6 METs vs. normal weight and obese, 2.6 METs), Cybex Trazer (9 yrs, 2.5 METs vs. 10-11 yrs 3.9 METs vs. ≥12 yrs 5.0 METs) and SportWall (8-9 yrs, 2.7 METs vs. 10-11 yrs 4.5 METs vs. ≥12 yrs 6.9 METs). Playing exergames resulted in similar MET values as other commonly performed PA in children (e.g., slow and brisk track walking, track running, playing catch, and soccer).

CONCLUSION: The results of this study show that, in general, the energy cost to play exergames is at a moderate intensity or greater. Exergames could be an alternative way for children to obtain MVPA in addition to the use of more traditional activities. However, there may issues related to age and BMI that need to be further investigated as not all activities work equally well for all individuals.

Study supported by NIH grant 5R21HL093407-02.

1278 Board #59 MAY 30 11:00 AM - 12:30 PM
Compliance with Physical Activity Recommendations and Blood Pressure In Preschool Children
Jorge Mota, Sandra Santos, Rute Santos, Luisa Soares-Miranda, Carla Moreira, Sandra Abreu, Susana Vale. Research Centre in Physical Activity health and Leisure, Porto, Portugal.

PURPOSE: Research suggests that moderate levels of PA are predictors of lower values of systolic and diastolic blood pressure (SBP and DBP). However, few studies addressed this issue in pre-school children. The purpose of this study was to analyse the associations between compliance of PA recommendations and SBP of preschool children.

METHODS: The sample comprised 593 preschool children (48% female) with mean age of 5.3 years. Physical activity was assessed during 7 consecutive days by accelerometer (Actigraph GTM1). We analyzed the recommendation of at least one hour daily of moderate-vigorous PA (MVPA). Blood pressure was measured using the Colin monitor. The measurements were performed with each subject seated and rested for at least five minutes before the test. Percentage of fat (%) was calculated using the equation of Westrate and Durenberg (1990).

RESULTS: The prevalence of BP above the 90th percentile (P90) was 7.8% and 1.3% respectively for SBP and DBP. We found that about 16.5% of the girls and 8.2% of the boys did not accomplish the recommended daily MVPA. Girls who did not meet the daily recommendations of MVPA were twice as much more likely to have SBP values above the P90 compared to those who meet the daily recommendations (OR: 2.6; CI 95%:1.0-6.6; p=0.05), even after adjustment to fat mass.

CONCLUSION: We found an association between the accomplishment of daily PA recommendations and SBP in pre-school children in girls.

1279 Board #60 MAY 30 11:00 AM - 12:30 PM
After-School Exercise Increases Endothelial Progenitor Cells in Overweight and Obese Children
Jong-Hwan Park$^1$, Masashi Miyashita$^2$, Yoshio Nakamura$^3$, Hyun-Tae Park$^2$, Yoo-Chan Kwon$^1$, Eun-Hee Kim$^1$, Jin-Kee Park$^1$, Ki-Beum Park$^1$, Sang-Kab Park$^1$, Chang-Min Park$^1$. $^1$Waseda University, Saitama, Japan. $^2$National Center for Geriatrics and Gerontology, Aichi, Japan. $^3$Dong-A University, Busan, Korea, Republic of.

Obese children who are home alone after school have limited time to be active outdoors and unlimited access to junk food, video games and electronic devices which can lead to a more sedentary lifestyle. The role of bone marrow-derived circulating endothelial progenitor cells is to maintain endothelial function and organ perfusion. Endothelial dysfunction is associated with the childhood obesity and is closely linked to the amount and function of endothelial progenitor cells. However, it remains unclear whether endothelial progenitor cells increase with after-school exercise in overweight and obese children.

PURPOSE: The purpose of this study was to investigate the effects of an after-school exercise program on endothelial progenitor cells in overweight and obese children.

METHODS: Total of 29 overweight/obese children were randomly divided into the control (i.e., no after-school exercise, n = 14) or after-school exercise (n = 15) groups. The 12-week after-school exercise intervention consisted of 3 days of combined aerobic and resistance exercise per week. Each 80-minute exercise programme included 10 minutes of warm-up and 10 minutes of cool-down after school. CD34+ (a cell surface marker on hematopoietic stem cells), CD133+ (a cell surface marker on hematopoietic progenitor cells) and CD34+/CD133+ (considered as endothelial progenitor cells) were measured at baseline and after 12 weeks using flow cytometry.

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RESULTS: Increased percentages of CD34+, CD133+ and CD34+/CD133+ were observed in the after-school exercise group (p = 0.018; p = 0.001; p = 0.002, respectively) compared with the control group. Carotid intima-media thickness decreased after 12 weeks in the after-school exercise group (p = 0.020) compared with the control group. Circulating concentrations of vascular endothelial growth factor and nitric oxide were increased in the after-school exercise group (p = 0.013; p = 0.005, respectively) compared with the control group.

CONCLUSIONS: This study provides preliminary evidence that an after-school exercise programme may represent an effective intervention strategy for improving vascular repair and endothelial function, leading to improved cardiovascular health in overweight and obese children.

1280 Board #61 MAY 30 11:00 AM - 12:30 PM
Physical Activity, Focused Education and Endothelial Function in an Obese Teen: A Case Study
Anna Gabbard, Nabil Boutagy, Elise Maniguet, Alison Peters, Shannon Ison, John W. Wygard, Robert M. Otto, FACSM, Adelphi University, Garden City, NY. (No relationships reported)

Endothelial function plays a significant role in vascular health. Normal endothelial function includes release of vasoactive substances and growth factors to maintain vascular homeostasis. Endothelial dysfunction (Reactive Hyperemia Index [RHI] < 1.67) can be defined as a loss of balance between vasoconstrictors vs vasodilators and other inflammatory factors. Endothelial dysfunction is precursor to atherosclerosis and is implicated in obesity, diabetes and hypertension. EndoPAT noninvasively assesses endothelial function by reactive hyperemia-pulse amplitude tonometry (RH PAT). Endothelial function is calculated by measuring blood vessel diameter relative to resting, occluded and hyperemic conditions.

PURPOSE: To determine whether a combined education and physical activity program has an effect on endothelial function in an obese female (age 18 yr, wt 108 kg, ht 170 cm, BMI 37.4 m/kg²).

METHODS: EndoPAT was performed in a thermo-neutral environment with the subject supine and both index fingers in the EndoPAT probe. A blood pressure cuff (BPc) was placed on the subject’s non-dominant arm. Baseline data were collected for 5 minutes. The BPc was inflated to ≥200 mmHg for complete occlusion for 5 minutes, rapidly released and post-occlusion data were collected. Body composition was measured by skinfolds & waist to hip (W/H) with Gulick tape. The intervention was a 12 week program of nutrition and physical activity education combined with twice weekly exercise sessions designed to reduce obesity and modify the participant’s obesogenic environment. Each 60 minute exercise session, consisted of 20-35 minutes of aerobic interval cross training on 4-7 exercise machines at 65-85% HRmax for 5 min. each. A circuit of resistance training was performed on 12 Nautilus resistance machines to an intensity of momentary muscular fatigue.

RESULTS: The subject reduced body mass 10.8%, BMI 10.9%, body fat 7.3%, W/H 2.5%, and improved muscular strength 79% (10 RM leg press). RHI improved from dysfunction of 1.46 at baseline to normal function of 2.61 following intervention.

CONCLUSION: A cardiovascular and resistance training intervention improved endothelial function, body composition and muscular strength in an obese teen and attenuated cardiovascular risk.

1281 Board #62 MAY 30 11:00 AM - 12:30 PM
Comparison Between Individual And Averaged Methodologies For Anaerobic Threshold Assessment Of Age-group Swimmers
Marisa Sousa, João Paulo Vilas-Boas, Ricardo Fernandes, University of Porto, Faculty of Sports, Porto, Portugal. (Sponsor: Carlo Baldari, FACSM) (No relationships reported)

The assessment of the velocity corresponding to anaerobic threshold (vAnT) is frequently part of elite swimmers training program in order to diagnosis their aerobic performance. However, the velocity corresponding to blood lactate concentration ([La]v=4) of 4 mmol/l (v4), an averaged value proposed for standard more than 30 years ago, is often used in detriment of individualized protocols; in addition, rarely swimmers of young ages are involved in training control.

PURPOSE: To compare the vAnT of 10-11 years old swimmers assessed by individualized protocols (step and critical velocity tests) and by the traditional v4 value.

METHODS: Fifteen age-group swimmers (10.7±0.70 years) performed a 5x200 m front crawl step test (increments of 0.05 m/s per step, and 1 min rest intervals), being capillary blood samples for [La] analysis collected from the earlobe at rest, after each step and at the end of the test, which allowed the assessment of the vAnTR step. [La]velcurve modeling method, and v4, by linear interpolation. Critical velocity (CV) was obtained through the slope of the linear relationship of time versus distance based on the times of the 100 and 400m competitive events. Mean and SD were computed, as well as repeated measurements ANOVA (with Bonferroni post hoc test) and Pearson correlation coefficient (r<0.05).

RESULTS: Means±SD values of vAnTRstep, CV and v4 were 1.03±0.05, 1.03±0.07 and 1.08±0.06 m/s, respectively, being the two former velocities significantly lower than v4; these differences corresponds to a 5 s gap in a 100m front crawl effort. The [La]velcurve corresponding to AnT obtained in the step test was 2.3±0.59 mmol/l.

CONCLUSIONS: v4 does not represent the individual vAnT in children involved in competitive swimming, and both a 200 m step incremental protocol, with the later determination of the precise point of the rise in [La], and CV, seems to be advised for individual anaerobic threshold assessment in young swimmers.

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1282 Board #63 MAY 30 11:00 AM - 12:30 PM
Validity of an Alternate Knee Raise Test for Assessing Aerobic Fitness of Adolescents
Stanley Sai-chuen Hui, FACSM, Wing-kuon Au, Lin Wang, Wing-yeu Chan, Ka-wai Chan, The Chinese University of Hong Kong, Shatin, Hong Kong, Hong Kong. (No relationships reported)

PURPOSE: Simple but valid home-based aerobic fitness test that can be self-administered with minimal equipment is lacking. The purpose of this study was to examine the validity of an alternate knee raise test (AKR) for assessing aerobic fitness of adolescents.

METHODS: With informed consent form completed, 30 male adolescents age 12 to 18 yrs-old (14.6± 1.56 yrs-old) volunteered to participate in an AKR test and a grade maximal treadmill exercise (GXT) test. In the AKR test, participants were asked to perform alternate knee raise movement in place following a cadence of 96 beats/min for 3 mins continuously. In each knee raise motion the participants were required to lift up their leg until their thigh touched their palm which was placed in front of their waist at the same level of iliac crest and above their thigh. The movement was similar to a platform step test but no platform was required. At the end of the 3 min AKR test, the post-exercise heart rate (PHR) at 20 seconds after the test was recorded by a Polar heart rate monitor. For GXT test, criterion measure of VO2max was examined by a portable COSMED K4b2 metabolic analyzing system. To evaluate the predictive validity of AKR test, independent variables of age, body weight, skinfolds, body mass index, resting heart rate, post-exercise heart rate were entered into stepwise regression procedures for predicting dependable variable of measured VO2max.

RESULTS: Regression analysis revealed that the AKR test produced good predictive validity and acceptable standard error of estimates. Only two independent variables were needed which were age and PHR. The suggested equation was VO2max (ml/kg/min) = 52.168 - 0.25 (PHR) + 1.568*(Age), R=0.71, SEE=7.57 ml/kg/min.

CONCLUSIONS: The AKR Test was found to be a valid submaximal field test for assessing aerobic fitness of adolescents. It is a practical test due to its’ simple procedure and can be self-administered at home with minimal equipment.

1283 Board #64 MAY 30 11:00 AM - 12:30 PM
Body Perception: Parents’ Poorly Perceive Children’s Fitness Characteristics
Elan J. Lieber, Carmen B. Swain, The Ohio State University, Columbus, OH. (No relationships reported)

At least 155 million school-age children worldwide are overweight or obese. Body Mass Index (BMI) as a measurement of parental recognition of child’s overweight status ranges from 6-73%. When examining overweight children, less than 50% of parents identify their child as such.

PURPOSE: The purpose of this study was to examine parental ability to appropriately identify their child’s BMI status and also measures of physical fitness (body composition, muscular strength, flexibility and aerobic fitness).
METHODS: Subjects consisted of 133 males (10.8±2.1 years), 110 females (11.4±2.4 years) and their maternal parent. Males and females scores were compared to maternal perception of score: BMI, body composition, and fitness characteristics (muscular strength, aerobic fitness and flexibility) were categorized according to normative rankings. The maternal perception questionnaire was administered while subject’s fitness characteristics were evaluated. Data associations were examined using descriptive statistics and bivariate correlation.

RESULTS: BMI, body fat and fitness characteristics ranged categorically from poor to excellent. Maternal parents ability to correctly identify fitness characteristics by categorical selection were: BMI (72.8%), body composition (49.4%), flexibility (26.3%), muscular strength (32.5%) and aerobic fitness (39.5%). The relationship between subjects scores and parental perception of scores was considered weak to moderate, as determined by Pearson correlation (BMI: r=0.618, body composition: r=0.693, muscular strength: r=0.268, aerobic fitness: r=0.406 and flexibility r=-0.435).

CONCLUSION: In children ranging from under-weight to obese, parent’s ability to predict characteristics relative to weight and body composition is substantially better than their ability to predict fitness characteristics. Parents have a strong influence on children’s behavior and physical activity levels. Primary prevention is key in fighting the obesity epidemic, thus adult’s awareness of their child’s fitness status is imperative. As such, professional or school-based screening could be suggested as a necessary tool to identify children’s fitness characteristics for parental informative purposes.

1284 Board #65

t0 11:00 AM - 12:30 PM
Prevalence Of Obesity In Japanese Children Aged 3.5 Through 6.5 Years Old
Kazuo Oguri1, Kosho Kasuga2, Takahiro Nakano1, Shizuka Sangyo University, Iwata, Shizuoka, Japan. 1Gifu University, Gifu, Japan. 2Nagoya Gakui University, Aichi, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

The prevalence of childhood obesity has risen progressively worldwide. It is said that obesity onsets in early childhood; however, factors not yet clarified include: age of obesity onset, and age when gender difference in obesity prevalence becomes apparent.

PURPOSE: The purpose of this study was to examine the prevalence of obesity and its development trends, such as differences with age and gender, in Japanese young children.

METHODS: This cross-sectional study analyzed height and weight among 6,235 children (3,147 boys and 3,088 girls) aged 3.5 to 6.5 years old. Subjects were categorized into age groups in increments of 0.5 years, and prevalence of obesity was compared between gender and among groups. Obesity was defined according to the National Health and Nutrition Survey of Japan as 115% of the standard weight for an individual’s height and gender. The chi-square test was used to compare differences in prevalence of obesity. Where appropriate, p values of the chi-square test were corrected according to Bonferroni inequalities.

RESULTS: Prevalence of obesity plateaued at 6.4% to 6.7% both in boys and girls, aged between 3.5 years and 4.5 years. However, it significantly decreased to 3.1% and 3.0% in boys and girls respectively, at age 5.0 years old (p<0.001). Prevalence of obesity in boys and girls aged 5.5 years increased to 8.0% and 6.8% respectively, which was significantly higher than that in boys and girls at 5.0 years old, and the rate gradually increased with age thereafter (p<0.001). No significant decrease in prevalence of obesity was found between boys and girls in each age group for ages 3.5 years to 6.0 years. However, the prevalence was significantly higher in boys than in girls at age 6.5 years (p<0.05).

CONCLUSIONS: Our data suggest that prevalence of obesity temporarily decreases at age 5.0 years old, however, it markedly increases from age 5.5 years old. Prevalence of obesity among boys significantly increases relative to that among girls at age 6.5 years. These findings indicate that prevention and treatment of young childhood obesity is important for pediatric healthcare.

1285 Board #66

t0 11:00 AM - 12:30 PM
Relationship of Body Mass Index to Exercise Participation and Adherence in Overweight Children and Adolescents
Amanda Gier, Christopher Kist, Wayne A. Mays, Robert Siegel, Shelley Kirk. Cincinnati Children’s Hospital Medical Center, Cincinnati, OH.

(Purpose reported)

METHODS: During medical visits for a clinical pediatric weight management program, height and weight was obtained on 603 overweight children and adolescents and used to calculate BMI. Patients were given information about the group exercise sessions available to them through the program. Group classes were offered five evenings per week, and participants could attend at their discretion. Classes were 1 hour long and consisted of strength training, cardiovascular activity and active games in a fun, non-competitive environment. Class attendance was tracked and duration of active participation was determined. Data was analyzed to determine if BMI was related to class attendance.

RESULTS: Active class attendance ranged from 0 to 182 weeks. There was no correlation between BMI (34.9±7.5 kg/m²) and weeks attended (10.7±22.4 weeks) (r=-0.054, NS) when looking at all participants. Within the group of participants that attended group exercise sessions, N=355, there was no correlation between BMI (34.4±7.8 kg/m²) and total weeks of exercise (r=-0.06, NS). However, when comparing the participants that attended classes to those who did not attend any classes, the children who did attend classes had a significantly lower BMI (34.4±7.8 vs 35.6±7.1 kg/m²) (p<0.05), but were also significantly younger (11.2±3.3 vs 12.0±3.3 years) (p<0.005).

CONCLUSIONS: BMI was not related to the length of time that children actively participated in group exercise sessions. However, BMI and age were significantly lower in the group that attended classes. Younger children may have a lower BMI but still be in a higher BMI percentile for age than older children with a similar BMI. Therefore, BMI alone may not be helpful in determining which patients will participate in an exercise program. Future research should focus on a multivariate analysis of BMI percentile and age as indicators of participation in exercise classes. Further research into these variables could give healthcare providers insight into which patients may need additional support and encouragement when beginning structured exercise.

1286 Board #67

t0 11:00 AM - 12:30 PM
Relationship between Health Status and Motor Ability among Young Children
Keisuke Fukutomi1, Kosho Kasuga2, Katsunori Fujii3, Tohru Isagaki1, Gifu Sports Science Training Center, Gifu, Japan. 1Gifu University, Gifu, Japan. 2Aichi Institute of Technology, Toyota, Japan. 3Aichi Prefectural University of Fine Arts and Music, Nagakute, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

(Purpose reported)

METHODS: The study included 2,431 young children (1,241 boys and 1,190 girls; age range: 4-6 years) and their parent. We administered motor ability tests comprising 10 exercises to young children from under-weight to obese, to have bad healthy children. However, less research has been performed on the motor ability of young children by using a large dataset.

PURPOSE: The purpose of this study is to examine the relationship between health status and motor ability among young children.

METHODS: The study included 2,431 young children (1,241 boys and 1,190 girls; age range: 4-6 years) and their parent. We administered motor ability tests comprising 10 exercises to gauge the motor ability status of these children. To obtain the overall motor ability parameter, the measurement items were summarized by using principal component analysis. And we concluded that the first principal component represented the overall motor ability. Further, the principal component score of the first principal component was divided by the number of subjects of each sex and 0.5 years to obtain the individual T-scores. These individual T-scores indicated the motor ability scores. Questionnaires comprising 13 items on health status, frequent loose bowels, frequently catching cold, having a nosebleed, having eczema and suppuration, having car sickness, having no notable symptoms, allergy constitution, asthma, atopy, nasal catarrh, food allergy, drug allergy, and conjunctivitis were administered to their parent. Student’s t-test was performed to determine the statistical differences in the motor ability scores between children who answered ‘True’ and those who answered ‘False’. The level of significance was set at p<0.05. The data were collected in 2009.

RESULTS: With respect to the health status, the motor ability scores of the group that answered ‘True’ were significantly lower than those of the group that answered ‘False’ for items under the category ‘having no notable symptoms’ (True: 50.7, False: 49.3) and ‘frequently catching cold’ (True: 47.9, False: 50.3). Particular attention was paid to allergy symptoms. Statistical analysis showed that there was no significant difference in the motor ability scores of young children who answered ‘True’ and those who answered ‘False’.

CONCLUSIONS: The young children who caught cold frequently had low motor abilities. Moreover, 38% of the subjects had allergy constitution; however, presence of an allergy did not have any correlation with motor ability.
Sedentary behaviors such as television viewing and video game playing increase the relative risk of morbidity and mortality independent of physical activity levels. Due to the direct relations between these sedentary behaviors and health risk, the American Academy of Pediatrics recommends no more than two hours of daily screen time for youth.

PURPOSE: To investigate the relations between sedentary behaviors and health-related physical fitness (PF) achievement and physical activity (PA) behaviors in middle school students. METHODS: Students (N=1,515) in grades 6-8 completed the FITNESSGRAM® PF items, and FITNESSGRAM PA questions in addition to Youth Risk Behavior Survey sedentary behavior questions as part of school activities. RESULTS: Using logistic regression and controlling for gender, age, ethnicity, and economic status, we calculated odd ratios (OR) for all components of health-related fitness, aerobic capacity (OR=1.70, 95%CI =1.30-2.34), muscular strength and endurance (OR =1.87, 95%CI =1.30-2.68), flexibility (OR =1.54, 95%CI =1.20-2.00), and body composition (OR =1.71, 95%CI =1.27-2.30). The odds of achieving the FITNESSGRAM Healthy Fitness Zone were higher when students reported ≤2 hours of sedentary behaviors per day. Similarly, the odds of achieving physical activity guidelines for aerobic (OR =1.42, 95%CI =1.09-1.84), muscular strengthening (OR =1.77, 95%CI =1.22-2.57), and flexibility (OR =1.47, 95%CI =1.15-1.88) activity were higher when students reported ≤2 hours per day of sedentary behaviors. CONCLUSION: Results illustrate the importance of keeping sedentary behaviors to ≤2 hours per day in middle school students, thus increasing the odds that students will achieve sufficient health-related fitness for health benefits. Less screen time is related to achieving national physical activity guidelines.

Grant support from the National Association for Sport and Physical Education.

PURPOSE: The purpose of this study was to examine associations among body fat % (BF%), BMI, and various fitness tests in school-aged children. METHODS: The participants included male and female 4th through 10th grade students (n=376) recruited from three private schools from a metropolitan area in the southwestern United States. Participants completed assessments of body composition, aerobic fitness and muscular fitness on 4 separate testing days with at least 48 hours between sessions. On day 1 participants completed the BMI, BF% and PACER aerobic fitness test. On day 2 participants completed DYNAMIC CURL UPS and ROMAN CHAIR STATIC extension tests. On day 3 participants completed PLANKS, LATERAL STRENGTH, and ROMAN CHAIR DYNAMIC extensions. On day 4 participants completed any test that they may have missed on previous days. Pearson-Product Moment (PPM) correlations were used to assess the degree of association between body composition and fitness variables. Alpha level of 0.05 was set to determine significance for statistical analyses. RESULTS: The BMI and BF% values were moderately correlated with each other (r=−.51, p<0.001). BF% had higher correlations with the fitness variables than BMI (PACER: r=−.407 vs. -.094; CURL-UP: r=−.197 vs. .108; PLANK: r=−.311 vs. -.06; LATERAL STRENGTH: r=−.239 vs. -.078; ROMAN CHAIR DYNAMIC: r=−.142 vs. −.128; ROMAN CHAIR STATIC: r=−.149 vs. −.133). BF% correlations were significant for all fitness tests (p<0.001) while BMI correlations were only significant for both ROMAN CHAIR extensions (p<0.05). CONCLUSION: The results suggest that BF% is negatively correlated with indicators of aerobic fitness and muscular fitness in youth. The moderate correlations between BF% and BMI and the weaker associations between BMI and fitness performance tests indicate that BMI may provide a less useful indicator of body composition for use in school health related fitness testing.

PURPOSE: High income countries around the world have experienced dramatic increases in obesity and sedentary behaviors in both genders, all income levels, ethnic groups, and all ages. We hypothesized that the lack of multiple TV channels or computers would have a positive impact on posture and fitness. This project was conducted in the rural villages outside of Irapuato, Mexico. The data were compared to similar studies conducted in Ghana, Australia and the United States. METHODS: Intervention: 29 children, ages 10-12, performed 5 exercises indicative of core strength (plank, left and right bridge, left and right stork); the times of how long they were able to hold the positions were documented. With reflective markers placed on bony landmarks, the children had posture assessment photographs taken of their normal standing posture from a lateral view. A software program was used to mark and measure postural angles.

RESULTS: Height and weight (and their SD) were greater in Mexico (139.7cm SD9.6 and 35.1kg SD11.9) than in Australia (138.8cm SD5.8 and 32.4kg SD3.8). The gaze angle was greater in the Hispanic children (14.10 deg SD8.48) compared to the Australian’s (10.3 deg SD7.6); this indicates a greater propensity towards a forward head posture. The head on neck angle was greater in the Australian children (55.7deg SD8.7) compared to the Hispanics (50.3deg SD6.1); however, we believe that this is the result of a protruding C7 marker rather than an actual postural dysfunction. Core strength: There were differences in exercise times for the side bridges and stork exercises between the children tested in Mexico and Utah County and for the left side bridge and stork exercises between the children tested in Mexico and Ghana (all with p-values <.05); there was no difference in exercise times between children tested in Ghana and Utah County.

CONCLUSIONS: Our hypothesis was not supported by this study. While life in Irapuato, Mexico, is less influenced by computers and TV, it doesn’t seem to have any impact on better posture or fitness. Reasons for this include widespread poverty which encourages consumption of cheaper high-calorie processed foods, culturally anchored sedentary lifestyle habits, lack of physical and health education and exercise-prohibitive living conditions.

PURPOSE: Obesity is one of the most pressing health concerns for children. Could positive results presenting an academic advantage be due to children more fit in BMI? The current study was to explore if middle school students who are BMI fit are likely to have better aerobic fitness and stronger academic performance. METHODS: The study included 250 middle school students (mean age: 11.9±0.4 yrs). Subjects were administered physical fitness tests after first signing the informed consent. The study used standard physical fitness tests and was conducted in a controlled manner by the trained professionals. The academic performance information was collected, including previous and current semester GPA (GPA-1, GPA-2), and final GPA for the academic year (F-GPA). Only those students with complete sets of scores for both variables were included in the statistical analysis. SPSS for Windows 17.0 was used for statistical analysis.

RESULTS: The results showed a significant mean difference of aerobic fitness in terms of 1-mile running time (min) between normal-BMI and overweight-obese-BMI students (mean±SD, 9.99±2.67 vs. 13.51±2.61; p=0.0001), and between underweight-BMI and overweight-obese-BMI students (10.38±2.52 vs. 13.51±2.61; p<0.0001). Students with normal-BMI tended having better academic performance than that of the overweight-obese-BMI students in terms of percentile rank for F-GPA (58.97±26.47 vs. 46.27±28.01; p=0.022) and C-GPA (59.02±26.05 vs. 49.99±2.67 vs. 13.51±2.61; p<0.0001).
CONCLUSIONS: This study suggests that normal-BMI students are likely to have high level of cardiorespiratory fitness, compared to those students with underweight-BMI and overweight-obese-BMI. Students with healthy BMI tend to have higher GPAs, showing better academic performance.

PURPOSE: To evaluate the relationship of participation in a pediatric weight management program inclusive of exercise classes and family-oriented dietary counseling to body mass index (BMI) change pre and post participation.

METHODS: We evaluated 289 pediatric obesity patients (mean age 11.2 ± 3.0 years, 106 males) with a 400 meter walk test pre and post participation in the pediatric weight management program. There were 178 patients that participated in exercise classes (EC) and 91 patients that completed the program without participation in the exercise classes (NC). Heart rate difference (HRDiff) was calculated by subtracting the pre 400 meter walk heart rate (HR) from the post 400 meter walk HR.

RESULTS: For the total group, there was a significant correlation between the change in BMI (0.12 ± 2.13 kg) and the percentage of exercise classes attended (12.3 ± 16.2%, r=0.21, p<0.005). Additionally, the change in BMI (34.7 ± 7.4 kg/m²) correlated with the pre and post HR Diff (38 ± 13 and 29 ± 13 BPM; r=0.15, p<0.01 and r=0.16, p<0.01). Also, the post BMI was significantly correlated with the post HRDiff (r=0.14, p<0.05). The NC group showed no correlations with pre or post HRDiff. However, the EC group showed significant correlation between the change in BMI (0.43 ± 2.46 kg) and the percentage of exercise classes attended (18.6 ± 16.7%, r=0.25, p<0.005). Additionally, the initial BMI (34.8 ± 7.9 kg/m²) correlated with the pre and post HR Diff (29 ± 13 and 28 ± 13 BPM; r=0.20, p<0.005 and r=0.20, p<0.005) Also, the post BMI was significantly correlated with the post HRDiff (r=0.17, p<0.005).

DISCUSSION: There was a significant correlation between the change in BMI pre and post exercise participation and the percentage of classes attended. This relationship was strengthened when patients that did not attend classes were removed from the analysis. Additionally, BMI was significantly correlated with HR difference from the 400 meter walk test indicating BMI relationship to the difficulty of the walk test.

CONCLUSION: There was a significant but weak correlation of BMI change to attendance in exercise classes in a pediatric weight management program. Further multivariate analysis may illuminate the relationship between attendance and BMI.

PURPOSE: The purpose of this study was to examine the influence BMI has on the new FITNESSGRAM® criterion standards for aerobic capacity compared to the previous standards for one-mile run and PACER tests in sixth-grade children.

METHODS: Subjects were 439 sixth-grade boys and girls (61.3% Hispanic; 7.1% African-American) who completed each of the FITNESSGRAM® test components of their yearly physical education assessment. While, 60% of students met the previous FITNESSGRAM® age and gender criterion standards for BMI, only 43% met the new HFZ standards, and only 2% were in the very lean category. For the remaining students, 13% were classified as NI-SR, while 42% were classified as NI-HR.

RESULTS: The percent of these students meeting the previous criterion standards were 48% for the one-mile run, and 44% for the PACER test. The percent of these students meeting the new FITNESSGRAM® age and gender aerobic capacity standards calculated from one-mile run times were 55% for the HFZ, 19% for NI-SR, leaving 26% in the NI-HR category. The percent meeting the new aerobic capacity standards calculated from PACER performance were 50% for the HFZ, 19% for NI-SR, leaving 31% in the NI-HR category. Logistic regression revealed that compared to students who failed to meet the new HFZ standard for BMI, students who met the new HFZ standards for BMI were 42.6 times more likely to meet the aerobic capacity HFZ standard determined from one-mile times, and 57.1 times more likely to meet the aerobic capacity HFZ standard determined by PACER performance.

CONCLUSIONS: A decrease in BMI of one unit (based on weight loss only, ~2.38 kilograms) would increase the probability of meeting HFZ criterion standards for aerobic capacity determined from the one-mile run by 45% and for aerobic capacity determined from PACER performance by 71%. This achievable (and safe) goal in similar youth populations remains to be tested in fitness interventions.

PURPOSE: The influence of BMI on AC is similar to that of WC. Receiver Operating Characteristic (ROC) analysis indicated that a waist circumference of 29 inches is the optimal cut-off score for determining successful completion for either BMI (AUC = .97) or AC (AUC = .93). These data suggest that interventions targeting a reduction in waist circumference or weight loss have the potential to improve performance on health-related fitness tests of aerobic capacity. Recent reports indicating an increase in overweight and obesity among children and adolescents make the development of such interventions even more meaningful for appropriate health-related fitness in youth.

PURPOSE: To compare cardiovascular fitness tracking between children from two different PE programs.
METHODS: Participants were 176 children (85 girls) in a PE4life Academy middle school (S1), which was known for its high level of moderate and vigorous physical activity (MVPA) in the PE class, and 118 children (63 girls) in a same-area middle school with a traditional PE program (S2). Two schools were similar in socioeconomic status, race composition (white > 93%), and weekly PE class time (approximately 90 minutes per week). Progressive Aerobic Cardiovascular Endurance Run (PACER) was administered to the cohort at the beginning and end of their middle school period. Spearman rank correlation was used to examine stability of cardiovascular fitness. Further, based on the criteria of FITnessgram Healthy Fitness Zone (HFZ), the cohort was categorized into either an at-risk group or an HFZ group. The square test was used to examine differences in distribution changes in in-at risk and HFZ between S1 and S2 across the three years. Children’s MVPA in the PE class were coded for 25 lessons in each school with System for Observing Fitness Instruction Time and analyzed with one-way MANOVA.

RESULTS: PACER correlations were .64 for S1 and .73 for S2 for boys, and were .77 for S1 and .49 for S2 for girls. Chi-square results for boys indicated similar distribution pattern in the two groups between S1 (49.1% in the at-risk group and 50.9% in the HFZ) and S2 (57.1% and 42.9%) at baseline. At the follow-up, however, the patterns became different between S1 (24.5% in the at-risk group and 75.5% in the HFZ) and S2 (81.0% and 19.0%), with χ² = 19.86 and p < .001 in favor of S1. Results for girls were similar. At baseline S1 had 21.6% in the at-risk group and 78.4% in the HFZ, and S2 had 33.3% and 66.7%, respectively. At the follow-up S1 had 29.4% in the at-risk group and 70.6% in the HFZ, and S2 had 61.5% and 38.5%, respectively, with χ² = 9.23 and p < .01 in favor of S1. Further, MANOVA results indicated that children in S1 had significantly larger percentage of PE class time in MVPA than those in S2 (p < .001), with 66.4 ± 6.50 vs. 44.12 ± 8.79.

CONCLUSIONS: These results program has much more positive tracking results in children’s cardiovascular fitness than traditional PE programs. But Spearman rank correlation alone could not identify or explain the differences.

1295 Board #76 May 30 11:00 AM - 12:30 PM Physical Activity Incorporation Within Head Start Curriculum Improves Early Literacy In African American Children Stacie M. Kirk, Erik P. Kirk. Southern Illinois University Edwardsville, Edwardsville, IL.

PURPOSE: To determine the effects of a low cost, teacher directed, minimal intervention program that delivered existing academic lessons taught through physical activity (PA) in Head Start preschools serving African American (AA) children.

METHODS: Seventy-two African American children (mean±SE, age 3.8±0.1y) from a low socioeconomic urban Head Start were randomized to Control (CON, n=3 classrooms, n=21, F=9, M=12) or PA groups (n=4 classrooms, n=51, F=29, M=22) for 6 mo. The PA program was designed to promote 150 min/wk of moderate to vigorous PA academic lessons (3.0-6.0 METS, ~15 min each, 2 lessons/day). Intensity of classroom PA was measured by a SOFIT. Height and weight to determine BMI were obtained using a stadiometer and digital scale. The Get It, Got It, Go Individual Growth and Development Indicators for children ages 3-5y was administered to assess early literacy and phonological awareness in the areas of alliteration and picture naming. All measures were assessed at baseline, 3 and 6 mo.

RESULTS: The PA protocol resulted in significantly (p<0.05) greater levels of PA in the classroom during free play at 3 (PA, 8.1±2.1% vs. CON, -2.2±1.6%) and 6 (PA, 20.1±2.1% vs. C, -7.1±2.1%) mo than children in the CON, resulting in between group differences at 3 and 6 mo, p<0.01. The 6 mo change in BMI for the PA group was 2.0±1.1 and CON 0.8±0.9% respectively. Alliteration (letters sounds/two min) significantly (p<0.01) improved in the PA group from baseline (0.4±0.1) to 3 mo (1.0±0.4) and was maintained at 6 mo (1.0±0.4) compared to no change in CON at 3 (0.1±0.3) and 6 (0.2±0.4) mo compared to baseline, p<0.05, resulting in between group differences at 3 and 6 mo, p<0.01. Picture naming (picture naming/picture per minute) significantly (p<0.01) improved in the PA group from baseline (17.2±3.5) to 3 (21.7±5.0) and 6 (24.8±5.4) mo compared to no improvement in the CON, resulting in between group differences at 3 and 6 mo, p<0.01. Higher scores for alliteration and picture naming indicate greater early literacy skills and phonological awareness.

CONCLUSION: A low cost, teacher directed, minimal intervention program incorporating PA within Head Start curriculum promotes daily PA, increases early literacy, and attenuate increases in BMI in AA preschool children, a group at an increased risk for poor literacy development and obesity.

1296 Board #77 May 30 11:00 AM - 12:30 PM Effect of Exercise Training in the Cold on Regional Body Composition in Obese Boys Boguslaw Wilk, FACSM, Joyce Obeid, Raymond Trott, Oded Bar-Or, Brian W. Timmons. McMaster University, Hamilton, ON, Canada.

(No relationships reported)

Exercise training in the cold reduces whole body fat mass in obese adolescent boys (Wilk et al 2006).

PURPOSE: To determine the effect of exercise training in the cold on regional body composition, substrate utilization, respiratory heat loss (RHL), and energy expenditure (EE) in obese adolescents.

METHODS: Twenty obese (>30% body fat) adolescent boys, ages 12 to 16 years, participated in a 6-week (3 times per week) exercise training program. Boys were randomly allocated to train in the cold (COLD; 5 °C; n=10) or a thermoneutral environment (NEUT; 24.5 °C; n=10). Each training session consisted of 3 x 20 min exercise bouts interspersed with 5 min rest performed in a climate chamber. The boys alternated between treadmill walking and cycling (both at 60 % VO2max) within each session. Regional body composition was measured before and after the 6-week training program using DXA. Volume, O2, CO2, and temperature of expired air were measured during exercise at the first (T1) and last (T18) training sessions to assess EE, substrate utilization (fat oxidation, carbohydrate oxidation, CHOx), and RHL. Two-way ANOVAs with between (COLD vs. NEUT) and within (pre- vs. post-training) factors were used (p<0.05).

RESULTS: Significant post-training % fat changes were observed for trunk (-1.6 %, P<0.05) and legs (-1.0%, P=0.001) in COLD and for arms in NEUT (+1.2%, P=0.04). Leg lean mass increased 4.6% (P=0.001) in COLD only. FATox was higher and CHOx lower at T18 compared with T1 (P<0.05), with no differences between groups. RHL were higher (P=0.001) in COLD at T1 (1.08 kcal/kg) and T18 (1.04 kcal/kg) compared with NEUT (0.61 and 0.57 kcal/kg at T1 and T18, respectively). Although EE was ~10% higher in COLD compared with NEUT at both T1 and T18, this difference was not statistically significant.

CONCLUSIONS: Six weeks of exercise training in the cold induces desirable changes in whole body regional body composition, particularly central adiposity, of obese boys.

1297 Board #78 May 30 11:00 AM - 12:30 PM Examining Elementary School Students’ Motor Skills, Physical Activity, and Health-related Physical Fitness Tao Zhang1, Ping Xiang1. 1University of North Texas, Denton, TX. 2Texas A & M University, College Station, TX.

(No relationships reported)

Promoting motor skills, physical activity (PA), and health-related physical fitness are all critical to our effort to help school-aged students live physically active lifestyles. Therefore, understanding their interrelationships is considered a research priority. While considerable research has examined PA in relation to students’ health-related physical fitness, research on the relationships among students’ motor skills, in-class PA and physical fitness has been scarce.

PURPOSE: The purpose of this study was to investigate the relationships among motor skills, in-class PA, and health-related physical fitness among elementary school students in physical education (P.E.).

METHODS: Participants were 104 fourth and fifth grade students (45 girls and 59 boys; M age = 11.0). They completed motor skills in basketball, overhead throwing, and striking assessed by PE Metrics TM (NASPE, 2010). Students’ PA across three PE lessons was measured by Actical accelerometers (Mini-Mitter Co., Inc., Bend, OR). Health-related physical fitness was assessed by FITNESSGRAM® (Cooper Institute, 2007), including Progressive Aerobic Cardiovascular Endurance Run, curl-ups, push-ups, height and weight (calculating BMI), trunk lift, and sit-and-reach tests. The total number of fitness tests in which students achieved the Healthy Fitness Zone was calculated and used as an overall measure of physical fitness.

RESULTS: There were positive relationships among basketball, overhead throwing, and striking. Basketball was positively associated with in-class PA. Health-related physical fitness was positively correlated with basketball, striking, and in-class PA. Two regression analyses indicated basketball and overhead throwing were significant predictors of students’ in-class PA (R² = 63.1%: β = 0.23, p = 0.001) and basketball was a significant predictor of students’ physical fitness (R²= 4.7%: β = 0.22, p < 0.05).

CONCLUSION: These results provided empirical evidence on relationships among students’ motor skills, PA, and health-related physical fitness. Given the small predictive strength of motor skills in this study, additional investigation is needed to further examine the dynamic relationships among motor skills, PA, and health-related physical fitness.
Effect Of An Exercise-based Cardiac Rehabilitation Program On Arterial Stiffness In Post Myocardial Infarction Patients

Norton Luis Oliveira¹, Fernando Ribeiro², Alberto Jorge Alves¹, Fátima Miranda¹, Marlene Fonseca³, Lilibeth Campos³, Madalena Teixeira³, José Oliveira¹.
¹University of Porto, Faculty of Sport, Porto, Portugal. ²CESPU, Polytechnic Health Institute of the North, Gandra PRD, Portugal. ³Centro Hospitalar de Gaia/Espinho, Vila Nova de Gaia, Portugal.

PURPOSE: To determine the effect of an exercise-based cardiac rehabilitation program on PWV in post MI patients.

METHODS: Twenty-four male and 2 female patients, mean (±SD) age 60.1 ± 10.5 years, after an acute myocardial infarction were randomized to either an 8-week exercise-based cardiac rehabilitation program (EG) or to a control group, which underwent only usual medical care (CG). Complete randomization was performed by choosing one of two sealed envelopes. The EG participated in an 8-week programme comprising 3 exercise sessions per week. Each exercise session included 10 minutes of warm-up, 35 minutes of aerobic exercise on a cycloergometer or treadmill, and 10 minutes of cool-down. The exercise intensity was calculated as 65-75% of maximal heart rate achieved in the exercise test. Outcome measures included changes in PWV, decrease in EG (8.2 ± 2.0 m/s, p<0.05). The main effect was also significant for VO2 (F 1.24 = 6.6) with an average increase of 3.4 ml/kg/min in EG (29.8 ± 8.1 ml/kg/min, p<0.05) and no change in CG (28.5 ± 6.1 ml/kg/min).

CONCLUSIONS: Exercise-based cardiac rehabilitation decreases systemic arterial stiffness in post MI patients. Therefore, this could be one of the mechanisms associated with the positive outcome (i.e., mortality rates) on post MI patients who undergo rehabilitation.

ClinicalTrials.gov Identifier: NCT01432639

Supported by the following grants from The Portuguese Fundação para a Ciência e a Tecnologia (FCT): SFRH/BD/48875/2008 and PTDC/DES/113753/2009

1299 Board #79  MAY 30 9:30 AM - 11:00 AM
Blind Reading Of Anaerobic Threshold (AT) To Detect Changes In Exercise Tolerance
Kazuo Kondou¹, Hirotaka Nishijima¹, Namiko Horigome¹, Oukusa Takano¹, Kazuya Yonezawa¹, Masayuki Sakurai². ¹Hokkaido Memorial Hospital, Sapporo, Japan. ²National Hospital Organization Hakodate Hospital, Hakodate, Japan.

PURPOSE: Although AT is a useful measure of exercise tolerance (ET), it has a drawback of requiring an evaluator, a source of subjectivity. This study was done to assess the AT by blind reading to detect changes in ET.

METHODS: The records of 166 patients who underwent cardiopulmonary exercise testing (CPX) during cardiac rehabilitation (CR) were retrospectively reviewed. CR was hospital (the mean of 3.1/mo) and home based. The mean time elapsed between the 1st and 2nd tests was 135(SD:29) days. The mean age was 64(11), with 143 males and 23 females. The underlying heart disease was mainly ischemic: post myocardial infarction in 95 and angina in 39. CPX was done using an upright bicycle with a breath-by-breath apparatus. The exercise was submaximal, which was mostly terminated with an appearance of AT or target heart rate. CPX records were erased of their ID’s and coded by the controller. AT was read by 2 independent experienced investigators (AB) based on the Wasserman’s criteria.

RESULTS: The table below shows the mean(SD).

<table>
<thead>
<tr>
<th>CR</th>
<th>Wt(kg)</th>
<th>HR(b/min) at highest workload</th>
<th>Borg scale</th>
<th>VO2 at highest workload (ml/min/kg)</th>
<th>AT(ml/min, VO2) by A</th>
<th>AT(ml/min, VO2) by B</th>
</tr>
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<tbody>
<tr>
<td>Pre</td>
<td>66.1(10.9)</td>
<td>111(22)</td>
<td>13.2(1.6)</td>
<td>14.6(3.5)</td>
<td>670(217)</td>
<td>706(194)</td>
</tr>
<tr>
<td>Post</td>
<td>66.7(10.9)</td>
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<td>13.6(1.7)</td>
<td>17.0(4.1)</td>
<td>721(251)</td>
<td>752(204)</td>
</tr>
<tr>
<td>p</td>
<td>0.006</td>
<td>0.958</td>
<td>0.012</td>
<td>&lt;0.0001</td>
<td>0.0004</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

The investigator A did not detect AT in 21.7% and B in 14.5%. About 2/3 of these cases had a AT<10 at the highest workload, suggesting a workload below AT. Although the pre-and post-AT values read by the investigators A and B were clearly different (p<0.001), the mean pre-post difference in AT detected by each was remarkably similar (51(161) vs 46(140) ml/min in VO2, ns). We speculated that since the entire portion of the v-slope would shift to the right with training, any identifiable deflection point on it would equally shift in parallel.

CONCLUSIONS: Despite differing AT readings at pre-and post-rehabilitation by the 2 independent investigators, the mean absolute difference (improvement) did not differ between the 2.

1299 Board #80  MAY 30 9:30 AM - 11:00 AM
Effect Of An Exercise-based Cardiac Rehabilitation Program On Arterial Stiffness In Post Myocardial Infarction Patients

Norton Luis Oliveira¹, Fernando Ribeiro², Alberto Jorge Alves¹, Fátima Miranda¹, Marlene Fonseca³, Lilibeth Campos³, Madalena Teixeira³, José Oliveira¹.
¹University of Porto, Faculty of Sport, Porto, Portugal. ²CESPU, Polytechnic Health Institute of the North, Gandra PRD, Portugal. ³Centro Hospitalar de Gaia/Espinho, Vila Nova de Gaia, Portugal.

PURPOSE: To determine the effect of an exercise-based cardiac rehabilitation program on PWV in post MI patients.

METHODS: The records of 166 patients who underwent cardiopulmonary exercise testing (CPX) during cardiac rehabilitation (CR) were retrospectively reviewed. CR was hospital (the mean of 3.1/mo) and home based. The mean time elapsed between the 1st and 2nd tests was 135(SD:29) days. The mean age was 64(11), with 143 males and 23 females. The underlying heart disease was mainly ischemic: post myocardial infarction in 95 and angina in 39. CPX was done using an upright bicycle with a breath-by-breath apparatus. The exercise was submaximal, which was mostly terminated with an appearance of AT or target heart rate. CPX records were erased of their ID’s and coded by the controller. AT was read by 2 independent experienced investigators (AB) based on the Wasserman’s criteria.

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CONCLUSIONS: Despite differing AT readings at pre-and post-rehabilitation by the 2 independent investigators, the mean absolute difference (improvement) did not differ between the 2.

1300 Board #81  MAY 30 9:30 AM - 11:00 AM
Double Product Based on Heart Sounds as a Marker of Catecholamines During Exercise
Takuro Matsuda¹, Yasuki Higaki¹, Akira Kiyonaga², Shigeru Obara¹, Hiroaki Tanaka¹. ¹Fukuoka University, Fukuoka, Japan. ²The University of Tokushima, Tokushima, Japan.

PURPOSE: To well documented that exercise-induced adrenergic stimulation enhances myocardial contractility in healthy humans. The break-point of the double product of heart rate (HR) and systolic blood pressure, which is a marker of cardiac oxygen demands, is strongly correlated with the epinephrine (Ep) threshold. The amplitude of the first sound (HS1) is a marker of cardiac contractility, which is a major determinant of cardiac oxygen demand and is easy to determine continuously during exercise. This study investigated the relationship between the double product (DP) based on heart sounds and Ep level.

METHODS: Twelve subjects, with a mean±SD age of 22±3 years and a mean±SD BMI of 23.1±3.5 kg/m², underwent graded cycle ergometer testing. The work rate started at 15 watts and then increased at 15 watts every 2 min until the heart rate reached 85% of its maximum expected for their age. The heart sounds were collected in a personal computer via an AD converter throughout the exercise test. Blood from the antecubital vein was sampled and Ep levels were measured every 2 min during the test. Values of the DP were calculated by the formula HR×HS1. The main effect was also significant for VO2 (F 1.24 = 6.6) with an average increase of 3.4 ml/kg/min in EG (29.8 ± 8.1 ml/kg/min, p<0.05) and no significant change in CG (28.5 ± 6.1 ml/kg/min).

CONCLUSIONS: Exercise-based cardiac rehabilitation decreases systemic arterial stiffness in post MI patients. Therefore, this could be one of the mechanisms associated with the positive outcome (i.e., mortality rates) on post MI patients who undergo rehabilitation.

ClinicalTrials.gov Identifier: NCT01432639

Supported by the following grants from The Portuguese Fundação para a Ciência e a Tecnologia (FCT): SFRH/BD/48875/2008 and PTDC/DES/113753/2009

289
CONCLUSIONS: The DP from heart sounds is a valid marker of the sympathetic nerve system during exercise stress. Monitoring heart sounds appears to provide valuable information related to the level of exercise stress. This information may be useful when determining an appropriate exercise prescription.

This work was supported by the Ministry of Education, Culture, Sports, Science, and Technology, Japan (No. 22300240) and Strategic Research Infrastructure No. 0801083, a grant from GFP at Fukuoka University.

1301 Board #82 MAY 30 9:30 AM - 11:00 AM
Is Cardiorespiratory Fitness, Muscular Fitness or Physical Activity Related to Diabetes Risk in Postmenopausal Women?
Judith A. Flohr, Elizabeth S. Edwards, Layne E. Eidenmiller, Christine M. Nicewonger, Christopher J. Womack, FACSM. James Madison University, Harrisonburg, VA.
(No relationships reported)

PURPOSE: The purpose of this study was to examine the activity (PA) with the prevalence of Type 2 diabetes mellitus (T2DM) in a group of sedentary healthy postmenopausal women.

METHODS: Thirty-five postmenopausal (age 57.9 ± 4.7 yrs.) women completed a graded exercise test on a treadmill to determine maximum relative oxygen consumption (VO2max) and the International Physical Activity Questionnaire (IPAQ) to estimate MET minutes/week of PA. Waist circumference (WC), body fat via DXA (BF), height, weight, SMR leg press and chest press were measured and used to estimate 1RM. These IRM values were then estimated by body weight, yielding ratios for leg press (LP) and chest press (CP). All participants had blood drawn and analyzed for HbA1c (A1c). Bivariate Pearson's correlations were used to identify variables that were associated with A1c. Stepwise regression was then used to identify variables that significantly predicted A1c.

RESULTS: The average A1c was 5.9%. Both LP (r = -0.344, p = .043) and CP (r = -0.414, p=.013) were significantly associated with A1c, but neither VO2max nor IPAQ were significantly correlated with A1c. In the regression model, only LP significantly predicted A1c, b = -0.57, t (33) = 2.61, p = .013. LP explained a significant proportion of the variance in A1c, R2 = 0.17, F (1, 33) = 6.84, p = .013.

CONCLUSIONS: Previous studies have reported an inverse relationship among CRF, PA, MS and T2DM in men. There is limited data available describing the relationship between MS and A1c in postmenopausal women. However, recent reports suggest that muscle mass may play a significant role in glycemic control. The results of the present study indicate that muscle strength as measured by LP and CP were related to A1c. Therefore, efforts to increase muscle strength in postmenopausal women in an attempt to lower diabetes risk appear to be warranted.

1302 Board #83 MAY 30 9:30 AM - 11:00 AM
The Effects Of Aerobic Training In The Patients With Heart Failure
Shang-Lin Chiang, Chinese. Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan. (Sponsor: Wen-Hsu Sung, FACSM)
(No relationships reported)

PURPOSE: Aerobic training can improve not only aerobic capacity but also symptoms and survival rate in patients with heart failure (CHF). The purposes of our study will test the effects of exercise training on aerobic capacity, heart rate, blood pressure, body composition, serum lipid and NT-proBNP (aminoterminal fragment brain natriuretic peptide prohormone) in CHF patients, and examine the potential benefit of changes over time.

METHODS: The methods consisted of 13 eligible cases with heart failure. Seven of them completed 12-week exercise program ( 30 minutes a day, 3 days a week, at 60 % peak oxygen uptake (VO2peak)). Every 4 weeks training, heart rate, blood pressure, body composition, serum lipid and NT-proBNP were measured after an overnight fast. Besides, VO2peak and cadioutput were measured at pre-training and post-training.

RESULTS: After 12-week exercise training program, seven cases completed the process. The results indicate that the parameters of cardiopulmonary capacity were all significantly improved. The VO2peak was improved from 20.30±5.30 to 22.49±4.36 ml/kg/min (p<0.002). The maximal metabolic equivalent (MET) was improved from 5.76±1.55 to 6.37±1.31 METs (p<0.0001). The maximal work load was improved from 220.43±76.39 to 276.57.43±75.91Watt (W)(p=.029) Although it was not significant, diastolic pressure and systolic pressure were improved over time.

CONCLUSION: It is concluded that aerobic exercise training could improve cardiopulmonary capacity, static heart rate, blood pressure, body composition, serum lipid and NT-proBNP in heart failure patients. The results also proved the effects of aerobic exercise for heart failure patients could be accumulated over time. Therefore, provide precise exercise prescriptions and educate them how to do the adequate aerobic exercise training are very important to patients with heart failure.

1303 Board #84 MAY 30  9:30 AM - 11:00 AM
Heart Rate Variability is Reduced at Peak Exercise in Individuals at Risk for Sleep Apnea
Trent A. Hargens1, Amanda Mallory2, Steve Vesbach2, James Madison University, Harrisonburg, VA. 1Ball State University, Muncie, IN. (Sponsor: M. Kent Todd, FACSM)
(No relationships reported)

Obstructive sleep apnea (OSA) is a sleep disorder that significantly increases risk for hypertension, cardiovascular disease (CVD) and diabetes, among others. OSA leads to dysfunction in the autonomic regulation of the cardiovascular system, a primary mediating factor in the increased risk for chronic disease. Heart rate variability (HRV) has been widely used for assessing autonomic function, and has been shown to be predictive of CVD and all-cause mortality at rest and during exercise. HRV has been shown to be reduced in OSA at rest, but to date, no studies have examined exercise HRV in individuals diagnosed with, or at high risk for, OSA.

PURPOSE: To examine the HRV responses during exercise in individuals identified as high risk for OSA.

METHODS: Nine (6 male, 3 female) obese subjects (BMI: Mean SD = 33.3 6.4 kg/m²; age = 47.4 8.2 yr) at risk for OSA (OSA) and 16 (6 male, 9 female) obese subjects (BMI = 32.5 4.9; age = 28.7 10.3) at low risk for OSA (Control) performed maximal cycle ergometer exercise tests utilizing a 20 watts/min ramp protocol. HRV was assessed at rest, during exercise and immediately post-exercise. Measures of time and frequency domain HRV were obtained. HRV variables were log transformed and converted into normalized units for statistical analysis. Risk for OSA was established through a screening result from an at-home sleep assessment device (Emblerta).

RESULTS: The OSA group was significantly older than the control group (P < 0.001). Body mass index, blood pressure, resting heart rate, and VO2peak did not differ between groups. After controlling for age and gender, peak exercise (last two minutes of exercise) log total power (0.74 ± 0.2 vs. 1.5 ± 0.2 ms²), log low frequency (-0.47 ± 0.3 vs. 0.31 ± 0.2), log high frequency (-0.92 ± 0.3 vs. 0.27 ± 0.2), normalized low frequency (1.03 ± 0.5 vs. 3.03 ± 0.4), and normalized high-frequency (0.60 ± 0.5 vs. 3.00 ± 0.4) were reduced in the OSA group (P < 0.05). No differences were noted in time domain variables at peak exercise. Resting, submaximal exercise or recovery HRV variables (time or frequency domain) did not differ significantly.

CONCLUSION: Results suggest that individuals at high risk for probable OSA display abnormal autonomic modulation of heart rate during peak exercise. Exercise HRV may be a useful tool for improving risk assessment in OSA, but needs further examination.

1304 Board #85 MAY 30 9:30 AM - 11:00 AM
Early Oxygen Uptake Response to Constant Work Exercise and Mortality in Men
Kai P. Savonen1, Vesa Kivimiesmi2, Heikki Rajala1, Jari A. Laukkanen1, Timo A. Lakka1, Rainer Rauramaa, FACSM1, 2Kuopio Research Institute of Exercise Medicine, Kuopio, Finland. 1Information Technology Center, University of Eastern Finland, Kuopio Campus, Kuopio, Finland.
(No relationships reported)

The blunted pulmonary oxygen uptake (VO2) response to constant work exercise is associated with a poor prognosis in congestive heart failure patients but no previous study has addressed this issue in asymptomatic subjects.
PURPOSE: To study the association between a blunted VO2 increase during the first 30 s of the constant work exercise in cycle ergometer and the risk of cardiovascular death in cardiovascularly healthy middle-aged men.

METHODS: The subjects were 484 men, 54-56 years of age, from eastern Finland without cardiovascular disease or cancer at baseline. VO2 response to constant work exercise at 50 Watts in cycle ergometer was quantified by calculating the average net VO2 during the first 30 s of exercise (VO230) in proportion to the average net VO2 at steady state (VO2ss, the average net VO2 during the third minute of exercise). The association of VO2 response with the risk of cardiovascular death was examined with multivariable Cox proportional hazards’ regression model. A total of 52 cardiovascular deaths were observed during an average follow-up of 19.8 years.

RESULTS: The average net VO2 during the first 30 s of exercise in proportion to the average net VO2 at steady state was not related to the risk of cardiovascular death. In Cox-multivariable model, the risk of death increased 8% (95% CI -19-43, p=0.58) for a 1-SD (0.19) increment in VO230/VO2ss after adjustment for myocardial ischaemia during exercise test, cigarette smoking, systolic blood pressure at rest, and body mass index.

CONCLUSION: An attenuated early VO2 response during the first 30 s of constant work exercise does not predict cardiovascular death in cardiovascularly healthy middle-aged men. While submaximal testing itself offers certain advantages, the early VO2 response can not be utilized for prognostic assessment in healthy men.
1308  Board #89  MAY 30  9:30 AM - 11:00 AM  
Ventilatory Efficiency Is Not Associated With Acsm Heart Disease Risk Factors In Asymptomatic Obese Adults  
(No relationships reported)  
Graded exercise tests (GXT) are administered to symptomatic heart failure patients as a diagnostic and prognostic assessment of mortality. GXT’s provide an assessment of functional capacity (VO2peak) and ventilatory efficiency (V̇E/VCO2 slope) and both outcomes are predictive of patient mortality. However, the V̇E/VCO2 slope has been shown to be a stronger predictor than VO2peak for heart disease severity. The American College of Sports Medicine (ACSM) has established several cardiovascular disease risk factors for determining the risk for cardiac disease in asymptomatic adults.

PURPOSE: This study evaluated the relationship between the V̇E/VCO2 slope, VO2peak, and the total ACSM heart disease risk factors in asymptomatic obese adults.

METHODS: 29 obese adults free of heart disease (Mean ± SE: Age 46.5 ± 2.6 years; BMI 35.9 ± 1.1 kg·m^{-2}) were stratified into low (LR <2 risk factor) or moderate risk (MR ≥2 risk factors) using ACSM’s Logic Model from self reported health history questionnaires. Each subject performed a treadmill GXT at a constant speed of 3.5 mph with 2.5% grade increase every 2 minutes. L rate exercised to volitional fatigue and MR until achieving 6 METS, or 76% predicted heart rate maximum. V̇E/VCO2 slope was determined as the rise in V̇E (L·min^{-1} BTPS) to the increase in V̇O2 (L·min^{-1} STPD) throughout the entire exercise session.

RESULTS: There were no significant differences in ventilatory efficiency between risk groups (LR 30.9 ± 0.9, MR 28.6 ± 1.4 V̇E/VCO2 slope). There were group differences in VO2peak (LR 33.9 ± 3.4, MR 19.7 ± 0.9 ml·kg^{-1}·min^{-1}) and total risk factors (LR 1.0 ± 0.0, MR 3.0 ± 0.25). V̇E/VCO2 slope was not associated with total risk factors (p = 0.12, r = -0.288) or final risk category (p = 0.17, r = -0.258). VO2peak was associated with total risk factors (p = 0.00, r = -0.614) and final risk category (p = 0.00, r = -0.665). Exercise test and exercise duration were not associated with V̇E/VCO2 slope.

CONCLUSIONS: Ventilatory efficiency, which has been shown to predict severity of heart disease in asymptomatic adults, was not associated with total ACSM heart disease risk factors in this group of asymptomatic obese adults. Our results suggest that VO2peak is inversely related to heart disease risk in asymptomatic obese adults.

1309  Board #90  MAY 30  9:30 AM - 11:00 AM  
Classical End-criteria With Impact On Maximal Oxygen Uptake In A Population  
Elisabeth Edvardsen, Bjarne Herman Hansen, Sigmund Alfred Andersen. Norwegian School of Sport Sciences, Oslo, Norway.  
(No relationships reported)

During a maximal exercise test, the subjects’ motivation and effort are important requirements to ensure valid and reliable results. Classical end criteria are a plateau in VO2, high RHR, [blood lactate] and ratings of perceived exertion. However, there is currently no consensus for the assessment of maximal effort and different end criteria may have an impact of the results.

PURPOSE: to describe classical end criteria during a maximal progressive exercise test in a random sample of 20 - 85 year old population, and to explore if changes in end criteria have an impact on VO2peak.

METHODS: A sample of 839 individuals (412 women), with a mean age of 51.0 (SD ± 14.8) performed a progressive exercise test on a treadmill to voluntary exhaustion. Gas exchange, heart rate, [blood lactate] and BORG scale ratings of perceived exertion were measured. A plateau in VO2 was defined by levelling off despite increase in ventilation at maximal power. Different end criteria were used to study the impact on VO2peak such as RER ≥ 1.15 and [blood lactate] ≥ 8 mmol·L^{-1}.

RESULTS: There were no sex related differences in HRmax, RER or BORG scale, while the [blood lactate] was significantly lower in women. When using RER ≥ 1.15 and [blood lactate] ≥ 8 mmol·L^{-1}, VO2max increased on average by 4.5 % and 11 %, respectively, compared to using only voluntary exhaustion. Furthermore, a [blood lactate] ≥ 8.0 mmol·L^{-1} excluded 65 % of the participants in the 50 - 85 year cohort (424 vs 148 respectively).

CONCLUSIONS: A range of typically end criteria are presented in a healthy population. Choice of end criteria during exercise testing will have an impact on VO2max. This shows the importance of maximal effort to ensure valid and reliable results.

### End criteria variables after voluntary exhaustion in healthy men and women age 20-85 years

<table>
<thead>
<tr>
<th>End criteria</th>
<th>Age (year)</th>
<th>Number</th>
<th>VO2max (ml·kg^{-1}·min^{-1})</th>
<th>VO2 peak (L·min^{-1} BTPS)</th>
<th>HRmax (beat·min^{-1})</th>
<th>RER (VO2 peak)</th>
<th>[BLa] (mmol·L^{-1})</th>
<th>BORG scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20-29</td>
<td>30-39</td>
<td>40-49</td>
<td>50-59</td>
<td>60-69</td>
<td>70-85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>76</td>
<td>43</td>
<td>97</td>
<td>80</td>
<td>61</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VO2max</td>
<td>44.9 (9.9)</td>
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</tr>
<tr>
<td>VO2 peak</td>
<td>29 (38%)</td>
<td>48 (34%)</td>
<td>75 (38%)</td>
<td>72 (40%)</td>
<td>55 (34%)</td>
<td>18 (22%)</td>
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<td></td>
</tr>
<tr>
<td>HRmax (beat·min^{-1})</td>
<td>191 (7.9)</td>
<td>187 (8.8)</td>
<td>180 (12.5)</td>
<td>171 (13.0)</td>
<td>162 (14.7)</td>
<td>152 (15.9)</td>
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<tr>
<td>RER (VO2 peak)</td>
<td>1.22 (0.1)</td>
<td>1.22 (0.1)</td>
<td>1.19 (0.1)</td>
<td>1.17 (0.1)</td>
<td>1.15 (0.1)</td>
<td>1.10 (0.1)</td>
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<tr>
<td>[BLa] (mmol·L^{-1})</td>
<td>10.9 (2.6)</td>
<td>11.3 (2.9)</td>
<td>10.0 (3.1)</td>
<td>8.8 (2.8)</td>
<td>7.0 (2.6)</td>
<td>5.7 (2.4)</td>
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<tr>
<td>BORG scale</td>
<td>17.8 (1.3)</td>
<td>17.8 (1.3)</td>
<td>17.3 (1.6)</td>
<td>17.3 (1.4)</td>
<td>17.1 (1.6)</td>
<td>17.1 (1.4)</td>
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1310  Board #91  MAY 30  9:30 AM - 11:00 AM  
Maximal Strength Training Enhances Functional Performance in Chronic Stroke Patients  
Tor Ivar Gjellesvik¹, Tessa R. Hill², Per Marities R. Moor³, Tom Tøshaug⁴, Marius S. Finland⁵, Jan Helgenud⁶, Jan Hoff⁷. ¹St.Olav University Hospital, Trondheim, Norway. ²Norwegian University of Science and Technology, Trondheim, Norway. ³Université Paris Descartes, Paris, France. ⁴The Norwegian School of Sport Sciences, Oslo, Norway. ⁵University of Petroleum and Minerals, Dhahran, Saudi Arabia. ⁶University of Northern Colorado, Greeley, CO. ⁷Norwegian School of Sports Medicine, University of Oslo, Oslo, Norway.  
(No relationships reported)

Physical impairment after stroke has been shown to have an immense impact on the reintegration of patients into society and can affect their quality of life. Muscle strength has been shown to be a significant contributor to physical disability (more than the loss of dexterity) after stroke. It is therefore assumed that by increasing a patient’s muscle strength, functional everyday tasks will become easier.

PURPOSE: This study aimed to demonstrate that maximal strength training improves muscle strength, and to assess the effect on functional measures and walking economy amongst chronic stroke survivors.

METHODS: Baseline control trial. 10 patients acted as their own controls for 4 weeks, prior to an 8-week training intervention. Patients trained 3 days/week, 4 sets of 4 repetitions at 85-95% one repetition maximum in unilateral leg press and plantarflexion with an emphasis on maximal mobilization of force in the concentric phase.

RESULTS: Post training, leg press strength improved by 30.6kg (75%) and 17.8kg (68%), and plantarflexion strength by 35.5kg (89%) and 28.5kg (223%) for the unaffected and affected limbs respectively (all p<0.005). The 6-minute walk test improved by 13.9m (p=0.007) and the Timed Up and Go test time by 0.6 seconds (p=0.028). No changes were observed in the control period. There were no significant changes in walking economy, peak aerobic capacity, Four square step test or health related quality of life post training.

CONCLUSIONS: Chronic stroke patients could benefit from maximal strength training as it generates large increases in strength and some improvements in functional measures.
1311 Board #92  
MAY 30  
9:30 AM - 11:00 AM
Enhanced External Counter Pulsation Improves Endothelial Function in Patients With Left Ventricular Dysfunction
(No relationships reported)
PURPOSE: Enhanced external counterpulsation (EECP) improves arterial function, exercise tolerance, and angina symptoms in patients with coronary artery disease (CAD) and normal LV function. To date, however, studies have not elucidated the mechanism of action and the overall effects of EECP therapy in patients with LV dysfunction. The purpose of this study was to investigate the effects of EECP on endothelial function in peripheral muscular conduit arteries in patients with LV dysfunction.

METHODS: Patients with ischemic etiology of LV dysfunction (EF <40%; n = 9), and age-matched patients with symptomatic CAD and normal LV function (n = 13), were studied after 35 1-hr sessions of EECP. Flow-mediated dilation of the brachial (fMD) and femoral (fFMD) arteries was performed using high-resolution ultrasound imaging.

RESULTS: EECP treatment improved comparably (p > 0.05 between groups) the following FMD parameters in both the CAD and LV dysfunction groups, respectively: absolute bFMD (0.213 to 0.325 and 0.226 to 0.385 mm); relative fMD (1.24±0.61 and 1.38±0.76 %); fFMD normalized for shear during the first 10 sec after cuff release (0.185 to 0.313 and 0.191 to 0.307 mm); absolute fFMD (0.198 to 0.264 and 0.194 to 0.226 mm); relative fMD (2.77±3.66 and 2.73±3.19 %); fFMD normalized for shear (0.198 to 0.264 and 0.194 to 0.226 mm). EECP treatment also improved comparably (p > 0.05 between groups) plasma levels of the stable nitric oxide metabolites nitrate and nitrite (NOx) in both the CAD (19.4 to 30.1 µmol/L) and LV dysfunction (22.0± 2.8 µmol/L) groups.

CONCLUSIONS: EECP treatment improves brachial and femoral artery endothelial function, and NOx levels similarly in patients with CAD possessing normal LV function and in patients with LV dysfunction. Our data suggest that peripheral vascular adaptations may be the specific mechanisms responsible for the beneficial clinical effects of EECP in patients with LV dysfunction.

1312 Board #93  
MAY 30  
9:30 AM - 11:00 AM
Evidence Of Reverse Left Ventricular Remodelling Following Exercise Training In Post-Myocardial Infarction Patients.
Gordon S. McGregor, 2 David C. Gaze, Rob E. Shave. 2 UHCW NHS Trust, Coventry, United Kingdom. 1St George’s Healthcare NHS Trust, London, United Kingdom. 2Cardiff Metropolitan University, Cardiff, United Kingdom. (Sponsor: Keith George, FACSM)
(No relationships reported)

Raised serum NT-proBNP concentration is indicative of hemodynamic compromise following myocardial infarction (MI) and also in chronic heart failure (CHF). A reduction in NT-proBNP is evidence of successful treatment and may also indicate reverse left ventricular (LV) remodelling. Cardiac rehabilitation exercise training has been shown to reduce NT-proBNP in CHF, however, the effect of exercise training on resting and peak exercise NT-proBNP is less well characterised in post MI patients.

PURPOSE: To determine the effect of exercise training on resting and peak exercise NT-proBNP in post MI patients following successful percutaneous coronary intervention (PCI).

METHODS: Cardiopulmonary exercise testing (CPET) was undertaken in 31 male (56±10 yrs) clinically stable post MI (33±7 days) patients prior to (CPET1) and following (CPET 2) 10 weeks of exercise training. NT-proBNP measurements were determined from serum samples obtained at rest and at peak exercise via a peripheral venous cannula. Mixed modality (treadmill, cycle, rower, cross-trainer) supervised exercise training was conducted for 30-40 minutes twice weekly at 60-80% of VO

RESULTS: V0 peak significantly improved (3.1±2.6 ml.kg

2peak

P<0.001) from rest to peak exercise on CPET 1 but not on CPET 2 (25±77 ng/L, P>0.05) despite a greater exercise stimulus (147±26 vs 171±28 Watts, P<0.001).

CONCLUSION: Consistent with findings in the HF population, exercise training improves V0 peak and lowers resting plasma NT-proBNP concentration in post MI patients. Furthermore, peak exercise NT-proBNP concentration is reduced. These reductions may potentially indicate reverse LV remodelling secondary to exercise training. However confirmation of this is required.

1313 Board #94  
MAY 30  
9:30 AM - 11:00 AM
Improvement in Exercise Capacity after Cardiac Rehabilitation is Independent of Ejection Fraction in Patients With Coronary Heart Disease
Aashish S. Contractor, Shraddha M. Khialani, Hetal D. Poptani, Anjali S. Zende, Priyanka M. Mehta. Asian Heart Institute, Mumbai, India.
(No relationships reported)

PURPOSE: A low ejection fraction (EF- <35%) risk stratifies an individual in the high risk category for cardiac events. It is a widespread belief that these patients should not engage in intense physical activity. The objective of this study is to determine safety and efficacy of exercise training in coronary heart disease patients (CHD) with low EF, and to evaluate whether cardiac rehabilitation (CR) outcomes differ in patients with normal or reduced EF.

METHODS: 454 patients who were diagnosed to have CHD and enrolled for a 4 week CR program at the Asian Heart Institute; Mumbai formed a part of this study. Based on the EF at enrollment patients were divided into three groups: EF (>55%- 240 patients), EF (35%-54% -154 patients) and EF <35%-60 patients. Exercise capacity was determined using the 6 minute walk test at baseline. Patients exercised under telemetry supervision for 13 sessions over 4 weeks. Exercise was prescribed at 60%- 80% of predicted maximum heart rate and a rating of 2-7 as per Borg Scale. EF 6 Minute Walk Distance (meters)

On comparing the change in the distance covered, no significant difference (p=0.694) was found between the three groups, indicating that improvement in the exercise capacity is independent of the EF.

CONCLUSIONS: Low EF patients with CHD can safely participate in a medically supervised exercise program and experience significant gains in exercise capacity equivalent to those with normal EF.

1314 Board #95  
MAY 30  
9:30 AM - 11:00 AM
Enhanced External Counter Pulsation Improves Exercise Capacity in Patients With Left Ventricular Dysfunction
(No relationships reported)

PURPOSE: Enhanced external counterpulsation (EECP) improves peak oxygen uptake (VO

2peak

and exercise time to angina symptoms in patients with coronary artery disease (CAD) and normal LV function. However, the efficacy of EECP in patients with LV dysfunction remains controversial. The purpose of this study was to investigate the effects of EECP on VO

2peak

and exercise time to angina symptoms in patients with LV dysfunction.

Fixed point exercise (40% of age predicted maximum heart rate) was prescribed for 35 1-hr sessions of EECP. Flow-mediated dilation of the brachial (fMD) and femoral (fFMD) arteries was performed using high-resolution ultrasound imaging.

RESULTS: EECP treatment improved comparably (p > 0.05 between groups) the following FMD parameters in both the CAD and LV dysfunction groups, respectively: absolute bFMD (0.213 to 0.325 and 0.226 to 0.385 mm); relative fMD (1.24±0.61 and 1.38±0.76 %); fFMD normalized for shear during the first 10 sec after cuff release (0.185 to 0.313 and 0.191 to 0.307 mm); absolute fFMD (0.198 to 0.264 and 0.194 to 0.226 mm); relative fMD (2.77±3.66 and 2.73±3.19 %); fFMD normalized for shear (0.198 to 0.264 and 0.194 to 0.226 mm). EECP treatment also improved comparably (p > 0.05 between groups) plasma levels of the stable nitric oxide metabolites nitrate and nitrite (NOx) in both the CAD (19.4 to 30.1 µmol/L) and LV dysfunction (22.0± 2.8 µmol/L) groups.

CONCLUSIONS: EECP treatment improves brachial and femoral artery endothelial function, and NOx levels similarly in patients with CAD possessing normal LV function and in patients with LV dysfunction. Our data suggest that peripheral vascular adaptations may be the specific mechanisms responsible for the beneficial clinical effects of EECP in patients with LV dysfunction.
CONCLUSIONS: EECP treatment improves VO\textsubscript{2peak} total exercise time, exercise time to angina, and CCS angina classification to the same magnitude in patients with CAD possessing normal LV function and in patients with LV dysfunction. Our data indicate that EECP serves as 'passive exercise' and may be a useful intervention in individual patients with LV dysfunction who are poor candidates for aerobic exercise training.

1315  Board #96  MAY 30  9:30 AM - 11:00 AM
Field versus Laboratory Tests: Exercise Capacity Estimates in Elderly Patients with Coronary Artery Disease
Sandra Mandic\textsuperscript{1}, Rob Walker\textsuperscript{1}, Emily Stevens\textsuperscript{1}, Bridget McIlraith\textsuperscript{1}, Sarah Featherston\textsuperscript{1}, Edwin R. Nye\textsuperscript{2}, Dianne Body\textsuperscript{1}, Leanne Barclay\textsuperscript{1}, Michael J A Williams\textsuperscript{1}.
\textsuperscript{1}University of Otago, Dunedin, New Zealand. \textsuperscript{2}Dunedin Public Hospital, Dunedin, New Zealand. (Sponsor: Jonathan Myers, FACSM) (No relationships reported)

Specific data are still lacking about the significance of repolarization abnormalities observed during exercise test in physically active asymptomatic subjects. Coronary CT is a highly sensitive diagnostic procedure able to confirm or exclude a significant coronary artery disease (CAD).

PURPOSE: To compare measured VO\textsubscript{2peak} during symptom-limited exercise testing versus estimated VO\textsubscript{2peak} derived from 6-minute walk test and incremental shuttle walk test in elderly CAD patients.

METHODS: Fifty-one elderly individuals with CAD (age: 73±6 years (range: 60 to 89), 86 (31\%) women) completed the following assessments: 1) symptom-limited graded exercise test with expired gas analysis on a cycle ergometer using a ramp protocol; 2) incremental 10-meter shuttle walk test and 3) two 6-minute walk tests. VO\textsubscript{2peak} was estimated based on maximal walking speed (shuttle walk test) and distance, age, height, weight and rate pressure product (6-minute walk test) using published equations. Data were analysed using Pearson Product Moment correlation and paired t-test.

RESULTS: Measured VO\textsubscript{2peak} obtained during symptom-limited exercise test was significantly related to distance covered during 6-minute walk test (r=0.71, p<0.001) and duration of the incremental shuttle walk test (r=0.75, p<0.001). Estimated VO\textsubscript{2peak} based on 6-minute walk test data (16.0±4.4 ml/kg/min) and maximum walking speed achieved during shuttle walk test (14.7±1.9 ml/kg/min) were significantly lower compared to VO\textsubscript{2peak} measured during a symptom-limited exercise test (19.4±7.7 ml/kg/min; p=0.001 for both comparisons).

CONCLUSIONS: Distance covered during 6-minute walk test and duration of incremental shuttle walk test can serve as an assessment of functional capacity and monitoring of cardiac rehabilitation progress in elderly CAD patients. Estimation of VO\textsubscript{2peak} based on these tests underestimates exercise capacity in elderly CAD patients.

Supported by University of Otago Research Grant

1316  Board #97  MAY 30  9:30 AM - 11:00 AM
Coronary CT In Asymptomatic Subjects With Ventricular Repolarization Abnormalities During Maximal Exercise Test
Andrea Ermola, Fausto Roman, Andrea Gasperetti, Maurizio Varnier, Eleonora Zenella, Marco Zaccaria. Università di Padova, Padova, Italy. (No relationships reported)

Specific data are still lacking about the significance of repolarization abnormalities observed during exercise test in physically active asymptomatic subjects. Coronary CT is a highly sensitive diagnostic procedure able to confirm or exclude a significant coronary artery disease (CAD).

PURPOSE: To evaluate if the occurrence in asymptomatic subjects of ECG repolarization abnormalities potentially suggesting a CAD, is confirmed by coronary CT. Further, clarify if the likelihood of detecting CAD or coronary anomalies was related to the degree of the ECG abnormalities and to the prevalence of cardiovascular risk factors.

METHODS: Among 940 athletes performing a maximal exercise test for sport eligibility (age 30-60yrs), 44 asymptomatic subjects (4.7\%, 39 men and 5 females, 45.2±7.1yrs) demonstrated repolarization abnormalities requiring the completion of a coronary CT. The exercise tests were classified into two categories: suspicious and positive for CAD.

RESULTS: The average maximal heart rate at exhaustion was 170.4±11.9. Risk factors evaluation demonstrated 10 subjects with hypertension, 23 subjects with hypercholesterolemia, 5 smokers. Among the 44 subjects 23 had a suspicious while 21 had a positive exercise test. The coronary CT demonstrated 6 subjects (13,6\%) with a clinically significant CAD, 8 non-significant CAD, while 7 showed various coronary abnormalities. Considering the coronary CT as "gold standard", the positive predictive value (PPV) of the exercise test for any coronary abnormality was 61,9\% for positive exercise tests (47,7\% including suspicious tests), while the PPV of positive tests for CAD was 47,6\% (31,8\% including suspicious tests). The association of late recovery abnormalities and cardiovascular risk factors improved the likelihood of CAD.

CONCLUSION: Our data suggest the clinical importance of slight repolarization abnormalities occurring at the peak of the exercise in asymptomatic middle-aged athletes, particularly when associated with the presence of cardiovascular risk factors. They also support the importance of a prolonged ECG monitoring during the late recovery phase. The PPV of a maximal exercise test in asymptomatic athletes appears lower than what observed in symptomatic subjects, however, about half of these subjects demonstrated some coronary anomalies.

1317  Board #98  MAY 30  9:30 AM - 11:00 AM
Effects of Exercise Training on Objectively Measured Physical Activity Levels in Heart Failure Patients
Daniel Clevenger, Peter H. Brubaker, FACSM, Joel Eggebeen, Dalane W. Kitzman. Wake Forest University, Winston-Salem, NC. (No relationships reported)

Physical activity (PA) levels have not been quantified in the heart failure population, particularly heart failure patients with a preserved ejection fraction (HFpEF).

PURPOSE: To objectively measure PA in HFpEF patients and evaluate changes in levels after structured exercise training and weight loss interventions.

METHODS: Participants of this investigation were assessed at baseline and follow-up on an RCT of exercise and/or weight loss in HFpEF patients. Participants were randomized to one of four intervention groups for 20 weeks: Exercise Only (EO), Diet Only (DO), Exercise plus Diet (E+D), or Attention Control (AC). Participants were asked to wear an accelerometer for 7 continuous days at baseline and then again during the final week of the intervention. The data was included if the participant wore the accelerometer for > 10 hours, of which included activity > 80% of the wear time, and had > 3 days of activity recorded. Each participant’s average steps/day, daily physical activity energy expenditure (PAEE) in kcal/min, minutes of light physical activity (LPA), and minutes of moderate/vigorous physical activity (MVPa) were analyzed.

RESULTS: Thirty-five subjects (77% female) with average age of 68.5±5.9 were included in the analysis. There were a significantly more steps per day in the E+D group compared to the AC group (6761 ± 2174 vs. 4052 ± 1083, respectively). There was also a significant difference for the E+D, EO, DO, and AC at follow-up for minutes of MVPa (31.0 ± 11.1, 11.6 ± 10.7, 14.2 ± 8.4, 9.9 ± 5.1, min/day respectively). There was also a significant difference for PAEE between the E+D and DO groups (280 ± 95 vs. 151 ± 52 kcal/day, respectively).

CONCLUSIONS: HFpEF patients randomized to the E+D group had significantly more minutes of MVPa compared to all of the other intervention groups and significantly greater number of steps/day than AC and more PAEE than DO. It appears that the weight loss, secondary to E+D, results in greater amounts of PA than EO and DO interventions for older HFpEF patients.

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**METHODS:** A retrospective data review was performed for CPX tests performed between July 2007 and July 2009. Patients with known cardiovascular disorders at the time of testing were included in the analysis. Peak functional capacity (VO\(_2\max\)), peak respiratory exchange ratio (RER), and reason for test termination were collected. Adverse outcomes included significant hemodynamic abnormalities, arrhythmias, or ischaemic changes.

**RESULTS:** The study population consisted of 815 patients (68% male) with the following cardiovascular diagnoses: dilated cardiomyopathy (41.8%), prior cardiac transplantation (25.2%), ischemic cardiomyopathy (12.3%), congenital/structural heart disease (3.9%), prior pulmonary embolism (3.4%), heart failure with preserved ejection fraction (2.9%), hypertrophic cardiomyopathy (1.8%), restrictive cardiomyopathy (1.7%), valvular disease (1.8%), and other cardiovascular disorders (5%). Mean peak VO\(_2\) was 15.9 ml/kg/min at a mean peak RER of 1.16. Eighty-three percent of patients achieved a peak RER \(\geq\) 1.05. Thirty-seven tests were terminated prematurely by the supervising exercise physiologist for the following reasons: hypotensive response (1.7%), hypertensive response (1.2%), and significant arrhythmia (1.6%). No myocardial infarctions, cardiac arrests, or deaths occurred.

**CONCLUSION:** Even amongst a population of patients with significant cardiovascular disorders, symptom limited CPX tests can be performed in a safe and effective manner with proper screening and test supervision.

**METHODS:** The aim of this study was to examine whether there are substantial differences in using the same verification test protocol for treadmill and cycle ergometry. Furthermore, verification tests subsequent to incremental tests and on separate days should be compared.

**METHODS:** 10 recreational runners (f=4, m=6, 29 ± 6 y, 1.74 ± 0.06 m, 66 ± 7 kg, VO\(_2\max\): 62 ± 6 ml/min/kg) and 10 male recreational cyclists (31 ± 5 y, 1.82 ± 0.05 m, 75 ± 9 kg, VO\(_2\max\): 62 ± 5 ml/min/kg) underwent an incremental exercise test to exhaustion (E) either on the treadmill or the bicycle ergometer. After 10 min of rest a first verification test was performed at 110% of \(V_{\text{max}}\) or \(P_{\text{max}}\) (V\(_1\)) was performed to exhaustion. 24h later a second verification test (V\(_2\)) similar to V\(_1\) followed. Breath by breath gas exchange data were measured continuously. Capillary blood samples were collected at the end of each stage and at the point of exhaustion. Differences in E, V\(_1\), and V\(_2\) were tested by using ANOVA for repeated measures,

**RESULTS:** Runners’ VO\(_2\max\): (E: 62 ± 6 ml/min/kg, V\(_1\): 61 ± 7 ml/min/kg) and cyclists’ VO\(_2\max\): (60 ± 6 ml/min/kg) was not significantly different between E and V\(_1\), while V\(_2\) was significantly lower than E (p<0.01). There was no statistically significant difference in the runners’ time to exhaustion (TTE; V\(_1\): 01:55 ± 00:15 min, V\(_2\): 02:05 ± 00:30 min). Cyclists’ VO\(_2\max\): (E: 62 ± 5 ml/min/kg, V\(_1\): 61 ± 6 ml/min/kg, V\(_2\): 63 ± 4 ml/min/kg) was significantly lower in V\(_1\) than in E (p<0.05) but there was no difference between E and V\(_2\). Cyclists’ TTE was significantly longer in V\(_2\) than in V\(_1\) (V\(_1\): 02:24 ± 00:20 min, V\(_2\): 03:23 ± 00:25 min, p<0.001). TTE was significantly longer in cyclists than in runners in V\(_1\) and V\(_2\) (p<0.001).

**CONCLUSION:** For recreational athletes, the time of verification testing seems less important since the observed differences in VO\(_2\max\) were irrelevantly small. Therefore, verification tests can be performed directly after incremental tests to ensure validity of maximum values. Due to the longer TTE in cyclists it seems needful to examine different test protocols for different populations.
kitchen and designed to achieve a 1-2 pound weight loss per week. The EX group followed their usual diet but attended three supervised weight training sessions per week. EX was comprised of eight exercises over 45 minutes designed to achieve similar calorie deficit as that computed for the diet groups. Body composition was assessed by bioelectrical impedance and RMR was measured during 40 minutes of supine rest in a fasted state following 24 hours of no exercise. Changes in body weight, RMR and %fat between groups were analyzed using ANOVA.

RESULTS There were no differences between groups at baseline. Change in body weight and %fat was significantly improved (p < 0.001) for the PRO and CHO groups as compared to EX (Wt: -5.9%, -6.2%, -0.5%; Fat: -3.5%, -5.3%, +1.2% respectively). There were no significant changes in RMR for any group.

CONCLUSION An energy-restricted caloric deficit produces greater weight loss and greater body fat loss in six weeks when compared to a resistance training exercise program inducing the same caloric deficit. It is possible that the EX group increased caloric intake despite increased exercise. Follow up is necessary to establish the long-term efficacy of these programs.

Supported by ASU Foundation.

### 1322 Board #103 MAY 30 11:00 AM - 12:30 PM

**Optimizing Fat Oxidation in Untrained Women: The Competing Indices of Fitness versus Fat Loss**

Harold C. Mayer, Deborah A. Beihl. Southern Adventist University, Collegedale, TN.

(No relationships reported)

Arresting the obesity epidemic is a high priority public health and restlessness issue. This study explores factors affecting fat oxidation and resting metabolism in untrained overweight/obese women.

**PURPOSE:** The objective of this research was to explore the effects of a high fiber diet (The Full Plate Diet) and exercise on resting metabolism, weight loss, and percent body fat loss, METHODS: Overweight/obese (BMI between 25 -39), sedentary women (n=20) were recruited with a fiber intake <30g/day. Participants were randomized into three groups and followed for 8 weeks: FPD alone (FPD); FPD + continuous heart rate exercise (FPD+conEx); FPD + variable heart rate exercise (FPD+varEx). Pre- and post-study assessments included dietary analysis, resting metabolic rate, VO2 max, treadmill test, and hydrostatic weight.

**RESULTS:** The high fiber FPD (consisting of 40 grams of whole food fiber daily) alone improved energy balance (from 139 to -226 kcals) without counting calories, but was inadequate to achieve fat (or weight) loss in the 8 weeks. The FPD+conEx group (training intensity = 58.4% ± 14.1 verified via Polar heart rate monitors) saw a significant drop in (health measure) percent body fat (35.3% to 31.3%, p=.03), but no significant change in weight or (fitness measure) VO2max. The FPD+varEx group (training intensity = 67.7% ± 5.8 verified via Polar heart rate monitors) saw a significant drop in weight (3.7 lbs, p=.03) and significant improvement in fitness measure Relative VO2 max (20.8 to 21.4, p.0016) and Absolute VO2 max (1.94 to 2.20, p.003), but no significant drop in percent body fat (39.9% to 38.2%, p=.06). A group showed a statistically significant metabolic efficiency change in resting metabolic rate (RMR).

**CONCLUSION:** The Full Plate Diet helped participants to regulate energy balance without counting calories by reducing caloric intake, since they were more aligned with the resting energy expenditure (REE). Both increased fiber intake and low intensity exercise appear to be necessary to decrease percent body fat in untrained, overweight/obese participants. In fact, it appears that there is an inverse relationship between increased fitness and increased fat oxidation. Further research in a larger population over a longer period of time is needed to clarify this competing health - fitness relationship.

### 1323 Board #104 MAY 30 11:00 AM - 12:30 PM

**Physiological and Psychosocial Benefits Associated with Weight Loss Programs: Changes in Body Weight, Social Physique Anxiety, and Exercise Enjoyment**

Lynn A. Darby, FACSIM1, Bonnie G. Berger1, Rob A. Carels1, Roberta L. Pohlman2. 1Bowling Green State University, Bowling Green, OH. 2Wright State University, Dayton, OH.

(No relationships reported)

Weight loss has been correlated with changes in social physique anxiety (SPA) and exercise enjoyment (PACES) after a behavioral weight loss program (BWLP) (Darby, Berger & Carels, 2011).

**PURPOSE:** To further explore relationships among psychophysiological variables and to assess changes from before to after two different weight loss programs.

**METHODS:** Thirty-six participants who were overweight or obese completed anthropometric assessments [visseral adipose tissue (VAT) determined from sagittal abdominal diameter (SAD) (Parr & Hught, 2006)], physiological tests (submax walking GXT’s), and dietary and activity (accelerometer) reports. They also completed the psychological inventories of the PACES (Physical Activity Enjoyment Scale; Kendzierski & DeCarlo, 1991) and SPA (Social Physique Anxiety; Hart, Leary, & Rejeski, 1989). All measures were completed before and after weight loss programs (BWLP LEARN, Brownell, 2004 or Transforming Your Life (TYL), Carels et al., 2011).

**RESULTS:** Completers included 10 men and 26 women (Age = 49 ±12 yr). Body weight (BW), VAT, BMI, GXT time were significantly different (p < 0.05) after 14-weeks. Mean scores pre- and post-program were as follows: BW (98.1 ±17.5, 93.3 ±18.2 kg), VAT (10.6 ±2.5, 8.6 ±2.5 lb), BMI (34.7 ±5.6, 32.3 ±5.6 kg/m²), and GXT time (563 ±216, 673 ±216 sec). Two-way ANOVAs (Time by Type of Program) indicated desirable changes in exercise enjoyment and social physique anxiety. Scores pre- and post-program were as follows: PACES (88.8 ±16.9, 97.7 ±14.1), and SPA (41.8 ±8.4, 37.6 ±8.7). There were no differences in PACES or SPA due to type of program, or sex. Not only did the PACES increase from beginning to end of the programs, pre- and post-values were significantly correlated with self-monitored average daily physical activity (r=.421, p=.02; r=.440, p<.01). Therefore, with participation in physical activity during the programs, there was a significant increase in exercise enjoyment and a decrease in anxiety. SPA scores at the beginning of the program were positively correlated with average energy intake during the program, however, SPA scores at the end of the program were not.

**CONCLUSION:** Weight loss programs, regardless of type, are associated with both desirable physiological and psychological changes.

### 1324 Board #105 MAY 30 11:00 AM - 12:30 PM

**Weight Loss Induced by Exercise Preserves Resting Metabolic Rate: Midwest Exercise Trial II (MET II)**

Jeffery J. Honas1, Richard A. Washburn, FACSIM, Stephen D. Hermann1, Kate Lamboume1, Jaehoon Lee1, Joseph E. Donnelly, FACSIM. 1University of Kansas Medical Center, Kansas City, KS. 2University of Kansas, Lawrence, KS.

(No relationships reported)

Weight loss resulting from decreased energy intake has been associated with decreases in metabolic rate. The RMR response to weight loss by exercise without energy restriction is unclear. The inconsistent results on the effect of exercise induced weight loss on RMR may be due, in part, to variability in length, intensity, duration, and the level of supervision/verification of the exercise intervention.

**PURPOSE:** To evaluate the impact of exercise induced by 2 levels of exercise energy expenditure (EEXEx) on RMR.

**METHODS:** 91 sedentary, overweight/obese (BMI 25-39.9) young adults (18-30 yrs.; 55% female), were randomized to either 2,000 (N=36) or 3,000 (N=37) kcal/wk. of supervised treadmill exercise at 70-80% max heart rate (HR), or to a sedentary control group (N=18) for 10 mos. Participants were instructed not to alter energy intake. Exercise was progressed slowly in both exercise groups with participants reaching their target level at the end of mo. 4. The intensity and duration of all exercise sessions were verified by HR monitor. EEXEx was assessed monthly by indirect calorimetry. RMR was assessed by indirect calorimetry at baseline and 10 mos. between the hrs. of 6-9 am, after a 12 hr. fast, and no exercise for 48 hrs.

**RESULTS:** Exercise at both 2000 or 3000 kcal/wk. resulted in clinically significant weight loss (2000 = -4.2%, 3000 = -5.3%) compared to the control group (+ 0.3%). Despite clinically significant weight loss, there were no significant decreases in RMR within or between exercise groups (2000 = -1.0%, 3000 = -1.6%; p =0.81) or between exercise and control (Exercise = -1.3%, Control = +1.1%; p=0.48). The RMR response to exercise did not differ by gender (p=0.76).

**CONCLUSIONS:** Weight loss induced by exercise without energy restriction prevents the decreases in RMR typically associated with weight loss by energy restriction alone. These results suggest that exercise may be the preferable mode of weight loss for the prevention of weight regain.

Supported by NIH R01 DK49181

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Self-monitoring is a crucial component of diet and exercise interventions and has been associated with greater amounts of weight loss. It is not known whether self-monitoring data reported for diet and exercise are different when participants are not seen directly by a health educator, such as in a phone-based intervention.

**PURPOSE:** To compare self-reported use of pre-packaged meals (PMs—shakes/entrees), fruit and vegetable (F/V) consumption, and physical activity (minutes, pedometer steps/day) between individuals receiving a group-based intervention delivered face-to-face (FTF) or by conference call, and to determine if these measures are predictive of weight loss.

**METHODS:** 395 overweight and obese adults (BMI 25-39.9, age 18-65) were randomly assigned to a 6-month weight loss intervention delivered by conference call or FTF clinic. The intervention targeted 300 min/week of moderate-to-vigorous exercise and 10,000 steps/day. Energy intake was reduced to ~1,200–1,500 kcal/day using PMs and FV. Participants in both groups attended weekly clinics consisting of lessons on exercise, nutrition, and lifestyle modification. T-tests compared differences in the self-reported diet and exercise data between the phone and FTF groups. A regression analysis examined whether self-reported diet and physical activity data predicted weight loss after controlling for baseline weight and sex among the participants who completed the intervention.

**RESULTS:** No significant differences were observed in the self-reported diet and physical activity data between the phone and FTF group (p>0.05 for all comparisons). The number of pre-packaged shakes used (M=2.6, SD=0.34) and number of steps/day (M=8485, SD=2508) were significant predictors of weight loss (beta = 0.14, p = 0.02; beta = 0.17, p < 0.01, respectively; R² = 0.28). The reported number of pre-packaged entrees, FV, and minutes of physical activity were not significant predictors of weight loss.

**CONCLUSION:** Changes in self-reported diet and physical activity were similar between weight loss interventions delivered FTF or by conference call. The use of pre-packaged shakes and a pedometer to monitor physical activity resulted in greater weight loss, independent of the clinic delivery method.

Supported by NIH DK076063 and Health Management Resources, Boston, MA.
body composition was observed, with an increase of 36% and 6% in fat mass among underweight and normal weight patients, respectively. Lean body mass increased among underweight, but not normal weight patients. Nine of the 29 patients had a body fat percentage exceeding healthy limits at admission; none of these showed decrease in body fat percentage at discharge.

CONCLUSIONS: Several underweight patients were still underweight at discharge, whereas none of the patients with excess amounts of body fat managed to reduce body fat percentage. Increase in aerobic capacity would have been beneficial to especially patients with excess body fat. These results calls for a more individualized treatment approach to achieve a more optimal body composition among both underweight and normal weight patients with longstanding ED.

1329 Board #110  MAY 30  11:00 AM - 12:30 PM
Systemic Inflammation and Disease Risk Factors in Mexican-American Children after an Intensive Lifestyle Intervention
Whitney L. Breslin 1, Craig A. Johnston 2, Jennette P. Moreno 2, Kelley Strohacker 1, Katie C. Carpenter 1, John P. Foreyt 2, Brian K. McFarlin, FACSM 2.
1University of Houston, Houston, TX. 2Baylor College of Medicine, Houston, TX. (Sponsor: Brian K McFarlin, FACSM)
(No relationships reported)

PURPOSE: Obesity is an independent risk factor for chronic disease. The prevalence of obesity is especially high among Mexican-American children. Peripheral blood monocytes are altered with obesity and may contribute to systemic inflammation that mediates the relationship between obesity and chronic disease. In addition, obesity alters the circulating levels of cytokines/chemokines that influence monocyte behavior. To evaluate the effects of a 6-month school-based healthy lifestyle program on systemic inflammation and disease risk markers in healthy weight (zBMI <85th percentile), overweight (zBMI=85th-95th percentile), and obese (zBMI ≥95th percentile) Mexican-American children.

METHODS: Participants were randomized to either a 6-month intensive intervention or self-help group. Pre- and post-intervention blood samples were analyzed for total monocyte concentration, pro-inflammatory monocyte concentration, and classic monocyte concentration via flow cytometry. Serum MCP-1, Fractalkine, IL-8, and TNF-α were measured using a Milliplex MagPix assay. Serum cholesterol, HDL, triglycerides, and glucose were measured using an enzymatic reagent kit.

RESULTS: At baseline, Total monocyte concentration (P=0.012), classic monocyte concentration (P=0.045), MCP-1 (P=0.015), and TNF-α (P=0.002) were significantly greater in obese children compared to healthy weight children. Also, overweight and obese children had elevated triglycerides (P=0.001) and reduced HDL (P=0.033) compared to healthy weight children. Post-intervention samples will be analyzed to determine the effect of the intervention on these markers of systemic inflammation and disease risk.

CONCLUSIONS: Elevations in circulating monocytes, MCP-1, and TNF-α have been implicated in the development of obesity-related chronic disease in adults. School-based healthy lifestyle interventions that promote zBMI reduction may reduce systemic inflammation and prevent the future development of obesity-related chronic diseases.

1330 Board #111  MAY 30  11:00 AM - 12:30 PM
Daily Exercise and Caloric Restriction Impact Fibroblast Growth Factor-21 in Hypophagic OLETF Rats
(No relationships reported)

PURPOSE: Chronic treatment with fibroblast growth factor-21 (FGF-21) favorably improves obesity and nonalcoholic fatty liver disease (NAFLD) outcomes; however, FGF-21 expression is paradoxically elevated in obese conditions. Here, we sought to determine the effects of obesity prevention by daily exercise (EX) vs. caloric restriction (CR) on hepatic FGF-21 in the hyperphagic, Otsuka Long-Evans Tokushima Fatty (OLETF) rat.

METHODS: At 4 weeks of age, male OLETF rats (n=7-8/group) were randomized to groups of ad libitum fed, sedentary (OLETF-SED), voluntary wheel running exercise (OLETF-EX), or CR (OLETF-CR; 70% of SED) until 40 wk of age. Nonhyperphagic, Long-Evans Tokushima Otsuka (LETO-SED) rats served as controls.

RESULTS: Both daily EX and CR prevented obesity and NAFLD development observed in the OLETF-SED animals. This was associated with significantly (p<0.01) lower serum FGF-21 (~80% lower) and hepatic FGF-21 mRNA expression (~65% lower) in the OLETF-EX and OLETF-CR rats compared with OLETF-SED. However, hepatic FGF-21 protein content was reduced to the greatest extent in the OLETF-EX animals (50% of OLETF-SED) and did not differ between OLETF-SED and OLETF-CR. Further examination of hepatic FGF-21 signaling mediators revealed that the protein content of the hepatic co-factor of FGF-21 (β-Klotho), hepatic FGF-21 receptor 2 (FGFR2) mRNA expression, and hepatic FGF-21 receptor substrate 2 (FRS2) protein content were elevated (+30.50%, 60-100%, and ~40%, respectively) in the OLETF-EX and OLETF-CR compared with OLETF-SED animals.

CONCLUSIONS: Daily exercise and caloric restriction modulate hepatic FGF-21 and its primary signaling mediators in the hyperphagic OLETF rat. Enhanced metabolic action of FGF-21 may partially explain the benefits of exercise and caloric restriction on NAFLD outcomes. Supported by NIH grant T32 AR 048523-07 and VHA-CDA2 IK2BX001299-01.

1331 Board #112  MAY 30  11:00 AM - 12:30 PM
Effects of Obesity and Exercise Training on Regional Adipose Tissue VEGF Production in Rats
Tongjian You, FACSM 1, Beth Disanzo 1. University of Massachusetts Boston, Boston, MA. 1State University of New York at Buffalo, Buffalo, NY.
(No relationships reported)

Vascular endothelial growth factor (VEGF) plays an important role in angiogenesis within adipose tissue. However, the effects of obesity and chronic exercise on regional adipose tissue VEGF production are still not well known.

PURPOSE: To compare the regional differences in VEGF production in subcutaneous and intra-abdominal adipose tissue, and investigate the effects of obesity and chronic exercise on adipose tissue VEGF production in rats.

METHODS: Lean (FaFa) and obese (fa/fa) male Zucker rats at 2 months of age were randomly assigned to a sedentary and an exercise training group (lean sedentary: n=7, lean exercise: n=8, obese sedentary, n=7, obese exercise: n=8). The exercise group walked on a rat treadmill at 20 m/min for 60 min, 5 times per week for 8 weeks. Inguinal and epididymal adipose tissue samples were collected and in vitro VEGF secretion levels were determined.

RESULTS: In the whole cohort, VEGF secretion levels were higher in epididymal (13.20±3.93 ng/g protein) compared to inguinal (6.41±1.18 ng/g) adipose tissue (P=0.01). There were significant main effects of obesity on inguinal (lean: 2.66±0.23 ng/g, obese: 10.17±1.93 ng/g, P<0.01) and epididymal (lean: 6.92±1.85 ng/g, obese: 19.48±7.42 ng/g, P<0.05) adipose tissue VEGF secretion, and significant main effects of obesity and chronic exercise on epididymal adipose tissue VEGF secretion (sedentary: 5.80±0.77 ng/g, exercise: 19.68±7.05 ng/g, P<0.05). There were no obesity-exercise interactions on the variables.

CONCLUSIONS: Our results support that intra-abdominal adipose tissue releases more VEGF than subcutaneous adipose tissue, and both obesity and exercise training increase adipose tissue VEGF production in rats. Future studies are needed to identify the role of VEGF in angiogenesis in response to chronic exercise in obesity.

1332 Board #113  MAY 30  11:00 AM - 12:30 PM
The Supplement Of A-keto Acids Supports Diabetes Patients To Do Physical Exercise
Yuefei Liu, Tamara Spreng, Jürgen M. Steinacker, FACSM. Sports and Rehabilitation Medicine, Ulm, Germany.
(No relationships reported)

PURPOSE: Type 2 diabetes mellitus (DM) is one of the most important epidemic diseases that threaten the public health, and physical inactivity plays an important role in the development of DM. Therefore, to improve physical activity is of critical significance for dealing with DM. However, to do physical exercise brings about a variety of physiological changes including metabolic challenges that can reduce exercise tolerance. The aim of this study was to investigate supportive effects of nutritional supplement of a-keto acids (KAS) in patients with DM doing physical training.

METHODS: In the double-blinded, placebo-controlled study 30 patients with DM (non-insulin-dependent) were recruited (60 ± 10 yrs, 173 ± 8 cm, 91 ± 16 kg) and randomized into two groups (placebo and KAS, respectively). The respective groups received 6 weeks of physical training on cycle-ergometers supervised by a professional assistant. The training program was composed of 3 obligatory sessions (3 x 15 min endurance training followed by 5 min high intensity strength training each) and voluntarily additional training. The agents with placebo or 0.2 g/kg/d a-keto acids (0.1g a-ketoglutarate and 0.1g branched-chain keto acids) were supplemented during the training phase and one following recovery week.
RESULTS: In the placebo group only 28 min/week voluntary training were performed while in the KAS group 78 min (P<0.05). With KAS the subjects attained higher maximum power output (224 vs 193 watts, P<0.05). A greater improvement in glucose control and Quantitativer Insulinsensitivitäts-Check-Index was achieved in the KAS group.

CONCLUSIONS: The supplement with a-keto acids in patients with DM during physical training could improve exercise tolerance and training effect along with beneficial effect on glucose control and insulin sensitivity. Thus, KAS supports patients with DM to do physical exercise.

1334  Board #114  MAY 30  11:00 AM - 12:30 PM
Similar Metabolite Shifts Following 75-Km Cycling Time Trials When Ingesting Bananas Or a Carbohydrate Beverage
David C. Nieman, FACSM1, Nicholas Gillitt2, Wei Sha1, Andrew Shanelly1, Amy Knabl1, Lynn Kann1. Appalachian State University, Kannapolis, NC. 1Dole Nutrition Research Institute, Kannapolis, NC. 2UNC-Charlotte, Bioinformatics Research Center, Kannapolis, NC.

(D.C. Nieman: Contracted Research - Including Principle Investigator; Dole Foods.)

PURPOSE: This study compared the acute effect of ingesting bananas (BAN) versus a 6% carbohydrate sports drink (CHO) on 75-km cycling performance and shifts in metabolites using metabolomics-based profiling.

DESIGN: Trained cyclists (N=14, age 37±1.9 y, Watts2max 379±12.5) completed two 75-km cycling time trials (3 weeks apart, randomized, crossover) while ingesting BAN or CHO. Subjects cycled on CompuTrainers for 75-km at the fastest pace possible while ingesting 0.2 g/kg carbohydrate from BAN or CHO every 15 min. Blood samples were taken pre-exercise, immediately following, and 1-h post-exercise, and analyzed for metabolite profiles using gas chromatography-mass spectrometry (GC-MS).

RESULTS: Performance time did not differ between BAN and CHO (2:41±0.08, 2:36±0.05 h, respectively, P=0.258). Of 103 metabolites detected, 56 had significant time effects following the 75-km cycling bouts, and only one (dopamine) had a pattern of change that differed between BAN and CHO. Score plots from the partial least squares discriminant analysis (PLS-DA) model visualized the global metabolic differences between pre-exercise, immediately post-exercise, and 1-h post-exercise, indicating a distinct separation between time points (R²Y(cum) = 0.869, Q²(cum) = 0.766). Of the top 15 metabolites (ranked by both variable influence on the projection, VIP, and FDR adjusted p-values), five (2-hydroxybutyric acid, 2-aminoxybutyric acid, L-glutamic acid, L-methionine, and L-proline) were related to liver glutathione production, four (palmitoleic acid, palmitic acid, oleic acid, and heptadecanoic acid) to lipid metabolism, three (2,3,4-trihydroxybutanoic acid, D-fructose, and pyruvic acid) to carbohydrate metabolism, two (malic acid and succinic acid) were intermediates in the tricarboxylic acid cycle (TCA cycle), and one (L-isoleucine) was involved in branched chain amino acid metabolism.

CONCLUSIONS: With the exception of higher dopamine in BAN (a polyphenolic found in bananas), shifts in metabolites following BAN and CHO 75-km cycling time trials indicate a similar pattern of heightened production of glutathione and utilization of fuel substrates in several pathways including glycolysis, lipolysis, and amino acid catabolism.

Supported by a grant from Dole Foods

1344  Board #115  MAY 30  11:00 AM - 12:30 PM
High Physical Activity Counteracts the Altered Incretin Response to High Fructose Consumption
Jill A. Kanaley, FACSM1, Amy Bidwell2, Timothy Fairchild1. 1University of Missouri, Columbia, MO. 2Syracuse University, Syracuse, NY. 3Murdock University, Perth, Australia.

(No relationships reported)

Fructose consumption has increased substantially in the past few decades and has been linked with metabolic maladaptations. Whether increased physical activity (PA) may confer protection against these metabolic adaptations is yet to be determined. Although the glucose and insulin response to fructose ingestion has been well studied, the incretin response is not well understood.

PURPOSE: The purpose of this study was to determine the interaction between high fructose consumption and PA levels on the incretin response to a fructose rich meal in normal weight individuals.

METHODS: Twenty normal weight men and women (age: 21±3 yr) consumed an additional 64 g high fructose corn syrup for 14 days on 2 occasions. During these 14 days, subjects maintained either low PA (4,500 steps/day) or high PA (12,500 steps/day). Each condition was followed by a study day where subjects were given a fructose-rich meal (600 calorie mixed meal [45% carbohydrate [7.3% fructose], 40% fat, and 15% protein]) in the morning after a 12 h overnight fast, and blood was sampled at baseline and for 6 h after the meal. Samples were analyzed for glucagon-like peptide 1 (GLP-1), glucose-dependent insulinotropic peptide (GIP) and insulin concentrations. The incremental area under the curve (iAUC) was calculated to quantify the postprandial responses.

RESULTS: GIP concentrations showed a significant PA by fructose loading interaction (P=0.00) such that fructose increased the GIP iAUC levels from pre to post-loading more so in the high PA condition (12.8±13 vs 14.9±19 pg/ml; P=0.034). With the exception of higher dopamine in BAN (a polyphenolic found in bananas), shifts in metabolites following BAN and CHO 75-km cycling time trials indicate a similar pattern of heightened production of glutathione and utilization of fuel substrates in several pathways including glycolysis, lipolysis, and amino acid catabolism.

Supported by a grant from Dole Foods

A-33  Free Communication/Poster - Exercise Recovery Measures
MAY 30, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

1335  Board #116  MAY 30  9:30 AM - 11:00 AM
The Influence of Aerobic Fitness on the Recovery of Peak Power Output
Mark Glaister, John R. Patison, Bernadette Dancy, Gillian Mclnnes. St Mary’s University College, Twickenham, United Kingdom. (Sponsor: Gregory B Dwyer, FACSM)

(No relationships reported)

PURPOSE: The aim of this study was to evaluate the influence of aerobic fitness on the recovery of peak power output (PPO) following a maximal 30 s sprint.

METHODS: On separate occasions, 16 well-trained men (age: 21 ± 3 years; height: 1.84 ± 0.05 m; body mass: 78.8 ± 7.8 kg; and VO2max: 4.28 ± 0.54 L·min⁻¹) performed a 30 s maximal sprint on a cycle ergometer, followed by a predetermined stationary rest period (5, 10, 20, 40, 80, or 160 s) and a subsequent 5 s sprint to determine the kinetics of PPO during recovery. On another occasion, oxygen uptake (VO2) was monitored during recovery from a 30 s sprint to enable the recovery kinetics of GIP and PPO to be compared. In addition, subjects completed a VO2max test to evaluate the influence of this parameter on PPO.

RESULTS: Comparison of the recovery kinetics of PPO and VO2 revealed no significant difference between the variables (F1,15 = 3.16, p = 0.096); there was, however, a significant effect of time (F1,37.5 = 3.44, p < 0.001), and a significant variable x time interaction (F1,37.5 = 3.86, p = 0.004). Post hoc tests detected differences between the two variables at 20 s only (p < 0.05). Time constants for the kinetics of PPO and VO2 (54.0 ± 19.1 s and 51.8 ± 11.0 s, respectively) were poorly correlated (r = −0.17, p = 0.541), but were not significantly different (t15 = 0.385, p = 0.705). There were no significant correlations between VO2max and the time constants of either PPO (r = 0.20, p = 0.455) or VO2 (r = 0.43, p = 0.041).

CONCLUSION: Despite many similarities, the results of this study suggest that the recovery of PPO may be faster than that of VO2 in the early phase of recovery following a maximal sprint; moreover, the speed of that recovery does not appear to be related to VO2max.

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The contribution of oxidative energy to multiple sprint exercise is of interest due to implications for the training needs of people engaging in anaerobic activities.

**PURPOSE:** The purpose of this study was to examine the effect of short and long active recovery durations on oxidative and anaerobic energy contributions during maximal intensity cycle ergometry.

**METHODS:** Six male subjects completed the study. After a VO2max test on the bicycle ergometer, each subject completed 2 conditions: a short recovery condition (SRC) and a long recovery condition (LRC). The SRC consisted of 10, 10-sec. supramaximal sprints with 30-sec. recovery periods. The LRC consisted of 10, 10-sec supramaximal sprints with 3-min. recovery periods. The load applied to the ergometer was 1.2 kg and the RPM during the sprints varied based on the maximal output. During recovery, no load was applied and subjects maintained a cadence of 80 RPM. VO2 was measured throughout both conditions and peak power and total work were calculated from two, 5-sec RPM averages generated during the sprints. Blood samples were taken pre-exercise, after sprints 4, 7, and 10, and 3 minutes post-exercise.

**RESULTS:** Peak power and total work were significantly greater (p < 0.05) in the LRC (1091.3 ± 109.2 W and 1161.6 ± 33.9 kgm) compared to the SRC (915.3 ± 109.2 W and 1161.6 ± 33.9 kgm). In addition, peak power decayed by 21.7% over the 10 sprints in the SRC compared to no decay in the LRC. Oxygen uptake averaged 28.3 ± 0.9 ml/kg/min for the entirety of the LRC; whereas, in the SRC there was a large increase in oxygen uptake during the second sprint that remained elevated and averaged 47 ± 1.5 ml/kg/min for the remaining sprints. There was no difference in blood lactate between conditions.

**CONCLUSION:** The heightened aerobic response and the lower work and power outputs seen in the SRC are suggestive of a decrement in both anaerobic glycolysis and phosphocreatine activity as successive sprints were completed. After repeated bouts of explosive exercise with short rest periods, oxidative processes play a more important role in energy production, most likely due to fatigue occurring in the anaerobic energy producing systems. These findings point to the need for enhancing the aerobic capacity of athletes engaging in consecutive high intensity bouts of exercise when rest intervals are short.

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**Board #117**

**MAY 30**

**9:30 AM - 11:00 AM**

**The Effect of Short and Long Recovery Periods on the Contribution of Oxidative Processes to Energy Expenditure During Multiple Bouts of Supramaximal Exercise**

Erik C. Olson1, Kenneth V. Christensen2, Adam Jantzer3, Jen Copeland4, Matt Unthank5, Joel B. Mitchell, FACSM5, 4Texas Christian University, Fort Worth, TX. 5Texas Christian University, Fort Worth, TX. (No relationships reported)

The contribution of oxidative energy to multiple sprint exercise is of interest due to implications for the training needs of people engaging in anaerobic activities.

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**CONCLUSION:** The heightened aerobic response and the lower work and power outputs seen in the SRC are suggestive of a decrement in both anaerobic glycolysis and phosphocreatine activity as successive sprints were completed. After repeated bouts of explosive exercise with short rest periods, oxidative processes play a more important role in energy production, most likely due to fatigue occurring in the anaerobic energy producing systems. These findings point to the need for enhancing the aerobic capacity of athletes engaging in consecutive high intensity bouts of exercise when rest intervals are short.

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**Board #118**

**MAY 30**

**9:30 AM - 11:00 AM**

**Post-match Recovery In Elite Soccer Referees**

Matthew Weston, Alan M. Batterham, FACSM. Teeside University, Middlesbrough, United Kingdom. (No relationships reported)

The measurement of recovery following competition is required to facilitate the effective planning and timing of subsequent training sessions. Soccer refereeing at the elite-level represents a significant physical challenge. The effect of match intensity on post-match recovery, however, has yet to be investigated.

**PURPOSE:** To examine the effect of match intensity on recovery in elite soccer referees.

**METHODS:** Data were collected from 14 elite soccer referees for 194 English Premier and Football League matches (range: 5 to 21 matches). Internal match loads were RPE (CR-10 scale) and heart rate (HR) load, computed by multiplying the accumulated duration in each of five different HR zones by a multiplier for each zone and summing the results. Each match was analysed using a semi-automated match-analysis system. External match loads were the referees’ total distance covered (m) and the total high-speed running distance (m; running speed >19.8 km/h). The referees’ recovery was recorded 30-min after waking on the day following their match, with a score of 0 representing poor recovery and 10 representing full recovery. A within-referee design was used to determine if high internal and external match loads were associated with low post-match recovery scores. Within-subject correlations between the referees’ measures of external and internal match load and post-match recovery (n=194) were examined, with 90% confidence intervals (CI) and effect sizes (Cohen’s d) also presented.

**RESULTS:** Match internal loads were 6.7 ± 1.5 and 304 ± 47 au for RPE and HR load, respectively. Match external loads were 11648 ± 609 and 1025 ± 338 m for total distance and high-speed running, respectively. Post-match recovery was 6.7 ± 1.2 au. There was a small correlation between post-match recovery and match RPE (r = -0.24; 90% CI -0.36 to -0.12, d = 0.49) and trivial correlations between recovery and total distance (r = 0.10: -0.02 to 0.22, d = 0.20), high-speed running (r = -0.03: -0.15 to 0.09, d = 0.06) and HR load (r = 0.06: -0.07 to 0.18, d = 0.11).

**CONCLUSION:** Elite soccer referees’ post-match psychophysiological recovery was influenced by the perceived exertion of their matches but not by their match running distances or match heart rates. Future research should investigate the effect of fitness levels and age on the post-match recovery process.

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**Board #119**

**MAY 30**

**9:30 AM - 11:00 AM**

**Effects of Recovery Duration from Prior Heavy Exercise on VO2 Kinetics and Performance**

Glen R. Belfry, Seung-Jun Park, William J. Karelson, Juan M. Murias, Matthew D. Spencer, John M. Kowalchuk, Donald H. Paterson, FACSM. University of Western Ontario, London, ON, Canada. (No relationships reported)

**PURPOSE:** To examine the effect of recovery duration on recovery in elite soccer referees.

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**CONCLUSION:** Elite soccer referees’ post-match psychophysiological recovery was influenced by the perceived exertion of their matches but not by their match running distances or match heart rates. Future research should investigate the effect of fitness levels and age on the post-match recovery process.
METHODOLOGY: Non-trained females (NT, n = 13, age 35 ± 3 years, VO2max: 36 ± 3 ml/kg/min) and recreational trained males (T, n = 13, age 35 ± 5 years, VO2max: 54 ± 4 ml/kg/min) performed three running exercises on a treadmill, separated at least by two days. In both groups, the effects of increased intensity (NT from 50 to 74 %, T from 60 to 85 % of VO2max) or the duration (NT from 3.5 to 7 km, T from 3 to 14 km) of the typical control exercise of the group was investigated. HRV data was collected during pre-exercise baseline, exercise and controlled recovery of 1 minute and analyzed with STFT method. The decrease in high frequency power, as an indicator of changes in vagal activation, from the baseline (HFpe) to the first minute of the recovery (HFrec1, P<0.05) was investigated.

RESULTS: HFpe in NT and T were 6.6 ± 1.1 and 7.8 ± 0.9 Hz, respectively. When compared to HFpe, HFrec1 varied from 41 ± 17 % (NT, 3.5 km at 74 % of VO2max) to 83 ± 20 % (NT, 3.5 km at 50 % of VO2max) after different exercises. Increased intensity of the typical exercise resulted in further decreased (P < 0.05) HFrec1 in both NT (from 83 ± 20 to 41 ± 17 %) and T (from 60 ± 15 to 46 ± 18 %). Increased duration of typical exercise resulted in lower HFrec1 in T (from 60 ± 15 to 47 ± 18 %, P < 0.05) while no change was seen in NT (83 ± 20 vs. 76 ± 26 %).

CONCLUSION: The effects of increased exercise intensity or duration, i.e. increased training load, of typical endurance exercises could be detected by HRV during the first minute recovery. However, small changes in duration or intensity may not necessarily induce changes on immediate HRV recovery. HRV during the first minute seems to reflect training load of different exercises, and may be useful in evaluating the physiological training effects.

1340  Board #121  MAY 30  9:30 AM - 11:00 AM
Effects of Two-Minutes Active Recovery On A “Booster” VO2max Test Using Collegiate Female Soccer Players
Andy Bosak1, Matt Hawkey2, Thomas Andre3, Nathan Winn4. 1Georgia Southern University, Statesboro, GA. 2Georgia Southern University, Statesboro, GA. 3University of Alabama, Tuscaloosa, AL. 4Ohio State University, Stillwater, OK. (No relationships reported)

Maximal oxygen consumption (VO2max) tests typically end at the point of volitional exhaustion. However, previous research with artificially fit individuals and highly fit NCAA Division II female athletes suggest that concluding a maximal treadmill test with 2min active recovery and allowing subjects to exercise a second time at the workload eliciting volitional exhaustion results in significantly greater VO2 max values (1.4% and 4.2% mean increase, respectively). The potential effects of this testing sequence (2min recovery) on VO2max treadmill tests has not been evaluated utilizing highly fit NCAA Division I elite female soccer players.

PURPOSE: To examine changes in VO2max values, in elite collegiate female soccer players, following 2min of active recovery at the conclusion of a treadmill GXT to volitional exhaustion.

METHODS: Twelve NCAA Division I female soccer players completed a max treadmill GXT until reaching volitional exhaustion (MAX1). Immediately following 2min active recovery (at 0% grade & 2.5 mph), each subject exercised to exhaustion a second time (MAX2). MAX1 and MAX2 were compared using a paired T-test. Differences were considered significant at P < 0.05.

RESULTS: No significant differences (p = 0.15) occurred between MAX1 (47.4 ± 4.7 ml/kg/min) and MAX2 (48.0 ± 5.3 ml/kg/min). Yet, the mean change from MAX1 to MAX2 following 2min active recovery was +1.3% with individual values ranging from -4.2% to +5.9%. Also, 66.7% of the subjects benefited (+3.3% mean increase) from the booster test with individual increases of 40.5% up to +5.9%.

CONCLUSION: Mean results suggest that 2min active recovery may not significantly greater VO2 max values to be achieved by highly fit NCAA Division I elite female soccer players during treadmill testing, yet 66.7% of the subjects increased their VO2max during the “booster” 2min treadmill protocol. Further research is needed to determine if fitness level, training experience, age, sport specificity, or other variables might affect this exercise testing protocol.

1341  Board #122  MAY 30  9:30 AM - 11:00 AM
In Vs. Out Of Water Recovery Methods, Performance And Inflammation Response: A Comparative Study
Mahdi Hossein Zadeh1, Valiollah Dabibi Roshani1, Hossein Babaei2, Vahid Shirinzadeh1, Lars Arendt-Nielsen1, 1Aalborg University, Center for Sensory-Motor Interaction (SMI), Aalborg, Denmark. 2College of Physical Education and Sport Sciences, University of Mazandaran, Babolsar, Iran, Babolsar, Iran, Islamic Republic of. 3Islamic Azad University, Branch Sari, Sari, Iran, Sari, Iran, Islamic Republic of. (Sponsor: Jonathan Myers, FACSM) (No relationships reported)

BACKGROUND: Repeated swimming sprints are commonly used to develop anaerobic performance in swimmers. The ability to recover from each high intensity sprint bout is an important factor for eliciting the best neuromuscular adaptations in order to attain the highest possible speed for each repetition, and therefore the best performance.

PURPOSE: To compare the effect of in (IN) vs. out of water (OUT) active recovery on cytokines (IL-6 and CRP), CK, lactate, and mean repeated sprint time (RS1m).

METHODS: 16 volunteer male swimmers (age:19±4years; weight:75±12kg) were assigned to either IN vs. OUT recovery methods. Six 50-m sprint swimming bouts were performed with a 120-second interval of either IN or OUT recovery in between. Measurements were done at baseline and after third and sixth sprint swimming bout.

RESULTS: Serum IL-6, CRP and lactate levels (mg/dl) increased from baseline to the third and sixth bouts in both groups (IL-6: from 1.09±.78 to 2.40±.047 and 3.86±.81 vs. 1.84±.7 to 3.76±.22 and 4.99±.2, P<0.05, IN vs. OUT respectively; CRP: from 0.39±.021 to 1.26±.69 and 1.95±.14 vs. 0.37±.025 to 1.29±.42 and 1.75±.56, P<0.05 IN vs. OUT respectively; and Lactate: from 18.2±12 to 50.3±13 and 77.1±10 vs. 19.8±10 to 57.0±14 and 55.0±8, P<0.05 IN vs. OUT respectively). The CK level (U/l) and the RS1m (s) only increased in OUT (CK: from 245±109 to 294±17 and 302±121, P<0.05, (RS1m: from 4.56±2.06 to 5.18±2.24 and 6.48±2.28, P<0.05).

CONCLUSION: Inflammatory and muscle damage markers are not affected by the IN vs. OUT recovery methods; however, out of water recovery might be associated with higher inflammatory responses. In-water recovery can improve performance compared with out-water recovery at the same intensity.

1342  Board #123  MAY 30  9:30 AM - 11:00 AM
Establishing An Active Recovery Protocol For Paralympic-level Swimming
Shane P. Esau, Jared R. Fletcher, Brian R. MacIntosh, FACSM. University of Calgary, Calgary, AB, Canada. (No relationships reported)

Following a competitive event, subsequent performance is thought to be enhanced by an active recovery. In competitive Paralympic-level swimming, the athletes compete twice a day for 4-8 consecutive days. Blood lactate concentration ([BLA]) has been used as a measure of the effectiveness of an active recovery. With this in mind, an active recovery protocol was investigated which could allow individualized prescribed active recovery.

PURPOSE: To determine [BLA] clearance during warm-down of elite Paralympic swimmers and test this in competition circumstances.

METHOD: 29 elite Paralympic swimmers (age = 20±3 years) completed either a 150 or 300 meter time trial in the shortest time possible, five days before the IPC Swimming World Championships. The distance covered was based on the athlete’s main event at the World Championships. Post event [BLA] was determined 5 minutes after the completion of the event. Subsequently, the athletes swam 1000 meters at a heart rate between 140-150 bpm as an active recovery. [BLA] was measured every 200 meters of the active recovery. Individual [BLA] clearance rates were determined from the half-life in exponential decay (t1/2). The following week, individual [BLA] clearance rates were used to determine active recovery distance after each event during the IPC World Championships (WC).

RESULTS: Mean post time-trial [BLA] was 9.3±3.4 mM. The mean [BLA]1/2 was 399±212 m. The distance required for the athletes [BLA] to return to 4.0 mM and 2.0 mM based on the 1/2 was 470±190 and 799±239 m, respectively. During the IPC WC, the distance required to return [BLA] to at least 4.0 mM was 543±157 m. This distance was not significantly different than the active recovery distance calculated from the 1/2 and was significantly shorter than the athletes traditional active recovery distance (P<0.05).

CONCLUSION: The results suggest that determining [BLA]1/2 could be an effective method to determine an appropriate active recovery distance in elite Paralympic swimmers. Next it will be necessary to determine the appropriate target lactate for an active recovery.
CONCLUSIONS: Females have a greater prevalence in hypertension and obesity compared to white females. Sympathetic overactivity (SO) is associated with several disease states including type 2 diabetes, obesity, and hypertension. Black Americans have the highest risk for hypertension and black

Previous studies have reported improvements in flexibility following dynamic warm-ups. However, it is possible that the recovery period may influence subsequent performance changes. Furthermore, the influence a dynamic warm up may have on balance may be minimal.

RESULTS: There was a significant decrease in hip flexor flexibility from 0 min post to 10 min (p = .015) and 20 min (p = .010) post warm up while also being significantly lower (p = .016) at 20 min post warm up compared to pre warm up values. Hamstring flexibility significantly increased from pre to 0 min post warm up (p < .001) while also significantly decreasing from 0 min post to both 10 min (p = .003) and 20 min (p < .001) post warm up. Hamstring flexibility was also significantly higher at 10 min post warm up (p = .006) when compared to pre warm up values. Balance contacts significantly decreased from pre to 10 min post warm up (p = .026), while balance time also significantly increased from pre to 10 min post warm up (p = .009).

CONCLUSION: A dynamic warm up may influence hamstring flexibility, however a longer recovery time following the warm up is less effective in maintaining hamstring and hip flexor flexibility improvements. Furthermore, the influence a dynamic warm up may have on balance may be minimal.

METHODS: After a 10-d detraining period, seven weight lifters performed a 2-h strength training program including back squat, seated shoulder press, dead lifts, and front squat. Weight lifting performance was evaluated at baseline (before training) and 3, 24, 48, 72 h following training. Electrocardiogram was continuously recorded for 5 min at rest in seated positions immediately before each strength performance measurement.

RESULTS: Weight lifting performance was recovered to baseline in approximately 24 h following training. Plasma creatinine kinase level was peaked at 3 h following training and gradually decline for 72 h. Weight lifting performances were maximally increased above baseline at 72 h of recovery. Although the subjective pain feeling was not completely vanished, activity level (mirrored by natural log HI) was maximal at 72 h after training.

CONCLUSIONS: After an acute weight lifting training program, vaginal activity dropped significantly and gradually elevated above baseline at 72 h post training while the weight lifting performance was recovered to highest level.

METHODS: Fifty-six obese females volunteered to participate in this study. HOMA-IR, SBP and %FAT were assessed during resting conditions in BOA (n=45, 13.7±1.6 yrs, 38.1±6.1 kg/m2) and WOA (n=11, 13.3±2.2 yrs, 34.3±4.9 kg/m2). An ERI was calculated during a 5-minute passive recovery period immediately following a graded treadmill exercise test to exhaustion.

RESULTS: The ERI was significantly greater (29.7±6.1 vs. 23.9±3.1, P=0.004) in BOA compared to WOA females. Using multiple linear regression modeling, there was a significant independent association between ERI and VO2peak per FFM (r = -0.317, P=0.049) in BOA after controlling for HOMA-IR, SBP, and %FAT. HOMA-IR (r=0.232, P=0.155), SBP (r=-0.237, P=0.146), and %FAT (r=0.178, P=0.280) were not independently associated with ERI in BOA. Additionally, VO2peak per FFM (r = -0.075, P=0.860), HOMA-IR (r=0.112, P=0.792), SBP (r=0.060, P=0.887), and %FAT (r = -0.026, P=0.951) were not independently associated with ERI in WOA.

CONCLUSIONS: These results suggest that BOA females have greater SO, as assessed by an ERI, than WOA females. Understanding racial differences can contribute to both prevention and treatment of hypertension in obese female adolescents.
1347  Board #128 MAY 30 11:00 AM - 12:30 PM
Load Carriage Increases Exposure Time during Tactical Combat Movements
Andrew P. Hunt1, Aaron J. Silk2, Paul J. Tofari2. 1Defence Science and Technology Organisation, Melbourne, Australia. 2University of Wollongong, Wollongong, Australia. (Sponsor: Christopher Gore, FACSM)

(No relationships reported)

Dismounted combatants engaging an enemy force are required to move tactically between points of cover, involving repeated high-intensity short duration bounds.

PURPOSE: To quantify the effect of external load carriage on exposure time, the period of vulnerability to enemy fire as the combatant moves between points of cover, during a tactical combat movement simulation.

METHODS: Nineteen qualified Airfield Defence Guards (age 21.7±2.4 years, height 181.4±8.0 cm, body mass 81.0±9.0 kg) provided written informed consent to participate. Experimental procedures were approved by the Australian Defence Human Research Ethics Committee. The tactical movement simulation involved sixteen 6-m bounds commencing every 20 s, each starting from a prone position and ending in a kneeling position. The simulation was performed in five load conditions (A - E) ranging between 10-30 kg (5 kg increments) and comprised a replica weapon, chest webbing, protective vest, and helmet. During all trials participants were fitted with a global positioning device which contained a 10 Hz global positioning chip and nine inertial sensors. The data were analysed by custom software algorithms that were developed to objectively identify the start and end points of each bound. Repeated measures ANOVA assessed differences in exposure time of external load carriage between load conditions. Paired sample t-test were used to compare time to peak velocity and peak velocity between load conditions.

RESULTS: Exposure time significantly increased as a function of external load (A 3.72±0.26 s, B 3.86 ±0.29 s, C 4.09 ±0.31 s, D 4.32 ±0.43 s, E 4.53 ±0.41 s, p<0.001). Peak velocity tended to decrease with increasing load, but this was not significant (A 2.65±0.26 m·s−1, B 2.76±0.26 m·s−1, C 2.58±0.30 m·s−1, D 2.51±0.30 m·s−1, E 2.42±0.25 m·s−1, p=0.095). However, a significantly greater time was required to reach peak velocity as external load increased (A 2.16±0.33, B 2.25±0.31, C 2.47±0.37, D 2.65±0.45, E 2.82±0.36, p<0.001). When normalised to exposure time, time to peak velocity did not differ, averaging 60% of the exposure time to 33% across increasing loads.

CONCLUSION: Load carriage significantly impacts the ability to move between points of cover during tactical movement simulations. With technology advancing and dismounted combatants being required to carry increasing amounts of equipment, these findings highlight how additional load may impact survivability and ultimately mission outcomes.

1348  Board #129 MAY 30 11:00 AM - 12:30 PM
Foot Trajectory and Swing Time changes with Soldier Borne Loads in Walking and Running
Kari Loverro1, Leif Hasselquist2, Michael Brown2. 1Oakridge Institute for Science and Engineering, Belcamp, MD. 2Natick Soldier Research, Development, and Engineering Center, Natick, MA.

(No relationships reported)

Soldiers are often tasked with carrying heavy loads. Little is known on how these loads affect trip avoidance. Previous researchers have used foot trajectory and swing time as predictors of tripping in the young and elderly adults.

PURPOSE: To compare foot trajectory and swing time of Soldiers during walking and running while carrying loads.

METHODS: Eight male soldiers walked (1.34m/s) or ran (2.24m/s) for 10 minutes on the treadmill with torso armor only (No RUCK: 17kg) and with a rucksack (RUCK: 40kg). Kinematic data was collected for 20s per condition; five strides from each trial were analysed. Three landmarks on each foot (toe, 5th metatarsal head, and heel) were used to calculate foot trajectory and swing time. Foot trajectory variables were defined using minimum toe clearance (MTC), first and second peak in toe trajectory (TOE1 and TOE2), first peak in 5th metatarsal trajectory (MET5) and first peak in the heel trajectory (HEEL). Swing time was examined as percent stride time. Two-way repeated measures ANOVA were performed for each variable.

RESULTS: At both speeds, increased load significantly decreased swing time (walk: No RUCK: 37.7±3.0% RUCK: 35.9±5.0% p=0.005, run: No RUCK: 58.2±1.0% RUCK: 48.3±0.3% p<0.001). Increased speed for all load conditions significantly increased HEEL (No RUCK: walk: 31.7±4.0cm run: 36.3±0.7cm p<0.001, RUCK: walk: 31.8±6.5cm run: 34.8±0.5cm p=0.001) and MET5 (No RUCK: walk: 15.7±0.4cm run: 19.2±0.4cm p=0.001, RUCK: walk: 15.8±0.3cm run: 17.3±0.5cm p=0.011); but significantly decreased TOE2 (No RUCK: walk: 18.2±0.4cm run: 14.9±0.5cm p=0.006). During running, increased load significantly decreased HEEL (p=0.012) and MET5 (p=0.010). However, MTC (p=0.085) was not significantly affected by load or speed.

CONCLUSIONS: When carrying a load while ambulating, toe clearance appears to be preserved while swing time and other foot trajectory variables change. This implies that toe clearance is a crucial factor to keep consistent and Soldiers attempt to do this to prevent tripping while running with heavy loads. However, the decrease of the heel and 5th metatarsal head peaks; and reduction of swing time during running with heavy loads will decrease the ability of the Soldier to adjust their gait to prevent trips and falls on varied terrains.

1349  Board #130 MAY 30 11:00 AM - 12:30 PM
Improving Estimation of Energy Expenditure with Accelerometers during Military Training using a Field-Based Calibration Procedure

(No relationships reported)

Estimation of physical activity energy expenditure (PAEE) in military populations is an important measurement. The gold standard for estimating PAEE is doubly labelled water (DLW). However it is expensive and can only be used following observation periods greater than seven days. Accelerometers are low cost and their output (Physical Activity Counts; PAC) is often used in linear prediction models. However, the contribution of PAC in predicting PAEE can be low unless individual calibration is performed.

PURPOSE: To determine if simple field-based individual user calibrations could improve the relationship between accelerometer PAC and PAEE.

METHODS: Following ethical approval, 32 participants (16 female and 16 male, body mass 67.9 ± 12.4 kg, stature 1.71 ± 0.10 m, estimated VO2max 44.3 ± 8.5 mL·kg−1·min−1) volunteered for the study. During 10 days of military training, PAC were measured using a 3-dimensional accelerometer device worn around participants’ waist and PAEE was measured using DLW. Participants completed a multistage fitness test (MSFT) to estimate VO2max while wearing the accelerometers. Daily PAC were divided by PAC recorded during the first six levels of the MSFT (PACMSFT) to calibrate the outputs to individual participants’ movement patterns during the walking and running shuttles. Relationships between PAC and PACMSFT with PAEE were established using Pearson bivariate correlations. Linear regression was used to develop multivariable models to predict PAEE from body mass and PAC or PACMSFT. All data are expressed as mean ± one standard deviation and priori α was set at p<0.05.

RESULTS: Mean 10 day PAC and PACMSFT were 53.34±15.143 counts-day−1 and 1.600 ± 386 kcal-day−1, respectively. PAEE showed a moderate relationship with PAC (r=0.44, p<0.02) and a stronger relationship with PACMSFT (r=0.71, p<0.01). PAC did not contribute (p=0.10) to a multivariable model that included body mass to predict PAEE. However, PACMSFT contributed (p<0.01) to the multivariable model [PAEE= 505.48 - (body mass x 14.53) + (PACMSFT x 1.29), R²=0.68, SEE=227].

CONCLUSION: Calibrating accelerometer PAC to sub-maximal individual participant movements using a field-based fitness test provides a simple method for improving the prediction of PAEE during military training.
analyses by ANOVA (p<.05) revealed no significant difference between footwear trials. However, the additional load of 29.7 kg required a significantly greater metabolic and cardiovascular physical training may be advantageous if injury potential is reduced.

**METHODS:**

6 current or veteran US Marines volunteered to participate in 8 randomly assigned steady state treadmill trials walking (W) (80.4 m/min 5% grade) and running (R) (160.8 m/min 6% grade). Ten members of the SW group completed 4 successive 15-min walking trials at a fixed treadmill speed (80.5 m/min) with SW placed on the left triceps. Data was recorded for a 26 hour period during which the subjects were instructed to maintain their usual sleep patterns. Data were collected at W and R in trials of unloaded with boots (UB), loaded state with boots (LB), unloaded with “go fasters” (LB), loaded state with “go fasters” (LF), unloaded with ankle braces (UB), loaded state with ankle braces (LB), and unloaded with ankle braces with ankle braces (LB).

**RESULTS:**

The mean energy cost for WUS, WUB, WLS & WLB trials: 17.4, 18.6, 22.8 & 23.9 mlO2/kg.min, HR: 101,114, 132 & 138 bpm, and LA: 2.9, 2.5, 2.4 & 2.3 mmol respectively. The mean energy cost for RUS, RUB, RLS & RLB trials: 31.9, 32.2, 40.3 & 41.0 mlO2/kg/min, HR: 150, 164, 172 & 181 bpm, and LA: 4.4, 2.5 & 7.5 mmol respectively. Statistical analysis by ANOVA (p<0.05) revealed no significant difference between foot wear trials. However, the additional load of 29.7 kg required a significantly greater metabolic and cardiovascular response at both W and R trials.

**CONCLUSIONS:**

The use of running shoes during non-combat physical training elicits a similar metabolic demand as the use of military boots. Therefore, the use of running shoes during physical training may be advantageous if injury potential is reduced.

**METHODS:**

Backpack-experienced subjects (18 men, 4 women; Mean ± SD: 32±8 yrs, 79±7.7 kg) completed 4 successive 15-min walking trials at a fixed treadmill speed (80.5 m/min).
and grade (2%). The Control trial (walking without a backpack) was always tested first, while the order of backpack frames tested were counterbalanced. Trials 2-4 corresponded to wearing one of 3 military backpack frames (MOLLE, FILBE, NICE), each of which was loaded with a 26.6 kg bag load. Subjects wore a portable metabolic measurement system for measuring oxygen uptake (VO2) and heart rate (HR), as well as carried a Rubber Ducky rifle in front, the total of which weighed another 4.1 kg (30.7 kg total load). CR variables were summarized at two time points (mins 6 and 13) for each trial, while blood lactate (BL) was measured during min 15. Data were evaluated using multivariate 2-factor RM ANOVA and Sheffe’s post-hoc (α=0.05).

RESULTS: Mean VO2 and HR values for the Control trial (Mean±SE: 13.7±0.4 ml/kg/min; 97±2 BPM) were significantly lower (P<0.05) than those for the MOLLE (16.5±0.3; 128±3), FILBE (16.4±0.4; 128±3), or NICE frames (15.9±0.4; 125±4), while there were no differences between frames. Mean BL for the FILBE trial (1.3±0.1 mmol/L) was significantly higher (P<0.05) than the Control (1.1±0.1) but not from either the MOLLE (1.3±0.1) or NICE (1.3±0.1) frames. The percent differences in VO2 of both FILBE (+4.4%) and MOLLE (+3.8%) frames were greater than the 2.5% practical significance threshold.

CONCLUSION: The influence of backpack frame designs on CR and BL responses were generally small and non-significant. However, the FILBE frame trial elicited a slightly higher BL than the Control trial, and the difference in walking economy (i.e., VO2) between the NICE frame and the other frames (+3.8-4.4%) was greater than the 2.5% practical significance threshold. This suggests that both practical and statistical significance are most likely observed when these frames are worn for longer rather than shorter walking bouts.

**Purpose:**

**Methods:** Two US Marine veterans (Age 26.5 yr, Ht. 170 cm, Wt 76.5 kg) volunteered to participate in this nine month trial. Aerobic efficiency was measured by open circuit spirometry and heart rate by telemetry during steady state trials at 93.8 m/min and 10% grade. Body composition was measured by DEXA. Pull ups were performed to repetition max. with palms facing at shoulder width to a 3-1-3 cadence. Squats were performed to repetition max, on a Smith machine, with a load of 97.8 kg at a 3-1-3 cadence and a range of motion of 70-180 degrees of knee flexion. Each subject wore a 9.1 kg weighted vest during all daily activities except sleeping. All parameters were measured monthly during the nine months of weighted vest application and one month after they stopped wearing the vests.

**RESULTS:**

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<th>Squats</th>
<th>IMD (g/cm²)</th>
<th>Mass (kg)</th>
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**Conclusions:** Chronic, long term musculoskeletal loading is associated with improvements in body composition, upper body strength and cardiovascular efficiency that persist for at least four weeks after the loading period.

**A-35**

**Board #135**

**MAY 30**

**9:00 AM - 10:30 AM**

**Effects Of 4-Month Heat Exposure On Body Composition, Physical Performance and Serum Hormone Concentrations**

Heikki Kyröläinen1, Matti Santtila2, Harri Lindholm3, Keijo Häkkinen1, Hanna Seikola1, Hannu Rintamäki1, 1University of Jyväskylä, Jyväskylä, Finland. 2Finnish Defence Forces, Helsinki, Finland. 3Finnish Institute of Occupational Health, Helsinki, Finland. (Sponsor: Paavo V. Komi, FACSM)

**Purpose:** To investigate changes in body composition, physical performance and serum hormone concentrations of soldiers during a 4-month deployment in physically demanding high ambient air temperature environment (range from 18.1 to 37.7 °C, in vehicles even 57.0°C). **Methods:** 20 voluntary male soldiers (age 23 ± 1 yrs, height 1.80 ± 0.06 m, body mass 78.4 ± 11.5 kg) participated in the study. Whole body composition was measured by bioimpedance device and the cross-sectional area (CSA) of the thigh by magnetic resonance imaging. Physical performance was measured before and after the mission, which resulted in the energy deficit was 677 ± 1023 kcal/day. Basal serum hormone concentrations were measured before, middle and after of the deployment. **Results:** Body mass decreased by 3.5% (p<0.05) but no changes were observed in fat % and CSA (subcutaneous fat and muscle) of the thigh. The mission did not cause any changes in the 12-min running distance (2788 ± 238 vs. 2749 ± 237 m; p=0.276) but increased MVC of the leg extensors (3042 ± 614 vs. 3277 ± 706 N; p<0.05). No changes were noticed in repeated squats and push-ups, while sit-ups and vertical jump improved (p=0.01-0.001). No significant alterations in basal cortisol (COR) or testosterone (TES) concentrations were observed but sex hormone-binding globulin (SHBG) concentration was higher (p<0.05) at 2 (33.2 ± 10.3 mmol/L) and 4 months (31.2 ± 10.3 mmol/L) compared with the initial values (25.5 ± 9.1 mmol/L). Insulin-like growth factor I (IGF-I) concentration was lower (p<0.05) at 4 months (29.6 ± 6.5 mmol/L) compared with initial (33.1 ± 5.9 mmol/L) and middle (33.8 ± 5.1 mmol/L) concentrations. **Conclusions:** Despite the heat stress and energy deficit, it seems that soldiers managed to retain their physical performance and basal COR and TES concentrations. Thus, it can be concluded that the overall stress during the mission was not very severe despite a decrease of the biomarker IGF-1. In addition, the type of physical activity, including strength training that soldiers often performed during the deployment might have played an important role in individual sustainability of the operational readiness.
PURPOSE: The present study examined the effectiveness of internal and external attentional foci for learning two novel locomotor skills varying in complexity.

METHODS: 48 children (ages 8-10) and 48 adults (ages 19-26) learned to ride a Double Pedalo either with or without stability handles while adopting either an internal or external focus of attention. Participants were instructed to either push their feet (internal focus) or the boards of the Pedalo (external focus) forward to make the Pedalo move. The dependent measure used was time to travel 7 meters.

RESULTS: For the simpler task, no attentional focus effects were elicited during either acquisition or retention. With the complex task, there were no significant attentional focus effects in acquisition, but in retention, an external focus of attention resulted in faster times than an internal focus, but only in males.

CONCLUSIONS: These findings further support the findings of Wulf, Toellner, and Shea (2007), suggesting that a certain degree of instability or error is necessary to elicit external focus benefits. In addition, they corroborate the findings of Wulf, Wächter, & Wörtmann (2003) which suggested females and males may be differentially affected by attentional focus instructions.

1357 Board #138 MAY 30 9:30 AM - 11:00 AM
The Development Of General And Soccer-specific Perceptual Motor Skills During Adolescence
Tomi Vanttinen, Research Institute for Olympic Sports, Jyvaskyla, Finland.
(No relationships reported)

Expert-novice comparisons have indicated that perceptual motor skills are sport-specific. That is, the level of expertise is more important than the age itself in sports. However, it is not clear what is the dynamics of development of sport-specific perceptual skills compared to the development of general perceptual motor skills.

PURPOSE: To examine how general and soccer-specific perceptual motor skills develop during adolescence.

METHODS: The subjects of the present study were four age groups (10y, 12y, 14y and 16y) from a club team (n=74). Subject’s simple reaction time was measured with Wayne Membrane Saccadic Fixator and peripheral reaction time with Wayne Peripheral Awareness Trainer. A specific laboratory test was used to measure soccer-specific decision making time and choice reaction time during simultaneous ball handling. Age comparisons were made using one-way ANOVA with Tukey’s post hoc.

RESULTS: All perceptual motor skills improved with age (Table 1) from 10 to 16 by but improvement was greater in soccer-specific perceptual skills (decision making time 79.0%, F=49.315, p<0.001; choice reaction time 27.7%, F=16.725, p<0.001) than in general perceptual motor skills (simple reaction time 17.6%, F=6.371, p<0.01; peripheral reaction time 26.1%, F=6.808, p<0.001).

CONCLUSIONS: These results suggest that soccer training provides training stimulus for soccer-specific perceptual skills that is beyond to be expected from the normal development of general perceptual skills. Decision making time was less than simple reaction time which means that the players ability to anticipate, not just react, is a key factor for success in soccer already at a young age.

1358 Board #139 MAY 30 9:30 AM - 11:00 AM
Analysis Of Inter-limb Force Coordination During Isometric Bilateral Grip Control Task
Chueh-Ho Lin, Wei-Hsu Sung, Li-Wei Chou, Shun-Hwa Wei, National Yang-Ming University, Taipei, Taiwan.
(No relationships reported)

Interhemisphere interaction plays an important role in motor performances, especially during inter-limb force control and coordination during exercise and activity of daily life. Simultaneous movement training can improve functional performance of the affected limb after CNS lesion. However, the effect of interhemisphere interactions on bilateral force control was still unclear.

PURPOSE: The aim of the preliminary study was to analyze interhemisphere interaction by investigating inter-limb force control and coordination during force-maintenance task.

METHODS: Seven female and seventeen male healthy adults participated in this study (mean age =23.8±3.4y/o). Subjects were asked to hold hand grip force of one hand at a given force level, then gradually decrease hand grip force of that hand while the other hand gradually increase hand grip force so that the sum of the total force from two hands maintained at the given force level. This task was performed at 10, 20 and 40% maximal force levels and was repeated in different order (right to left hand and left to right hand). The force outputs of the participant’s hands were recorded and analyzed. The timing of grip force cross point between two hands during force generating process was used to evaluate the force balance between both hands. Two-way analysis of variance was performed to determine the timing differences in handgrip force control under different conditions.

RESULTS: The results demonstrated that the force modulation timing in right to left hand was longer than in left to right hand condition at 10% (46.2±17.6% vs. 33.1±14.7%, p=.005), 20% (40.4±11.3% vs. 29.8±11.3%, p=.002) and 40% (40.7±13.7% vs. 27.9±14.6%, p=.002) isometric force-maintain tasks. The timing difference of target force-maintain task for both hands at 3 force levels was not significant different (19.8±14.6% vs. 13.1±11.6% vs. 17.6±9.5%, p=.229).

CONCLUSIONS: We concluded that left brain controlling right hand has greater control ability than right brain during bilateral force modulation. This finding could indicate interhemispheric interactions during bilateral limb control, which provide new information with implications for clinicians and therapists an evaluation program for inter-limbs coordination. Supported by the Taiwan NSC grant (NSC99-2221-E-010-002).

1359 Board #140 MAY 30 9:30 AM - 11:00 AM
Visuospatial Working Memory in Children with Poor Motor Coordination as Revealed by Event-Related Potential
Ming-Wei Chen1, Chia-Liang Tsai1, Chien-Yu Pan2, Tzu-Chi Chen3, Feng-Ying Chou1. 1National Cheng Kung University, Tainan, Taiwan. 2National Kaohsiung Normal University, Kaohsiung, Taiwan. 3Chi Mei Medical Center, Tainan, Taiwan.
(No relationships reported)

Children with poor motor coordination have been demonstrated to show an impairment in working memory in visuospatial domains. However, no studies have yet been conducted on the mechanisms of deficits of visuospatial working memory (VSWM) in children with poor motor coordination as revealed by event-related potential (ERP).

PURPOSE: The present study aimed to investigate the mechanisms of motor processing in brain activity underlying behavioral anomalies in children with poor motor coordination, and to compare them with those found in children with normal motor coordination when performing the VSWM task. METHOD: Twenty-five children with poor motor coordination and 25 age- and sex-matched children with normal motor coordination were identified with the Movement Assessment Battery for Children-Second Edition test. Each child simultaneously performed one spatial non-delay and two time-delayed spatial memory tasks (i.e., 3s-dealy and 6s-delay) with concomitant ERP recording. Behavioral and ERP data were statistically analyzed using repeated measures ANOVA.

RESULTS: Children with poor motor coordination had a significantly longer reaction time (879.93±67.13 vs. 829.07±52.43ms in 3s-delay task; 864.84±54.63 vs. 820.81±50.22ms in 6s-delay task; both p<0.05) and lower accuracy rates (0.79±0.08 vs. 0.87±0.05 in 3s-delay task; 0.72±0.08 vs. 0.82±0.07 in 6s-delay task; both p<0.05) than children with normal motor coordination in the
two spatial memory tasks. With respect to the ERP components, children with poor motor coordination, as compared to children with normal motor coordination, showed smaller P3 (13.55±5.93 vs. 19.61±6.44 µV in 3s-delay task; 15.47±8.35 vs. 21.05±7.59 µV in 6s-delay task; both p<0.05) and pSW (i.e., positive slow wave) (14.41±4.56 vs. 20.17±5.47 µV in 3s-delay task; 15.40±5.75 vs. 19.38±7.93 µV in 6s-delay task; both p<0.05) amplitudes during the retrieval-process phase for later remembered items.

CONCLUSION: Children with poor motor coordination showed impairment when performing VSWM task and the mechanisms could allocate less resources and less effort for comparison of spatial locations and response selection.

Key words: motor coordination, visuospatial working memory, event-related potential, neuropsychology

1360 Board #141 MAY 30 9:30 AM - 11:00 AM Effects of Exercise Intervention on Attention Networks in Children with Poor Motor Coordination: ERP Evidence

Tz-Chi Chen1, Chia-Liang Tsai1, Feng-Ying Chou1, Chien-Yu Pan2, Yu-Ting Tseng3. 1National Cheng Kung University, Tainan, Taiwan. 2National Kaohsiung Normal University, Tainan, Taiwan.

Children with poor motor coordination (PMC) have been demonstrated to exhibit impaired inhibitory control capacity. However, no studies have been undertaken on the potential effects of exercise intervention on the attention networks of such individuals.

PURPOSE: The aim of the present study was to investigate the effects of soccer training on the inhibitory control of children with PMC, focusing on the event-related potential (ERP) components regarding early modality specific inhibition (N2) and late general inhibition (P3).

METHODS: Forty-two children were screened with the Movement Assessment Battery for Children test and categorized into those with normal motor coordination (n=14, control group) and those with PMC (n=28). Children with PMC were then quasi-randomly subdivided into either an exercise-intervention (EI) group (n=14) or a non-exercise-intervention (NEI) group (n=14). Before and after a ten-week training program (50-minute sessions, five times a week), all children performed the visuospatial attention task with centrally non-predictive gaze-directed cues with the lower extremities, while brain ERP were concurrently recorded. Repeated measure analysis of variance was used to analyze the training effect.

RESULTS: Before training, although the N2 component did not have any significant differences among the three groups, children with PMC, when compared to the control group, showed an impaired inhibitory control capacity (NEI: 49.15±3.79, EI: 43.04±2.31, Control: 10.00±1.79, p<0.05), slower P3 latency (NEI: 19.38±7.93, EI: 11.44±1.32, Control: 15.34±1.21, p<0.05) and slower P3 latency (NEI: 31.73±15.34, EI: 31.23±16.28, Control: 30.00±12.28, p<0.05) across conditions of the visual spatial attention orienting task. After training, beneficial effects emerged with regard to the strength of inhibitory control (EI: 34.12±28.61 vs. NEI: 32.12±27.61, p<0.05). The P3 latency (EI: 292.89±24.43, Control: 299.96±24.43, p<0.05) in the EI group.

CONCLUSION: The execution and acquisition of compound lower-limb motor skills during extensive soccer training for children with PMC seems to induce reinforced neuronal networks that enable faster cognitive processing.

1361 Board #142 MAY 30 9:30 AM - 11:00 AM Changes In Mental Simulation Of Goal-directed Movements In Healthy Adults Aged 20-89

Bouwien C. Smânts-Engelsman, KULeuven, Leuven, Belgium.

Mental simulation or imagery is a common mental training technique in sports and is gradually introduced for rehabilitation purposes in patient populations. Imagery research has demonstrated that motor imagery and motor execution share similar neural representations. However little is known about changes in the relation between the duration of actual and mental movements. We have recently shown that motor imagery training from a first person perspective in young healthy adults leads to improvements in performance of the executed movements (Herremans et al, 2011). However little is know about changes in the ability to represent actions during normal aging.

PURPOSE: To examine age-related similarities and differences in duration of mental and actual goal directed upper limb movements using a Fitts paradigm.

METHODS: 3 groups of adults performed the Radial Fitts Task with 5 Indexes of Difficulty (2.91-6.91) on a digitizer [young (20-29; n=39), senior (50-65; n=39) and elderly individuals (70-89 n=29), 97% right handed and 69% female],

RESULTS: Overall, the elderly group was significantly slower on the mental and executed tasks (F1,2) 9.36, p<0.001, means 8.1, 7.5 and 12.7 seconds, respectively). However, no interaction with task condition (mental and executed) emerged, indicating that the mental and actual tasks slowed down comparably. In the second analysis the goodness of fit for the Index of Difficulty was determined. Here a highly significant group effect was found for the goodness of fit, testing for the adherence to Fitts’ Law, (F1,2) 15.92, p<0.001; mean R2 was 0.70, 0.65 and 0.43, respectively).

CONCLUSIONS: The oldest group had a clear idea of their movement durations: they knew they were slow. However when they imagined to move they were also very slow, leading to good correlations between motor imagery and motor execution duration. Therefore we conclude that the ability to mentally represent goal directed actions is still intact.

1362 Board #143 MAY 30 9:30 AM - 11:00 AM Ankle Movement Discrimination Is Correlated with Sports Performance Levels

Jia Han1, Gordon Waddington2, Judith Anson3, Roger Adams1. 1University of Canberra; Shanghai University of Sport, ACT, Australia. 2University of Canberra, ACT, Australia. 3University of Sydney, Sydney, Australia.

Numerous studies have tried to find evidence to suggest athletes specialized in particular sports have better ankle proprioceptive ability than athletes in other sports or non-athletes. However, the results in the literature are inconsistent. Although different testing methods and the diversity of testing range and planes of movement may account for this variability, other possible confounding variables such as years of training and sports performance levels have not been systematically investigated.

PURPOSE: To determine the relationship between ankle movement discrimination ability and years of training and sports performance levels.

METHODS: One hundred and twenty right handed, healthy young Chinese athletes (handness was determined by the Edinburgh Handedness Test), without significant injuries during the past 6 months, mean 20.5 years, (range 18-25) and mean 8.2 years of current professional training. (range 2-15) across 6 sports (aerobic gymnastics (12F, 8 M), hand ball (9F, 11M), swimming (10F, 10M), soccer (7F, 13M), sports dancing (13F, 7M), badminton (8F, 12M)) were tested with a purpose-built ankle Active Movement Extent Discrimination Apparatus (AMEDA). Sports performance levels were determined by the athletes’ best record within the past year (level 1: national top 6 and above; level 2: national top 16; and level 1: national top 32 or regional top 3; mean level 1.7, range 1-3). Participants were tested in standing position with bare feet and undertook 50 trials (10 for each of 5 different inversion displacements) presented at random to the right ankle. Pearson correlations, with statistical significance at p<0.05, were calculated to estimate the relationship between movement discrimination scores and years of training and sports performance levels.

RESULTS: Enhanced ankle movement discrimination was positively correlated with higher levels of sports performance (p<0.001), but not with years of training (p>0.05).

CONCLUSION: These results are consistent with Ericsson’s (2006) hypothesis about deliberate practice underpinning high level sport performance. Given that higher level athletes have better ankle movement discrimination ability, ankle proprioception could possibly be considered as one of the measures used in sports talent identification testing.
Management of concussions is commonly focused on “return to play” decision for athletes; however concussion may impact other activities, such as the ability to drive an automobile. Findings from other neurologically compromised populations have shown that deficits in information processing speed, working memory and executive functioning are related to changes in driving performance. Concussion research has implicated deficits in these same domains, yet little to no research has been done to examine the relationship between driving and concussion.

**PURPOSE:** The current study compares driving performance (using a virtual reality driving simulator; VRDS) between individuals recently concussed (RC) and an age and gender-matched healthy control (HC) group.

**METHODS:** Participants were recruited from consecutive referrals from 2 universities. Concussion was diagnosed by treating sports physician using the Zurich Concussion Consensus guidelines. Participants were seen for a 2.5 hr. testing session within the first 72 hours post-concussion. Testing included VRDS administration and a series of cognitive measures. The current findings are a part of a larger ongoing study. Sixteen individuals (11m; 5f; M=20 yrs old) were included. All participants were licensed, active drivers with greater than 2 years driving experience.

**OUTCOME MEASURES** The VRDS generates a variety of driving performance measures. For the current analysis, 2 driving variables; 1) center lane deviation and 2) mean speed were examined across 3 environments; 1) straight lane segment, 2) curve lane segments and 3) a complex driving task of following a truck. 

**RESULTS:**

1. **Z-axis changes:** 3-increment changes resulted in longer QE duration than both 1- and 2-increment changes (+0.144 s; +0.041 s), and 2-increment changes resulted in longer QE duration than 1-increment changes (+0.073 s).

2. **Interaction effect:** An interaction effect was also observed between target direction and target distance. For Y-axis changes, 3-increment changes resulted in longer QE duration (+0.039 s) than 1-increment changes. Larger target displacements result in longer QE duration compared to smaller target displacements. Therefore, when throws require greater reprogramming of movement parameters, the QE period will be longer.

**CONCLUSIONS:** These preliminary findings suggest that changes in driving behaviors may exist at 72 hours post-concussions and this may be related to cognitive performance. Supported by NIH Grant # 1R03HD064847

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**CONCLUSIONS:**

In this limited number of participants GM skills were all within the median range or lower (10th percentile) suggesting that mental health problems may lead to impaired GM skills development.
group (33.2±11.33 yrs) and 9 in the experimental group (34.50±12.69 yrs). Each participant was expected to learn three advanced wheelchair skills (wheelie, ramping, and curbing) through four sessions: training session, competition test, retention test, and comparison test. The paired t-test was employed to determine the differences of learning and performing time (minutes), spotter intervention (times), occurrence of tip (times) and successful rate of performance between the two groups. A mixed-model ANOVA and Bonferroni post hoc test were used to compare mean differences between the two groups on three wheelchair skills and four sessions.

RESULTS: In the pair t-test, out of the 51 comparisons, only three comparisons were significantly different between the two groups. The experimental group had a significantly less performing time in wheelchair competence test (13.3±17 minutes vs. 20.5±7.6 minutes, pc.05), a significantly more spotter intervention in curbing transfer test (6.15±1.3 times vs. 4.35±1.7 times, pc.05), and a significantly lower successful rate in curbing transfer test (33.5% vs. 81.5%, pc.05). In the mixed-model ANOVA analysis, no significant differences on ramping and wheelie skills across the four sessions were found between the two groups, except a significantly higher successful rate on the curbing in the control group than experimental group (81.4% vs. 56.7%, pc.05).

CONCLUSIONS: This study didn’t demonstrate the superiority of video feedback to conventional training for advanced manual wheelchair skills training for individuals with SCI. However, the immediate video feedback might be used to assist the conventional training for advanced wheelchair skills.

Supported by NIDRR Center Grant #: H133E080003

A-36 Free Communication/Poster - Nutritional Supplementation: Alternative Nutrients and Physiological Outcomes

MAY 30, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

1367 Board #148 MAY 30 11:00 AM - 12:30 PM
Effects of Three Weeks of Carnitine Supplementation and High-intensity Interval Training on Endurance Performance
Kuei-Hui Chan, Shao-Zeng Hu, Kang-Hao Lu, Chuan-Yi Shih. National Taiwan Sport University, Taoyuan, Taiwan.

Carnitine has been presented to have the benefits on anti-oxidative and endurance capacity. High-intensity interval training (HIT) was demonstrated to increase the endurance capacity and oxidative stress.

PURPOSE: To investigate the effects of three weeks of carnitine supplementation and HIT combination on aerobic capacity and oxidative stress.

METHODS: Ten untrained healthy males were recruited and randomly assigned into carnitine group (25.0±4.4 yr, 80.3±8.5 kg, 170.2±4.3 kg) or placebo group (22.4±3.3 yr, 69.1±1.2 kg, 172.2±6.3 kg). Subjects received carnitine or placebo supplementation 2 g per day for 3 weeks. Subjects also performed the HIT three per week. The HIT protocol contains 10 bouts of cycle trail at 90%VO2max, with each bout lasting 2 min and separated by 1 min of rest. The increment running tests and high-intensity interval exercise tests were conducted before and after supplementation. The VO2max and time to fatigue were measured by the increment running test. Blood samples were drawn before test, immediately after test, 1 h and 3 h after test of high-intensity interval exercise test to determine the activities or concentrations of creatine kinase (CK) and uric acid.

RESULTS: After 3 weeks of supplementation, VO2max (43.0±2.4 vs. 37.6±5.0 mL/min/kg) and time to fatigue (1563.0±221.0 vs. 1496.0±207.6 sec) significantly increased (p<0.05) in carnitine group. However, there were no differences in placebo group. In carnitine group, the values of blood CK and uric acid in high-intensity interval exercise test before supplementation still elevated at 3 h after test (170.0±44.6 vs. 160.8±32.8 U/L for CK and 8.88±2.16 vs. 7.88±2.0 mg/dL for uric acid, pc.05). But the values returned to baseline after 3 weeks of supplementation (184.8±48.7 vs. 174.6±43.5 U/L for CK and 7.82±1.98 vs. 7.74±1.95 mg/dL for uric acid).

CONCLUSION: Carnitine supplementation during HIT is benefit to aerobic capacity and recovery of high-intensity interval exercise.

Supported by NTSS Grant 99D014.

1368 Board #149 MAY 30 11:00 AM - 12:30 PM
Effects Of Chronic Green Tea Extract Supplementation On Substrate Utilization And Time-trial performance
Brian J. Martin, J. Albert Bartolini, Taylor S. Thurston, Nicholas W. Aguirre, Benjamin M. Kamel, Jared W. Coburn, FACSM, Lee E. Brown, FACSM, Daniela A. Rubin, Daniel A. Judelson, FACSM. California State University, Fullerton, Fullerton, CA.

Supplementation with green tea extract (GTE) has been shown to increase fat oxidation at rest and during moderate intensity exercise. Despite its potential ergogenic utility, little work examines if or how GTE supplementation influences metabolic function and performance during time-trial exercise in humans.

PURPOSE: To determine the effects of chronic GTE supplementation on markers of substrate oxidation and physiological stress during 1 h constant load submaximal exercise and performance during a subsequent 10 km time-trial.

METHODS: Nine male participants with previous 10 km or half-marathon race experience volunteered (age = 27 ± 5 y, height = 174.8 ± 7.2 cm, mass = 71.6 ± 6.1 kg, body fat = 10.3 ± 2.7%, and VO2max = 64.2 ± 6.0 mL/kg/min). In a double-blind crossover design, subjects supplemented with GTE (725 mg) or placebo for 14 days then performed 1 h of treadmill running at 50% VO2max immediately followed by a 10 km time-trial. Investigators collected 1) expired gasses during the constant load exercise only, and 2) heart rate (HR) and ratings of perceived exertion (RPE) throughout both bouts. A 14 day washout separated supplementation periods.

RESULTS: No significant differences existed between trials in VO2 or respiratory exchange ratio during constant load exercise. GTE supplementation also failed to affect HR and RPE during either constant load exercise or time-trial. Time-trial performance was similar between trials (placebo = 47.9 ± 6.7 min, GTE = 46.6 ± 5.8 min).

CONCLUSIONS: Supplementation with GTE did not affect metabolic, physiological or perceptual variables during moderate intensity exercise. Additionally, no differences were observed in performance during a 10 km time-trial. These data suggest chronic GTE supplementation does not alter substrate utilization or increase endurance exercise performance in trained individuals.

1369 Board #150 MAY 30 11:00 AM - 12:30 PM
Green Tea Consumption And Risk Of Prostate Cancer: Meta-analysis Of Epidemiologic Studies
Byungsun Kim, Seunghyun Lee. Kyunghee University, Seoul, Korea, Republic of.

PURPOSE: Worldwide, prostate cancer has the second highest incidence of all male cancers. Prostate cancer incidence and mortality varies widely between geographic regions, with overall rates in USA being nearly six-times higher than that of Asian countries. This variation suggests that prostate cancer may be linked to lifestyle-related factors, particularly dietary factors. Several epidemiologic studies have focused on the lower incidence of prostate cancer in Asian countries where green tea consumption is high. We undertook a meta-analysis to verify the relation between green tea consumption and prostate cancer.

METHODS: We performed meta-analysis with the search of MEDLINE (PubMed), EMBASE and Cochrane Library, using the keywords “green tea” or “polyphenols” or “catechins” for the exposure factors, and “prostate cancer” for the outcome factors. Studies included in this review are prospective cohort and case-control studies published between 1966 and July 2010. The search was limited to English language.

RESULTS: A total of 20 articles were identified for this review. Only 6 studies met the inclusion criteria. When using all the case-control and cohort studies, the pooled RR of prostate cancer for the highest vs lowest category of green tea consumption was 0.82 (95% CI, 0.75-1.07). In case-control studies, green tea drinking habit showed preventive effect on prostate cancer with the odds ratio of 0.40 (95% CI, 0.17-0.92). When cohort studies were pooled, no significant association was seen between green tea consumption and prostate cancer. (RR, 1.08 CI, 0.89-1.32)

CONCLUSION: Green tea consumption was not associated with the risk of prostate cancer in this meta-analysis. Further cohort studies are needed.
Oxidative damage to proteins was evidenced by increased protein carbonyl (PC) levels in control exercised rats. Interestingly, low dose was marginally, and medium dose was completely decreased the PC levels, whereas, no change with high dose of Panagin. In addition, high dose significantly increased the PC levels at resting condition. Nitric oxide (NO) levels decreased as a result of exercise in control group, and also with high dose of Panagin treatment at resting condition. In contrast, glutathione S-transferase (GST) activity was increased with all doses of Panagin. Superoxide dismutase (SOD) and catalase (CAT) activities were significantly decreased as a result of exercise in control group, and remaining nine groups treated with 21% fructose water for 8 weeks to induce insulin resistance and hyperglycemia. After 8 weeks, oral glucose tolerance test (OGTT) was performed to confirm the insulin resistance (IR). Then, we treated rats with different doses of American ginseng and combined with swimming exercise for 28 days (low-dose, low-dose and exercise, medium-dose, medium-dose and exercise, high-dose, high-dose and exercise, placebo, placebo and exercise, metformin). Second time OGTT was performed to know American ginseng and swimming effects.

RESULTS: In our study, we found that fasting blood glucose was significantly increased in fructose-fed groups. After 8 weeks, the insulin resistance was markedly increased in fructose groups compared to control group (p<.05). Calculated glucose area under curve (GAUC) was significantly decreased in both high-dose of ginseng and medium-dose of ginseng combined with exercise compared to placebo group. The HOMA (homeostasis model assessment of IR), an indicator of insulin sensitivity, was significantly increased in placebo, low-dose and medium-dose groups (p<.05) compared to control group. This elevation was attenuated by exercise in placebo and low-dose groups. High-dose intake of ginseng also decreased the HOMA compare to placebo (p<.05) group.

CONCLUSIONS: Our study concludes that high-dose of American ginseng can control the blood glucose levels in hyperglycemia rats. Furthermore, medium-dose of American ginseng combined with swimming exercise also able control the blood glucose in hyperglycemia rats.

Panax ginseng Extracts Suppress Hepatic Oxidative Damage in Exhaustive Exercised Rats

PURPOSE: Chinese herbal medicine is most popular in the world, and ginseng is widely used herb in that traditional medicine. Previous studies showed divergent results from ginseng extracts. This study was aimed to examine the effects of Panax ginseng extract on oxidative damage in liver of rats.

METHODS: In the present study, 80 male Sprague Dawley (SD) rats were equally divided into four groups, including placebo (0.9% saline), DS-20 (Dammarene oigo-saponins 20 mg/kg), DS-60 (60 mg/kg) and DS-120 (120 mg/kg bodyweight) groups. DS was orally administered for a period of 10 weeks. After completion of the last treatment half number of rats (n=10) from each group performed exhaustive swimming exercise.

RESULTS: A significant (p<0.05) decrease in hepatic glutathione peroxidase (GSH-Px) activity after exhaustive exercise in placebo group was ameliorated in DS pretreated rats. Glutathione S-transferase (GST) and glutathione reductase (GR) activities were not significantly altered after exhaustive exercise in placebo. Interestingly, DS pretreatment for 10 weeks significantly increased GST activity. The activity of free radical source enzyme, xanthine oxidase (XO) was significantly elevated after exhaustive swimming and abolished in DS pretreated rats. In addition, the lipid peroxidation marker, thiobarbituric acid reactive substance (TBARS) was dramatically raised after exhaustive exercise in placebo group and attenuated in DS pre-treated group.

CONCLUSIONS: Administration of Panax ginseng extract, Dammarene oigo-saponins can protect liver from oxidative damage by suppressing free radical production and increasing antioxidant status after exhaustive exercise.

Dose Dependant Studies of Panagin DS-1227 on Free Radical Scavenging System in the Liver of Exhaustive Exercise Rats

PURPOSE: Ginseng extracts are able to cope against oxidative stress condition; however, it is limited to emphasize the therapeutic application of specific compounds with specific dose. This study was designed to explore the therapeutic properties of Panagin DS-1227 (HPLC-grade extract of ginseng stem and leaves), against exhaustive exercise-induced oxidative stress in rats.

METHODS: Rats (n=120) were evenly divided into four groups such as, control, P-20, P-60 and P-120. Panagin DS-1227 (P) extracts were orally administered to respective groups at 20 (low), 60 (medium) and 120 (high) mg/kg bodyweight for 10-week. Half number of rats from each group performed exhaustive exercise in a swimming pool and sacrificed along with their unexercised rats immediately after exercise.

RESULTS: Exhaustive exercise-induced drastic (P<0.001) drop in liver glutathione (GSH) content was significantly restored in P-20 and P-60 groups, while unable to restore in DS-120 group. Oxidative damage to proteins was evidenced by increased protein carbonyl (PC) levels in control exercised rats. Interestingly, low dose was marginally, and medium dose was completely decreased the PC levels, whereas, no change with high dose of Panagin. In addition, high dose significantly increased the PC levels at resting condition. Nitric oxide (NO) levels were increased in control group after exhaustive exercise, nevertheless, no change with all doses of Panagin. Superoxide dismutase (SOD) and catalase (CAT) activities were significantly decreased as a result of exercise in control group, and also with high dose of Panagin treatment at resting condition. In contrast, glutathione S-transferase (GST) activity was increased with all doses of Panagin.

CONCLUSIONS: Our findings elucidate that purified ginseng extract, Panagin DS-1227 attenuates the oxidative damage in liver of exhaustive exercised rats. Interestingly, low and medium doses of Panagin showed better results than the high dose.
after exercise. BUN levels were significantly lower 3-h after exercise in DS-60 group compared to control group at same time point. Interesting finding of the present study is that increased CK levels after exercise were decreased in all DS treated groups 3-h after exercise compared to control group.

CONCLUSIONS: The data of the present study concludes that purified ginseng extracts, Dammarane Oligo-Saponins possesses beneficial effects against exhaustive exercise challenge. Further detailed investigations are under progress to suggest the DS as nutraceutical substance.
METHODS: Recreational active subjects (29 men, 31 women, 22±4 y) completed 4946 min of cycling (37±2°C, 45±5% relative humidity) after consuming either yeast β-glucan (250 mg/d, BG) or a placebo (sugar pill, PL) for 10 days prior to each exercise session. The investigators were blinded to the supplement conditions until all data was collected and analyzed. Venous blood was collected at baseline (prior to supplement), pre-, post-, and 2-hours (2H) post exercise. Total and subset monocyte concentration was measured by flow cytometry. LPS-stimulated production of 12 cytokines was measured using a whole blood assay. Plasma concentration of 12 cytokines was measured using a high-sensitivity MagPix assay.

RESULTS: Monocyte (CD14+) concentration was significantly greater at 2H (P=0.05) with BG. Also, compared to PL, BG boosted LPS-stimulated production IL-2, IL-4, IL-5, and IFN-γ at PRE and POST (P=0.05). Plasma concentration of IL-2, IL-4, IL-5, IL-7, IL-10, and IFN-γ were significantly greater at 2H in the BG compared to PL. In the placebo condition we observed the traditional response to strenuous exercise (rise at POST and suppression at 2H). It appears that 10-days of supplementation with BG primed blood leukocytes for the production of IL-2, IL-4, IL-5, and IFN-γ. These cytokines were elevated prior to and immediately after exercise in LPS-stimulated cultures and subsequent elevation were observed at 2H with unstimulated plasma measurements. In addition to cytokine changes, BG appeared to blunt post-exercise reduction in blood monocyte concentration, which may have implication of immune-surveillance.

CONCLUSIONS: The key findings of the present study demonstrate that BG may be a suitable countermeasure to protect and boost the immune system following stressful exercise. Such boost is likely to lower the duration of the "open window" response. This study was funded by Biothera, The Immune Health Company.
Supplementation with 100 mg brown seaweed extract (0.8 % fucoxanthin) and 100 mg pomegranate seed oil (70 % punicic acid), abbreviated as Xan, has been shown to significantly reduce body fat, liver fat, and serum lipids in obese females.

**PURPOSE:** To determine the effects of Xan supplementation on serum lipid levels [i.e. high-density lipoprotein (HDL), low-density lipoprotein (LDL), total cholesterol, triglycerides] in obese men and women.

**METHODS:** Twenty-nine obese men and women (29±8 y; 36.50±5.39 kg/m²; 43.8±8.0 % body fat) were randomized to either a Xan (n=14) or olive oil placebo (Pla; n=15) group. This study was double-blind and placebo-controlled. Participants were instructed to ingest 200 mg capsules of their given supplement three times per day (prior to meals) for 16 weeks while consuming a reduced calorie diet (equivalent to their resting energy expenditure). The 2011 ACSM physical activity guidelines were also recommended. Data were analyzed with repeated measures ANOVA and presented as means ± SD changes from baseline.

**RESULTS:** Data analysis demonstrated that there was a trend for a reduction in serum triglycerides (Xan:-31±45 mg·dl⁻¹; Pla:-5±66 mg·dl⁻¹; p=0.071) and a trend for an interaction effect for ALT (p=0.088). No significant within- or between-group effects were observed in serum total cholesterol, HDL, or LDL levels.

**CONCLUSION:** The 16 weeks of Xan supplementation (600 mg/d) did not significantly augment the beneficial effects of exercise and a reduced calorie diet on serum cholesterol and triglyceride levels in this obese population. However, the use of Xan in this study might have been too short to show the full beneficial effects of exercise alone.

Supported by a grant from P.L. Thomas & Co., Inc.

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**Effects of 16wk Fucoxanthin and Punicic Acid Supplementation IV: Markers of Liver and Kidney Function**

Emily R. Buras, Geoffrey M. Hudson, Lisa A. Knecht, Cody J. Tullos, Alicia D. Sample, Michael J. Webster, FACSM. The University of Southern Mississippi, Hattiesburg, MS.

(No relationships reported)

Supplementation with 100 mg brown seaweed extract (0.8 % fucoxanthin) and 100 mg pomegranate seed oil (70 % punicic acid), abbreviated as Xan, has been shown to significantly reduce body fat, liver fat, and improve serum markers of liver function in obese females.

**PURPOSE:** To determine the effects of Xan supplementation on serum markers of liver and kidney function in obese men and women.

**METHODS:** Twenty-nine obese men and women (29±8 y; 36.50±5.39 kg/m²; 43.8±8.0 % body fat) were matched on gender, age, and body fat percentage and randomized to either a Xan (n=14) or olive oil placebo (Pla; n=15) group. This study was double-blind and placebo-controlled. Participants were instructed to ingest 200 mg capsules of their given supplement three times per day for 16 weeks while consuming a reduced calorie diet (equivalent to their resting energy expenditure). The 2011 ACSM physical activity guidelines were also recommended. Data were analyzed with repeated measures ANOVA and presented as means ± SD changes from baseline.

**RESULTS:** Data analysis demonstrated that significant reductions in serum levels of alkaline phosphatase (ALP; Xan:-5±6 U·L⁻¹; Pla:-3±9 U·L⁻¹; p=0.001), alanine aminotransferase (ALT; Xan:-2a±2 U·L⁻¹; Pla:-4±7 U·L⁻¹; p=0.021), total protein (Xan:-0.3±0.3 g·dl⁻¹; Pla:-0.2±0.3 g·dl⁻¹; p=0.001), and creatinine (Xan:-0.1±0.15 mg·dl⁻¹; Pla:-0.08±0.13 mg·dl⁻¹; p=0.001) were observed over the 16 weeks with a trend for an interaction effect for ALT (p=0.101), but no other between-group effects. Blood urea nitrogen (BUN) levels did not change over time, but there was a significant between-group effect (Xan:144±4 mg·dl⁻¹; Pla:114±3 mg·dl⁻¹; p=0.018). No within- or between-group effects were observed in serum aspartate aminotransferase, total bilirubin, or albumin.

**CONCLUSION:** The 16 weeks of Xan supplementation (600 mg/d) did not affect these liver and kidney function markers in this obese population.

Supported by a grant from P.L. Thomas & Co., Inc.
Effects of Quercetin Supplementation on Physical Function in Older Adults

Stephen C. Chen, I, Mark Davis, FACSM I, E. Angela Murphy, I Michele Neese, I Matthew Kostek, I Kei Lam, I John Sieverdes, I Victor Hinth, I Andres Leon, I Seung H. Jung, I Benjamin Gordon, I Katie Becofsky, I Toni Torres-McGehee, I Steve Blair, FACSM, I J. Larry Durstine, FACSM I, University of South Carolina, Columbia, SC, Palmetto Health Senior Primary Care, Columbia, SC. (Sponsor: Mark Davis, FACSM)

Fatigue is a common complaint among older adults and is associated with functional decline and multiple adverse health outcomes. Previous studies in our laboratory have shown that the dietary flavonoid quercetin can enhance voluntary activity and endurance performance in mice as well as aerobic capacity in young adults. However, the benefits of quercetin on physical function in older adults has not yet been evaluated.

PURPOSE: To determine the effects of short-term quercetin (QUE) versus placebo (PLA) supplementation on habitual physical activity (N=10), physical performance (N=18) as well as markers of mitochondrial biogenesis (N=4) in healthy older adults (61 to 89 years).

METHODS: Subjects were randomized to receive QUE (1000 mg·day⁻¹) or PLA for 14 days using a double-blind, placebo controlled, crossover study design with a 2-week washout period. Physical activity patterns were assessed by accelerometry daily throughout the study. After completion of treatments, physical performance including VO₂ peak, Short Physical Performance Battery (SPPB) and 6-minute walk (6MW) were determined, and muscle biopsies acquired from the vastus lateralis were analyzed for mRNA gene expression of PGC-1α, citrate synthase and cytochrome c using RT-PCR.

RESULTS: QUE feedings significantly increased daily steps count by 16.7% compared with PLA (4811.7 ± 778.5 vs. 5614.9 ± 993.3 steps·day⁻¹, respectively, p=0.02), along with a trend for increased minutes of moderate intensity of physical activity (10.5 ± 3.9 vs. 7.6 ± 2.6 min·day⁻¹, p=0.11). QUE increased mRNA gene expression of PGC-1α, citrate synthase and cytochrome c by 49%, 26% and 32%, respectively, although these did not reach statistical significance which is likely due to the small sample size that was used in this analysis. No differences were found between QUE and PLA conditions for VO₂peak, SPPB score, and 6MW distance.

CONCLUSION: These novel data suggest that short-duration QUE feedings can promote physical activity in older adults, and that these effects may partially attributed to the increased muscle mitochondrial biogenesis which plays a role in fatigue development. Overall, the results of this study provide evidence in support of dietary QUE as a possible safe and effective nutritional strategy for disease prevention and health promotion in the elderly.

Effect Of Resveratrol On Oxidative Stress And Skeletal Muscle Oxygenation With NIRS In Trained Cyclists

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During strenuous exercise, there is a dramatic increase in oxygen consumption that leads to an increased oxygen species (ROS) production. This increase in ROS results in oxidative stress, which has been associated with muscle fatigue and impaired recovery following high-intensity aerobic exercise.

PURPOSE: The purpose of the present study was to evaluate the effects of a Resveratrol supplementation on protein blood markers of oxidative stress and blood antioxidant capacity during a single bout of intermittent exercise and recovery in trained cyclists. A second purpose was to measure vastus lateralis muscle oxygenation, using near infrared spectroscopy (NIRS), blood lactate concentration and whole body oxygen consumption under the Resveratral condition.

METHODS: A double-blind study was conducted with 7 male trained cyclists, aged 37.3 ± 11.7 years. The participants completed two sessions high intensity interval training (HIIT) in two conditions, with and without Resveratrol supplementation (1000 mg daily) in orange juice, 7 consecutive days before the experiment, with partially counterbalanced conditions across subgroups. Blood sampling was collected pre- and post-exercise for the determination of protein carbonyls (PC) and total antioxidant capacity (TAC).

RESULTS: Resveratrol supplementation did not improve organism’s antioxidant defence and protein carbonyl blood concentrations following HIIT. Under Resveratrol supplementation, tissue saturation index in oxygen (TSI%) in vastus lateralis was slightly less attenuated (p=0.05) at the end of HIIT (Δ = -1.3%) as compared to placebo condition (Δ = 2.0%). Resveratrol had no effect on skeletal muscle oxygenhemoglobin (O₂Hb) deoxygenhemoglobin (HHb) and total hemoglobin (THb). Heart rate and blood lactate concentration recovery both showed a tendency (p = 0.10) to decrease following 15 min passive recovery under the Resveratral condition. However, a positive correlation trend (r = 0.72, p = 0.07) was observed between THb and TAC.

CONCLUSION: This study did not show an effect of Resveratrol on protein carbonyl and antioxidant capacity. However, Resveratrol improved tissue saturation index (TSI%) in vastus lateralis during the HIT.

Involvement of PI3K/Akt/mTOR Pathway in Angelica sinensis Induced Myotube Hypertrophy.

Tzu-Shao Yeh, FACSIM1, Jen-Fang Liu1, Mei-Chich Hsu, FACSM1, 2Taipei Medical University, Taipei, Taiwan. 2National Taiwan Sport University, Taoyuan, Taiwan.

PURPOSE: Herbal medicine has long been used in ergogenic aids for athletes but there is little scientific evidence for their actions. To investigate whether Angelica sinensis increases hypertrophy of myotubes through activating the PI3K/Akt/mTOR pathway, we have been promoted to promote skeletal muscle hypertrophy and prevent muscle atrophy.

METHODS: We examined the PI3K/Akt/mTOR pathway in C2C12 myotubes, a well-established in vitro model of skeletal muscle hypertrophy, with or without Angelica sinensis extract for 72 hours.

RESULTS: In Angelica sinensis extract treated, the average myotube diameter was 1.34±0.13 fold to normal, which is significantly larger than the diameter in non-herbal supplements cultures. This indicates clearly that myotubes were hypertrophied by Angelica sinensis extract. Hypertrophy was largely suppressed by wortmannin or rapamycin, inhibitors of PI3K or mTOR, respectively. The PI3K inhibitor, wortmannin, decreased the diameter of Angelica sinensis extract treated myotubes by 25%, as well as that of positive controls by approximately 30%. The mTOR inhibitor, rapamycin, behaves similarly to wortmannin. These results indicate that the PI3K/Akt/mTOR pathway plays an important role in Angelica sinensis-induced myotube hypertrophy.

CONCLUSIONS: Angelica sinensis promotes hypertrophy in cultured skeletal myotubes through activating the PI3K/Akt/mTOR pathway. Furthermore, phosphorylation of Akt was enhanced by Angelica sinensis treatment and suppressed by wortmannin. Angelica sinensis and its derivatives may be promising candidates for the treatment of muscular dysrophy.

Efficacy of Tart Cherry Juice to Reduce Inflammation Among Patients with Osteoarthritis

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PURPOSE: Tart Cherry Juice pluraceutical (OA) is a common syndrome affecting 65 million Americans characterized by joint pain, limitation of movement, crepitus, occasional effusion, and variable degrees of local inflammation. Up to 40% of OA patients have inflammation. Numerous antioxidant and anti-inflammatory agents have been identified in tart cherries and may be beneficial for the treatment of pain and inflammation. This study assessed the effects of tart cherry juice on serum inflammation biomarkers among women with inflammatory OA.

METHODS: We used a three week, randomized, placebo controlled design among twenty 40-70 year old females with inflammatory OA. All subjects fulfilled the 1990 American College of Rheumatology classification guidelines for the diagnosis of osteoarthritis with evidence of swelling in at least one joint in the past year. For 21 days, subjects ingested 10.5 fl oz of tart cherry juice or a placebo beverage twice a day. Pre and post drink intervention blood measurements included IL-6, IL-10, TNF-α, and CRP.
RESULTS: Among the subjects who consumed tart cherry juice, all serum biomarkers showed evidence of decreased inflammation, however the only statistically significant change was observed in TNF-α (P<0.05). In addition, a subset analysis was performed on those subjects with active inflammation as defined by CRP≥3.0 mg/L. Within the high inflammation subset (n=12), there was a statistically significant decrease in TNF-α and CRP for subjects on the tart cherry juice as compared to placebo.

CONCLUSIONS: Tart cherries have the highest antioxidant and anti-inflammatory content of any food. This study suggests a benefit of tart cherry juice in reducing inflammation as measured by certain serum inflammatory biomarkers among women with OA. Pain relief and improvement of functional disability are the main goals of OA treatment and it is important to look at healthy alternative therapies to conventional methods in the treatment and management of inflammatory osteoarthritis. Tart cherries may provide beneficial anti-inflammatory activity helping OA patients manage their disease.
1393  Board #174  MAY 30  11:00 AM - 12:30 PM  
Can Therapeutic Use Of Terbutaline Be Distinguished From Doping Use With A Urine Sample  
Jimmri Eilers. Copenhagen University Hospital: Bispebjerg, Copenhagen, Denmark.  
(No relationships reported) 
PURPOSE: We examined urine and serum concentrations after therapeutic use of single and repetitive doses of inhaled terbutaline and supratherapeutic use of a single oral dose of terbutaline.  
METHODS: We compared the concentrations in asthmatics with regular use of beta2-agonists prior to study and healthy subjects with no previous use of beta2-agonists. We enrolled 10 asthmatics and 10 controls in an open-label, cross-over study in which subjects were administered 2 mg inhaled and 10 mg oral terbutaline on two study days. Further 10 healthy subjects were administered 1 mg inhaled terbutaline every second hour (total 4 mg), which is the maximum permitted daily dose by the World Anti-Doping Agency (WADA). Blood samples were collected at baseline, 30 min, 1, 2, 3, 4, and 6 h after the first inhalations. Urine samples were collected at baseline, 0-4 h, 4-8 h, and 8-12 h after the first inhalations.  
RESULTS: Median (IQR) urine concentrations peaked in the period 0-4 h after inhalation with Cmax 472 (324) ng x mL-1 in asthmatics and 661 (517) ng x mL-1 in healthy subjects, and 4-8 h after oral use with Cmax 666 (877) ng x mL-1 in asthmatic and 402 (663) ng x mL-1 in healthy subjects. All urine concentrations were corrected for the urine specific gravity.  
CONCLUSION: In conclusion we found no significant differences in urine and serum concentrations between asthmatic and healthy subjects. We compared urine and serum concentrations after therapeutic inhaled doses and supratherapeutic oral doses and observed significant statistical differences in both groups. We found high variability in urine concentrations between subjects in both groups. The variability between subjects was still present after the samples were corrected for urine specific gravity. When evaluating our results we found it impossible to distinguish between permitted therapeutic use and prohibited supratherapeutic use based on doping tests with urine and blood samples.

1394  Board #175  MAY 30  11:00 AM - 12:30 PM  
Effect of Exercise and Aged Garlic Extract on Metabolic Parameters in High-Fat Diet-Induced Obese Rats  
Due Yun Seo1, Sung Ryul Lee1, Yeong Ho Baek1, Yi Sub Kwak1, Arturo Figueroa3, Nari Kim3, Byoung Do Lee3, Kyung Soo Ko1, Tae Hee Ko1, Jin Han1, 1Inje University, Busan, Korea, Republic of. 2Pusan National University, Busan, Korea, Republic of. 3Dong Eui University, Busan, Korea, Republic of. 4Florida State University, Tallahassee, FL.  
(No relationships reported) 
The worldwide prevalence of obesity is increasing at an alarming rate, with major adverse consequences for human health. Aged garlic extract (AGE) is widely promoted as a cholesterol-lowering agent and exercise alone is widely perceived to be beneficial for improving metabolic function in high fat diet (HFD) induced obese rats through reducing metabolic parameters.  
PURPOSE: The purpose of this study was to investigate the effect of exercise and/or AGE on body weight, lipid profiles, inflammatory and oxidative stress markers in HFD induced obese rats.  
METHODS: Forty Sprague Dawely rats were switched to HFD diet for 6 week and randomized into five groups: HFD (n=10), HFD with exercise (n=10), HFD with AGE (n=10), and HFD with exercise and AGE (n=10) for 4 weeks. AGE was administered orally at a dose of 2.86 g/kg. Exercise consisted of 15~60 min of running 5 times/day with gradually increasing intensity.  
RESULTS: AGE (p<0.01), Exercise, and Exercise with AGE (p<0.001) significantly decreased body weight gain, average weight gain and food efficiency rate compared to HFD. AGE significantly decreased visceral fat (p<0.05), and liver (p<0.01). Exercise significantly decreased visceral fat, and liver (p<0.01). In reducing visceral fat (p<0.001), epididymal fat (p<0.01) and liver weight (p<0.001), Exercise with AGE was effective but exercise showed stronger suppressing effect than AGE admin. Consumption of AGE significantly inhibited the increase in total cholesterol (65.1±10.0 vs HFD: 92.6±2.9) and low density lipoprotein-cholesterol (37.4±8.1 vs HFD: 52.1±18.6). C-reactive protein (CRP) and malondialdehyde (MDA) were significantly decreased compared to HFD (p<0.05).  
CONCLUSION: AGE supplementation and exercise alone have anti-obesity effects AGE with exercise result in improvements of inflammatory and oxidative stress markers independently of changes in adiposity and lipids.

1395  Board #176  MAY 30  11:00 AM - 12:30 PM  
Effects of Oxygenated Water on Aerobic Performance in Division II Collegiate Male Soccer Players  
Tina M. Manos, Peter J. Fuller, Thomas J. Koesterer. Humboldt State University, Arcata, CA.  
(No relationships reported) 
Supplemental oxygen (O2) ingested in commercially-available “oxygenated water” preparations, has not been shown to have consistent effects on aerobic performance measures. Most researchers have found no significant differences in oxygen saturation of hemoglobin, VO2 max, and time to exhaustion when comparing the effects of oxygenated water to placebo; yet, in some studies, highly-fit subjects ingesting oxygenated water were found to have significantly higher values for these measures.  
PURPOSE: To determine the effects of oxygenated water on aerobic performance in Division II male soccer players.  
METHODS: A randomized, double-blind, cross-over design was used to study 12 Division II soccer players (age = 20.1 ± 1.4 years; mass = 73.3 ± 10.6 kg; height = 176.0 ± 6.9 cm) with the fastest two-mile run times (12:34 ± 2.46; via pulse oximetry), heart rate (HR), and expired gases were measured until volitional exhaustion) approximately 1 week apart; conditions were 500 ml of bottled water (placebo) or commercial “activated stabilized oxygen” water taken 15 min prior to the test. To examine oxygen saturation of hemoglobin (SpO2; via pulse oximetry), heart rate (HR), and expired gases were measured.  
RESULTS: The SpO2 (95.58 ± 0.10 vs. 96.08 ± 0.246; p = .4971), HR (187.00 ± 8.66 vs. 187.16 ± 7.73 bpm; p = .942), and VO2 (57.26 ± 4.93 vs. 58.15 ± 3.87 ml/kg/min; p = .351) at the highest common workload achieved on both trials were not different between the placebo and oxygenated water conditions, respectively. The SpO2 at the lowest point during the maximal testing (94.58 ± 2.90 vs. 94.92 ± 2.06%; p = .732) and the SpO2 at exhaustion (94.75 ± 3.01 vs. 95.16 ± 2.24%; p = .610) were not different between conditions. VO2 max (59.97 ± 4.24 vs. 60.92 ± 3.1 ml/kg/min; p = .247) and maximum HR (192.08 ± 7.69 vs. 191.08 ± 7.63 bpm; p = .597) also were not significantly different between the conditions. Although the time to exhaustion (428.83 ± 2.54 vs. 451.17 ± 5.07 sec; p = .072) was longer by 22.34 seconds for oxygenated water versus placebo, the difference did not reach statistical significance.  
CONCLUSION: Ingestion of oxygenated water did not result in any changes in aerobic performance measurements in Division II male soccer players.

1396  Board #177  MAY 30  11:00 AM - 12:30 PM  
Polyphenol Rich Juice Supplementation in Olympic Swimmers does not alter Inflammation or Immune Biomarkers  
Amy M. Knab1, Nicholas D. Gillitt1, Lynn Ciadella-Kam1, David C. Nieman, FACSM1, R. Andrew Shanholtz1. Appalachian State University, Kannapolis, NC, 1Dole Nutrition Research Institute, Kannapolis, NC.  
(No relationships reported) 
PURPOSE: This study investigated the effects of consumption of a juice blend made from whole fruits and vegetables on innate immunity, and chronic and acute inflammation in elite swimmers training three hours per day, compared to non-athletic controls.  
METHODS: Nine male swimmers and seven controls were recruited and compared before and after a 10-day study period. Swimmers were randomized, and completed 10 days supplementation with or without 16 oz of the juice ingested pre- and post-workout, with a three week wash out period between supplementation periods. Blood samples were taken pre-supplementation, post-10 days supplementation, and immediately post-exercise on the 10th day.  
RESULTS: Age was not different between swimmers (24.6 ± 0.7 y) and controls (25.7 ± 1.3 y). Swimmers were significantly fitter (VO2max = 33.1 ± 1.4 ml kg⁻¹ min⁻¹, body fat = 11.7 ± 0.8%), compared to controls (VO2max = 39.9 ± 2.7 ml·kg⁻¹·min⁻¹, body fat = 19.6 ± 6.4%). All pre-exercise measures of inflammation and immune function were not different between swimmers and controls. The patterns of change (chronic) in inflammatory cytokines (IFN-γ, IL-1β, IL-6, IL-10, IL-12p70, and TNF-α) and innate immune function (granulocyte and monocyte phagocytosis/ oxidative burst activity) were not different between juice and non-juice conditions over the 10-day study period. A single training bout at the end of the 10-day supplementation period caused a small but significant increase in plasma IL-6 (0.3 ± 0.1 to 0.8 ± 0.1 pg·ml with juice, and 0.5 ± 0.1 to 0.8 ± 0.1 pg·ml with no juice) and IL-10 (but not other cytokines), with no
differences between juice and non-juice conditions. The training bout caused a small but significant increase in phagocytosis and oxidative burst activity, with no differences between juice and non-juice conditions.

CONCLUSIONS: Contrary to expectations, high-level training in elite swimmers was not associated with chronic inflammation or dysfunctional innate immunity, and acute changes post-3-h aerobic/anaerobic training bouts were mild or indicative of immune stimulation. The mixed fruit-vegetable juice supplement (~9500 ORAC units) is a nutritious addition to the training diet, but has no influence on inflammation and innate immune measures that could be considered already at favorable levels. (Funded by Dole Foods Inc.)

1397  Board #178  MAY 30  11:00 AM - 12:30 PM
Effect of 4 Weeks Resveratrol Supplementation on Body Composition in Healthy Adults
Sarah J. Wherry1, James M. Smoliga2,1, Arizona State University, Phoenix, AZ. 2High Point University, High Point, NC.

(No relationships reported)

Resveratrol, a polyphenol found in grapes and other plants, has been demonstrated to have a number of beneficial health effects in laboratory models. Current evidence suggests there is much potential for resveratrol to decrease fat mass and increase muscle mass and bone mass. However, no human clinical trials have examined the effects of resveratrol supplementation on body composition parameters in healthy adults, including total mass, fat mass, lean mass, and bone mass.

METHODS: 41 healthy adults (13 male, 28 female) between the ages of 18-75 were randomized to either the resveratrol (RES, n = 21) or placebo (PLA, n = 20) groups. Individuals participated in two testing visits: baseline (Pre) and post-supplementation (Post). Each visit included a fasting Dual-Energy X-ray Absorptiometry (DEXA) scan during which total body mass, fat mass, lean mass, and bone mass were measured. Following Pre, participants self-administered their respective supplement once daily for 4 weeks. Participants then underwent their Post DEXA scan. Data were analyzed using Repeated Measures ANOVA to determine if a significant (p ≤ 0.05) Group x Visit effect existed.

RESULTS: Total body mass was unchanged between groups (mean ± sd; PLA: Pre = 70.4 ± 14.1 kg, Post = 70.2 ± 13.9 kg; RES: Pre = 74.7 ± 14.7 kg, Post = 74.8 ± 14.8 kg; p = 0.167). There were no significant Group x Visit effects for fat mass (PLA: Pre = 24.2 ± 9.5 kg, Post = 24.3 ± 9.6 kg; RES: Pre = 23.7 ± 9.3 kg, Post = 23.7 ± 9.3 kg; p = 0.664, power = 0.071), lean mass (PLA: Pre = 46.4 ± 10.3 kg, Post = 46.1 ± 9.8 kg; RES: Pre = 48.1 ± 10.2 kg, Post = 48.3 ± 10.0 kg; p = 0.195, power = 0.251), or bone mass (PLA: Pre = 2.83 ± 0.62 kg, Post = 2.84 ± 0.63 kg; RES: Pre = 2.87 ± 0.62 kg, Post = 2.87 ± 0.63 kg; p = 0.435, power = 0.120). DISCUSSION: It appears that short-term resveratrol supplementation does not alter body composition parameters in healthy adults. Further research using larger sample sizes, longer supplementation periods, and concurrent exercise in a variety of populations should be performed to better evaluate resveratrol’s efficacy.

1398  Board #179  MAY 30  11:00 AM - 12:30 PM
The Bioavailability Of Resveratrol (3,4’,5 Trihydroxystilbene)
Martin R. Lindley1, Annika Rasiejfi2, Shannon R. Siegel2, Timothy D. Mickleborough, FACSMD, 1Loughborough University. Loughborough. United Kingdom. 2California State University, San Bernardino, San Bernardino, CA. 3Indiana University, Bloomington, IN. (Sponsor: T.D. Mickleborough, FACSMD)

(No relationships reported)

PURPOSE: Resveratrol is one of many phenolic compounds that have been suggested as having potential applications in chronic disease prevention, however, most of the current evidence is based on in vitro findings. Given the potential benefits of resveratrol for combating chronic inflammatory diseases, it is important to evaluate the bioavailability of resveratrol especially as it has been suggested that the compound is rapidly metabolized and eliminated in humans.

METHODS: Twelve healthy, young males completed the study. Blood samples were collected at 30, 60 and 90 min following ingestion of a 1 g oral resveratrol dose (Transmax, Biotivia Bioceuticals, Vienna, Austria). Plasma samples were analyzed using high performance liquid chromatography and eluted resveratrol and metabolite peaks identified by mass spectrometry. The identity of resveratrol was confirmed by MS in plasma samples containing a standard at 100 ng/mL and 200 ng/mL concentrations with retention time identified by spiking out of six peaks appearing on the HPLC chromatogram, the identities of resveratrol, and two metabolites were confirmed by MS (Metabolite B - mono-glucuronide; metabolite C- mono-sulfate conjugate).

RESULTS: The concentration of resveratrol (ng/mL) and metabolites (resveratrol equivalents in ng/mL) showed an increasing trend over time following ingestion. Plasma concentrations of resveratrol and metabolites at 30, 60 and 90 min post-dose were different from baseline (p < 0.008) except for metabolites C and E. There was an increase in the concentration of metabolite D: 181.3 ng/mL ± 284.4, 1325.9 ng/mL ± 1425.5, (p = 0.005) and metabolite F: 155.0 ng/mL ± 311.4, 1926.5 ng/mL ± 2369.5 (p = 0.005) between 30 and 60 minutes. Significant increases from 30 to 90 min (PLA: Pre = 43.4 ng/mL ± 1634.1, Post = 1327.4; RES: Pre = 43.4 ng/mL ± 1634.1, Post = 1327.4, p = 0.006) for metabolite B (438.4 ng/mL ± 756.3, 1634.1 ng/mL ± 1327.4, p = 0.006), metabolite D (181.3 ng/mL ± 284.4 to 1748.1 ng/mL ± 1578.0, p = 0.005 ), metabolite F (155.0 ng/mL ± 311.4 to 2783.7 ng/mL ± 2174.3). p = 0.001 and resveratrol (p < 0.001). No differences were seen in resveratrol or any of its metabolites from 60 to 90 minutes (p > 0.008).

CONCLUSIONS: Resveratrol has been shown to have low bioavailability as well as being lower than its metabolites and as such future research should focus not only on resveratrol bioavailability but also that of its metabolites.

1399  Board #180  MAY 30  11:00 AM - 12:30 PM
Effects of High Antioxidant Foods on Antioxidant Capacity in Post-Menopausal Women
Shelby Kloiber1, Robert Sawyer2, Melaine Hart1, Jacalyn McComb1. 1Texas Tech University, Lubbock, TX. 2Utah Valley University, Orem, UT.

(No relationships reported)

Oxidative stress brought on by free radicals can lead to an increased risk of certain diseases such as heart disease and some cancers. Oxidative stress mediated damage can be reduced by scavengers, or antioxidants that can eliminate the high tendency of free radicals by turning them into non-radical and nontoxic metabolites. Many scientists have investigated the effects of different kinds of foods (whole, liquid, or supplement) to measure the change in oxidative damage and antioxidant capacity.

METHODS: To examine the effects of two types of foods high in antioxidants on antioxidant capacity in postmenopausal women.

RESULTS: Healthy post-menopausal women without hormone replacement, (N=16) were randomly divided into four groups: fruits (F), soymillk (S), fruits and soymillk (F+S) and control (C). The intervention included a one week wash-out period where participants refrained from a list of foods high in antioxidants. The next four weeks involved a diet intervention. The S group was instructed to consume a total of 700 ml of approved soymilk throughout the day. The F group was instructed to consume 5 or more servings of fruit per day. The S+F group followed both the soymilk and fruit instructions. Subjects in the C group were instructed to maintain their normal diet. Fasting blood samples were drawn before and after the intervention. Spectrophotometric assays were conducted for antioxidant capacity by SOP (Cayman Chemical).

RESULTS: SOD showed a significant main effect for Test with the mean for the pre-test (M = 0.28 units/ml, SD = 0.15) being significantly lower than the mean for the post-test (M = 0.39 units/ml, SD = 0.23). There were no significant between group differences in SOD.

CONCLUSION: The results of a diet high in antioxidant rich food, specifically fruits and/or soymilk, after a 4 week time period, did significantly increase antioxidant levels. Both diets appear effective in increasing antioxidant capacity, with no diet being more effective than the other.

1400  Board #181  MAY 30  11:00 AM - 12:30 PM
Impact Of Intermittent And Continuous Physical Exercise On Endothelial Function And Oxidative Stress Postprandially
Robinson Ramirez-Velez1, Jose G. Ortega2, Ana C. de Plata Aguilar1, Cristina Araujo, Nur1, Celia Escobar Hurtado1, Ricardo A. Agredo Zutiña1, Jorge H. Ramirez2.
1University of Valle, Cali, Colombia. 2University ICESI, Cali, Colombia.

(No relationships reported)

PURPOSE: To evaluate the impact of intermittent and continuous physical exercise on endothelial function and blood oxidative stress postprandially after a high-fat meal.
CONCLUSIONS: Moderate intensity intermittent physical exercise was found to be associated with beneficial effects on endothelial function and oxidative stress in the postprandial state. Randomized clinical trials assessing the effect of intermittent versus continuous physical exercise on hard outcomes of cardiovascular disease and metabolic syndrome are warranted.

METHODS: Cross-sectional study of 141 healthy male subjects, 20 years of age, randomized to three experimental groups: (i) no exercise, (ii) 1 hour of moderate intensity continuous physical exercise, and (iii) 1 hour of moderate intensity intermittent physical exercise. Endothelial function was assessed using the total antioxidant capacity (TAC) test. Oxidative stress and antioxidant defense were assessed after 14 to 18 hours of physical inactivity (baseline); posterior measurements were performed 1h and 2h after the consumption of a high-fat meal.

RESULTS: No statistically significant differences were found on baseline FMD% in the three experimental groups. However, NO2/NO3 levels were significantly higher in the intermittent and continuous exercise groups compared to the control group (P<0.01). After the high-fat meal ingestion the FMD% decreased in the no-exercise and continuous exercise group but significantly increased in the intermittent exercise group. Furthermore, intermittent exercise was associated with increased TAC compared to no exercise and continuous exercise.

CONCLUSIONS: Antioxidant supplementation to prevent the progression of microangiopathy in hindlimb unloading-induced atrophied soleus muscle in rats

METHODS: Four groups of Wistar rats were studied: control (Con), control with ASX (Con+ASX), hindlimb unloading (HU), hindlimb unloading with astaxanthin (HU+ASX) groups. In the Con+ASX and HU+ASX groups, astaxanthin (ASX) was orally administered twice in a day for seven consecutive days (50mg/kg). Hindlimb unloading was applied to animals by suspending their tails for seven days. Intracellular ROS generation was determined by use of the redox-sensitive probe dihydroethidium. The capillary network of the soleus muscle was visualized using confocal laser microscopy. The expression levels of SOD-1 and VEGF protein were measured by immunoblotting and the mRNA expression levels of angiogenic factors (VEGF, KDR, Flt-1, Ang-1, Ang-2, Tie-2, and IFN-1 alpha) in the soleus muscle were determined by TaqMan probe-based real-time PCR.

RESULTS: HU resulted in an increase of ROS and a decrease of the number of capillaries, capillary volume, and capillary luminal diameter. Namely, the capillary network of the soleus muscle regressed in HU. In addition, HU caused the overexpression of SOD-1 and decreased the expression level of VEGF. However, the capillary network of the soleus muscle prevented disuse-induced capillary regression in HU+ASX. Furthermore, ASX supplementation abolished the unloading-induced overexpression in SOD-1 and attenuated the decrease in VEGF expression, and other angiogenic factors.

CONCLUSIONS: These results revealed that astaxanthin is effective to attenuate the development of oxidative stress and maintain the architecture of capillary network in disused skeletal muscle.

Supported by Grants-in-Aid for Science Research from the Japanese Ministry.

CONCLUSION: Quercetin supplementation for 3 weeks maintained volitional grip strength in mice undergoing cachexia, which may be due to the retention of muscle mass and testes size. Funded by NCI RO1-CA121249

METHODS: Crossover trial in 14 healthy male subjects, 20 years of age, randomized to three experimental groups: (i) no exercise, (ii) 1 hour of moderate intensity continuous physical exercise, and (iii) 1 hour of moderate intensity intermittent physical exercise. Endothelial function was assessed using the total antioxidant capacity (TAC) test. Oxidative stress and antioxidant defense were assessed after 14 to 18 hours of physical inactivity (baseline); posterior measurements were performed 1h and 2h after the consumption of a high-fat meal.

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CONCLUSIONS: Moderate intensity intermittent physical exercise was found to be associated with beneficial effects on endothelial function and oxidative stress in the postprandial state. Randomized clinical trials assessing the effect of intermittent versus continuous physical exercise on hard outcomes of cardiovascular disease and metabolic syndrome are warranted.
Heart attack is the most common cause of line-of-duty deaths in the fire service. Daily aspirin therapy is a common preventive measure used to reduce the morbidity of heart attacks in the general population. However, the mechanism of aspirin can hypothetically impair thermoregulation and anecdotal reports have suggested aspirin use increases the risk of heat illness. In spite of these observations, the safety profile of aspirin during uncompensable heat stress has not been well described.

**PURPOSE:** Determine if fourteen days of daily aspirin therapy (81mg PO) alters body core temperature responses during exertion in the heat while wearing thermal protective clothing (TPC).

**METHODS:** In this double-blind, placebo controlled study, 102 firefighters were randomized to receive either 14 days of aspirin (N=54) or a placebo (N=48) prior to completing a 50 minute bout of treadmill exercise in the heat (38.9±1.1°C; 24±7% RH) while wearing TPC and self contained breathing apparatus. Heart rate, weighted mean skin temperature, and body core temperature were monitored throughout the 50 minutes of exercise.

**RESULTS:** There were no differences in age, height, mass, BMI, or VO2max between groups. Heart rate at the end of exercise did not differ between aspirin and placebo groups (174±17 vs. 171±17 bpm, respectively). In the aspirin group, baseline core body temperature was 37.1±0.3°C, which was similar to the placebo group (37.2±0.5°C; p=0.55). Maximal body core temperature was 38.7±0.5°C in the aspirin group and 38.6±0.5°C in the placebo group (p=0.39). The percent change in core temperature from baseline was 4.3±1.2% in the aspirin group and 3.9±1.6% in the placebo group (p=0.20). Upon completion of exercise, maximal weighted skin temperature was 38.3±0.5°C in the aspirin group and 38.1±0.6°C in the placebo groups. Skin temperature rose 12.5±2.3% from baseline in the aspirin group and 12.2±2.6% with the placebo (p=0.55).

**CONCLUSIONS:** Fourteen days of aspirin therapy does not alter temperature responses among firefighters performing exertion in the heat.
PURPOSE: The purpose of this review was to identify potential health issues associated with jockeys complying with current stipulated weight standards operating in Australian horse racing.

METHODS: The review comprised (i) a comprehensive review of national height and weight statistics, (ii) a review of the international scientific literature on population specific normative data, (iii) evaluations of race-day jockey urine samples collected on 875 jockeys over the past 3 years in New South Wales for determination of urine specific gravity (Usg) and the comparison of the results of Usg samples collected for the purpose of drug testing in the work place in the state of Victoria on 452 petrolchemical workers (control group) and 305 jockeys at the race course.

RESULTS: Jockeys were found to have 8 key health issues associated with race riding. Issues included: 'Making weight'; poor dietary practices; compromised bone health; dehydration; smoking; engaging in a high risk sport; lifestyle challenges; and mood disorders. Disturbing levels of consistent and pervasive dehydration were found in jockeys both on race day and non-race days. Results indicate that on race day 48.4% of 875 samples indicated significant dehydration,(Usg ≤ 1.025), 27% had moderate to high levels of dehydration (Usg≤1.025 and ≥ 1.02), 24.5% within the dehydration threshold as defined by Sawk et al., 2007 (Usg ≤ 1.020).

CONCLUSION: Based on these findings, the following recommendations were presented to the ARB; (i) increase the minimum riding weight by 1 kg to 54 kg; and (ii) increase the median and maximum riding weight by 1 kg. It is anticipated that significant health outcomes will result in a decrease in the extreme dehydrating practices currently employed by many jockeys.

1408 Board #189 MAY 30 11:00 AM - 12:30 PM
Anthropometric Measurements of Obesity and Their Link to Lifestyle and Cardiovascular Risk in Colorado Firefighters
Tiffany Lipsy, Lorin O'Toole, Tracy Nelson, Jennifer Peel, Richard G. Israel. FACSM. Colorado State University, Fort Collins, CO.

No relationships reported

Cardiovascular disease (CVD) is the leading cause of death in firefighters as it is in the general population. Despite data promoting Colorado as the leastest state in the nation and the image of firefighters as healthy and physically fit, obesity is evident in Colorado firefighters and continues to be an important CVD risk factor. Job performance and health outcomes among those in public safety are greatly impacted by obesity despite the perception of the general public that firefighters are healthy and fit.

PURPOSE: To determine obesity prevalence, depending on measurement and classification, and its association with lifestyle factors and cardiovascular (CV) risk in a cohort of Colorado firefighters.

METHODS: Analyses were conducted on data from 466 Colorado firefighters (41 females; 425 males; mean age 38 y). Using standard classification cut-points, rates of obesity were determined using body mass index (BMI), waist circumference (WC), sagittal abdominal diameter (SAD), and percent body fat (%BF) from skin fold (SF) and hydrodensiometry (H) measurements. Lifestyle factors used in the analysis included diet, physical activity, sleep, and stress. Lipids, C-reactive protein (CRP), predicted maximal oxygen consumption and strength measures were also included. CV risk was also assessed using the Cooper Risk Profile. Correlation statistics were run for each anthropometric measure with the above variables.

RESULTS: Obesity prevalence varied by measurement in females and males respectively: BMI=9.8 %, 19.1%; WC=19.5%, 19.8%; SAD=31.6%, 43.5%; %BF(SF)=17.1%, 15.1%; and %BF(H)=23.7%, 28.6%. In both sexes, anthropometric measures were positively correlated with triglycerides and CRP but inversely associated with high-density lipoprotein cholesterol, sit & reach, and estimated maximal oxygen consumption (VO2max) (p≤0.05). All anthropometric measures were significantly correlated with CV risk (p≤0.05) except WHR in females. The strongest link to CV risk was %BF(SF) in females and WHR in males.

CONCLUSIONS: The rate of obesity in Colorado firefighters varies depending on the measure used. There are significant associations between obesity, lifestyle factors and CV risk that should be further explored in light of the already increased risk for CVD in firefighters.

1409 Board #190 MAY 30 11:00 AM - 12:30 PM
The Beneficial Effects Of Walking Following Repeated Bouts Of Sustained Static Postures
François Taillefer, Jean P. Boucher, FACSM, M Zunno, R Savard, A.S. Comtois. University of Quebec in Montreal, Montreal, QC, Canada.

No relationships reported

PURPOSE: We have shown that 20 min of various sit, sit-stand and stand static postures interspersed by 5 min walking periods was beneficial for lower limb muscle blood flow and oxygenation (Taillefer et al., 2011). However, the physiological impact of walking on the lower limbs following static postures remains to be shown, especially in individuals confronted with varicose veins. Thus, the present study measured the physiological effects of a 5’ walk following repeated bouts of 20’ static periods.

METHODS: Two groups (n = 10 per group) of women (without varicose veins, C0 and with varicose veins, C2) were studied during the maintenance of 6 twenty minute periods of different static postures all interspersed by 5 min walking periods: blood perfusion (foot), transcutaneous partial pressure (TeP) of O2 and CO2 (foot), cutaneous temperature (Cl, medial malleolar), EMG of the gastrocnemius muscle, VO2 and heart rate (HR).

RESULTS: Physiological variables were pooled since no significant differences were observed between both groups (C0 vs C2). The variables were significantly (p≤0.05) modified during walking when compared to the static postures (blood perfusion, 120.0 ± 35.31 vs 5.7± 1.79 perfusion units; TcPO2, 75.7 ± 19.56 vs 59.4 ± 16.77 mmHg; TcCO2, 27.48 ± 5.83 vs 33.1 ± 5.82 mmHg; Cl, 28.4 ± 1.60 vs 27.8 ± 3.14; EMG, 23.4 ± 9.50 vs 23.1 ± 2.50 mV; VO2, 629.9 ± 195.50 vs 219.9 ± 40.10 ml·min-1; HR, 84.7 ± 10.40 vs 72.5 ± 10.60 b·min-1, respectively).

CONCLUSIONS: The varicose vein group (C2) responded very similarly to the non varicose vein group (C0) during walking. These results indicate the importance of walking to maintain lower limb oxygenation to possibly minimize the cascade of physiological events leading to the appearance of varicose veins, especially when these individuals have to maintain prolonged static postures.

1410 Board #191 MAY 30 11:00 AM - 12:30 PM
The Effect of Pre-cooling on Cardiovascular and Metabolic Strain During Incremental Exercise
Eric M. Hultquist1, Logan Arena1, Welsey K. Lefferts1, Thomas W. Storer2, Christopher B. Cooper, FACSM2, Patricia C. Fehling, FACSM3, Denise L. Smith, FACSM1, 1Skidmore College, Saratoga Springs, NY, 2UCLA, Los Angeles, CA.

No relationships reported

Pre-cooling has been shown to improve endurance performance and to lessen heart rate (HR) for a given level of work. However, the effect of pre-cooling on the relationship between HR and oxygen uptake (VO2) has not been well studied.

PURPOSE: To investigate the relationship between cardiovascular and metabolic responses during maximal exercise performed at either normal or depressed core temperature (Ta). Methods: Ten men (age 21 ± 1 yr; VO2max, 60.2 ± 6.9 ml·kg-1·min-1) performed a maximal treadmill test following two conditions: (a) control (CON), in which participants rested in a thermoneutral laboratory (21.6 ± 4.8 °C), and (b) pre-cooling (PC), during which participants were submerged up to their armpits in 23.1 ± 0.2 °C water for 24 min. The chronotropic index (CI) was derived from the slope of the regression line between HR and VO2. A repeated measures ANOVA was employed to examine differences in Ta, HR, and VO2 and the CI. Significance was set at p≤0.05.

RESULTS: Prior to the onset of exercise Ta, was significantly lower for PC (36.69 ± 0.32 °C) compared to CON (37.12 ± 0.39 °C; P < 0.05). Time to fatigue was significantly longer in the CON (914 ± 97 s) compared to the PC condition (889 ± 97 s). Ta during exercise remained consistently lower for PC compared to CON (P < 0.05). Furthermore, there was a significant condition x time interaction for Ta, between conditions (P < 0.05). VO2 was not significantly different between conditions. PC resulted in an 8-10 b·min-1 lower HR than the CON condition at any given time point during the exercise protocol and at peak (PC, 178 ± 9 b·min-1; CON, 188 ± 6 b·min-1). The CI did not differ between conditions; however, the y-intercept was significantly lower for PC compared to CON (PC, 53.6 ± 11.0; CON, 67.3 ± 11.0).

CONCLUSIONS: Reductions in Ta significantly reduced cardiovascular strain (HR) at any given workload and decreased time to fatigue. However, pre-cooling did not change VO2 or alter the relationship between HR and VO2 (CI). Although there was no change in the CI, pre-cooling decreased the HR response, shifting the regression line down. These results suggest potential use of pre-cooling to mitigate cardiovascular strain in firefighters.

Supported by contract from DHS Science and Technology (UCLA contractor).

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1411  Board #192  MAY 30  11:00 AM - 12:30 PM  
Cardiovascular and Metabolic Responses During Maximal Incremental Exercise in Firefighter’s Personal Protective Equipment  
Wesley K. Lefferts, Eric M. Hultquist, David A. Barry, Thomas W. Storer, Christopher B. Cooper, FACSM, Patricia C. Fehling, FACSM, Denise L. Smith, FACSM, Skidmore College, Saratoga Springs, NY. UCLA, Los Angeles, CA.  
(No relationships reported)  
Personal protective equipment (PPE) is worn by firefighters to protect them from work related hazards. Work in PPE increases the metabolic cost of a given work load. Due to added weight, restrictive properties and the circulatory properties of full encapsulation, working in PPE may affect the relationship between heart rate (HR) and oxygen uptake (VO2) as expressed as the chronotropic index (CI) (slope of the regression line for HR vs. VO2); however, the extent to which the physiological stress imposed by PPE impacts the CI is unknown.

PURPOSE: To investigate the effects of PPE on cardiovascular and metabolic responses during incremental exercise and to determine if PPE affects the CI.

METHODS: HR and VO2 were measured in 10 male participants (age, 21 ± 2 yr; height, 178 ± 8 cm; weight, 76.2 ± 3.1 kg; VO2max, 51.9 ± 5.0 mL kg-1 min-1) when performing graded exercise tests across 3 conditions: control (CON; wearing athletic attire), wearing PPE and PPE and weighted vest (WV) (weight equal to PPE).

RESULTS: Time to exhaustion was significantly different across all 3 conditions (CON, 866 ± 121 s; PPE, 582 ± 92 s; WV, 671 ± 105 s; (P < 0.01). Over time, submaximal VO2 and HR were significantly lower in the CON condition (P < 0.01) compared to the PPE and WV conditions, which were similar to each other. Peak HR was significantly higher in the CON (191 ± 11 min-1) condition compared to the WV (187 ± 10 min-1) and PPE (183 ± 9 min-1) conditions (P < 0.01). There was a tendency for peak HR in the PPE condition to be lower than the WV condition (P = 0.07). VO2max was significantly different among all 3 conditions (P < 0.01). VO2max was 9.4% higher in the CON (3.96 ± 0.51 min-1) condition compared to the PPE (3.62 ± 0.41 min-1) condition (P < 0.01). VO2max was 4.8% higher in the CON condition compared to the WV (3.78 ± 0.41 min-1) condition; however, this was not statistically significant (P = 0.07). The CI (CON, 31.8 ± 4.4; PPE, 31.7 ± 5.4; WV, 32.6 ± 4.6) and y-intercept (CON, 72.1 ± 20.7; PPE, 74.6 ± 23.8; WV, 72.0 ± 18.8) were similar across all conditions.

CONCLUSION: The present study has shown that increasing the physiological strain with PPE or equivalent weight increases HR and VO2; however, the tight linear relationship between HR and VO2 (CI) remains unaffected. Supported by contract from DHS Science and Technology (UCLA contractor).

1412  Board #193  MAY 30  11:00 AM - 12:30 PM  
The Relationship Between BMI And A Graded Maximal CPR Compression Test  
Patrick W. Davidson, Christopher C. Dunbar, FACSM, Robert Curran, Paul F. Martinowicz, Springield College, Springfield, MA. Brooklyn College, Brooklyn, NY. Brooklyn College, Brooklyn College, NY.  
(No relationships reported)  
PURPOSE: To determine if there was a relationship between subject BMI and VO2peak during an Incremental Work Test using a CPR simulator (IWT).

METHODS: Eleven male subjects (age: 23 ±4/-4 yr; body mass: 81.06 +/- 11.40 kg; BMI: 25.86 +/- 3.03 kg/m2) underwent the following conditions: 1) Incremental Work Test (IWT): using a CPR simulator where the cadence of CPR compressions increased every 30 sec to volitional fatigue 2) Treadmill VO2max (TM): incremental oxygen consumption (VO2) test using the Bruce Protocol. During all conditions VO2 and Heart Rate (HR) were measured using a Parvo-Medics True One 2400 Metabolic Measurement System (Sandy, Utah).

RESULTS: The VO2peak measured during maximal graded treadmill testing using the Bruce Protocol averaged 38.13 mL/kg/min +/- 5.98. The VO2peak measured during maximal graded CPR compression testing averaged 14.76 mL/kg/min +/- 3.46. There was no relationship found between subject BMI and TM; however, a significant (p < .05) inverse relationship was found between subject BMI and IWT.

CONCLUSION: A significant inverse relationship was found between BMI and IWT. The results indicate that the larger an individual is relative to height, the poorer the performance during repeated CPR compressions irrespective of cardiorespiratory fitness as measured by treadmill exercise.

1413  Board #194  MAY 30  11:00 AM - 12:30 PM  
Changes in Physical Fitness and Anthropometry of Police Academy Cadets During a 16-Week Physical Training Program  
Ross A. Sherman, Amy A. Crawley, William R. Crawley, William J. Burgess, III, Grand Valley State University, Allendale, MI. (Sponsor: Jeffrey A. Potteiger, FACSM)  
(No relationships reported)  
Law-enforcement organizations require their employees to attain and maintain a threshold level of physical fitness so they are ‘fit to work’. As part of a college-run police academy, cadets undertake a structured 16-week physical training program.

PURPOSE: To describe changes in physical fitness and anthropometry of academy cadets after performing their 16-week physical training program.

METHODS: 15 cadets (24±5 yrs, 180±30.8 m), thirteen males and two females, were tested in Wk 1, 8, and 16 of their 3-day per wk police academy training program. A battery of tests was used to assess physical fitness (flexibility, vertical jump, grip strength, sprint speed, and agility) and anthropometrical characteristics (body mass and body fat) and . Time-related changes in each test are shown as mean difference and 95% confidence interval (CI).

RESULTS: Only 40-yd sprint time substantially improved during the 16-wk program; specifically between Wk 1 and Wk 8 (-0.45 [-0.78 to -0.12] s). However, flexibility was found to marginally decrease during the 16-wk program (Wk 1-16: -5.4 [-10.9 to 0.1] cm). The remaining markers of physical fitness did not change (see Table 1).

Table 1. Mean differences (95% CI) in police cadet physical fitness during a 16-wk academy.  
<table>
<thead>
<tr>
<th>Test</th>
<th>Wk 1-8</th>
<th>Wk 8-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>T test run time (s)</td>
<td>-0.18 (-0.93 to 0.58)</td>
<td>-0.21 (-0.98 to 0.56)</td>
</tr>
<tr>
<td>1-rep max bench press (kg)</td>
<td>7.8 (+17.9 to 35.2)</td>
<td>3.2 (-30.1 to 23.8)</td>
</tr>
<tr>
<td>Left hand grip strength (kg)</td>
<td>8.2 (+0.4 to 16.8)</td>
<td>3.2 (-11.8 to 5.4)</td>
</tr>
<tr>
<td>Right hand grip strength (kg)</td>
<td>7.5 (+1.1 to 16.2)</td>
<td>-5.2 (-13.9 to 3.4)</td>
</tr>
<tr>
<td>Vertical jump (cm)</td>
<td>1.0 (+0.6 to 2.4)</td>
<td>-2.1 (-5.0 to 0.9)</td>
</tr>
</tbody>
</table>

Neither body mass (Wk 1-16: -1.9 [-15.0 to 11.1] kg) nor body fat (Wk 1-16: -0.6 [-4.6 to 3.3]%)] changed during the course of the 16-wk training program.

CONCLUSION: The 16-wk physical training program currently used had little or no impact on pre-academy physical fitness or anthropometric characteristics. Only 40-yd sprint performance improving during the first eight week block, and there were no improvements in any test during the second eight week block.

1414  Board #195  MAY 30  11:00 AM - 12:30 PM  
Wildland Firefighters Demonstrate Seasonal Acclimatization to the Heat Despite No Changes in Aerobic Fitness  
Brianna Lui, Walter S. Hailes, John S. Cuddy, Brent C. Ruby, FACSM, Montana Center for Work Physiology and Exercise Metabolism, The University of Montana, Missoula, MT.  
(No relationships reported)  
Wildland fire suppression involves long hours of strenuous work across rugged terrain with frequent exposure to high ambient temperatures. These physical demands of the job, coupled with the environmental conditions, increase the probability of heat related injury (HRI). Although heat acclimatization may mitigate the risk of HRI, the degree to which wildland firefighter’s (WLF) demonstrate seasonal acclimatization is unknown.

PURPOSE: To determine the physiological changes associated with heat acclimatization across the 4-month fire season in the western United States.

MAY 30  11:00 AM - 12:30 PM  
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PURPOSE: To determine the physiological changes associated with heat acclimatization across the 4-month fire season in the western United States.
RESULTS: VO2max did not change for the WLFF across the season. In contrast, non-WLFF demonstrated a significant increased in VO2 max (55.9 ± 7.8 ml/kg/min vs. 58.7 ± 8.6 ml/kg/min pre and post season, respectively, p<0.05). Neither group demonstrated significant seasonal differences in the heart rate response to the heat stress trials. In contrast, WLFF demonstrated a significant seasonal reduction in core temperature during the heat stress trials at 45-min (38.1 ± 0.3°C vs. 38.2 ± 0.30°C, p<0.032) and 60-min (38.2 ± 0.39°C vs. 38.5 ± 0.34°C, p=0.022). WLFF PSI also demonstrated a significant seasonal decrease from 5.84 ± 1.3 to 5.13 ± 1.2 (p<0.05, main effect of season). There were no differences in core temperature or PSI for the non-WLFF.

CONCLUSIONS: WLFF demonstrate significant changes in seasonal acclimatization to exercising in the heat independent of changes in aerobic capacity. This suggests that long-term exposure to the environment strongly drives adaptation to hot environments.
CONCLUSION: Change in IMAT was the body composition parameter most strongly related to change in function. Interventions that target IMAT in older adults may be of particular importance for improving function.

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1418  Board #199  MAY 30  9:30 AM - 11:00 AM
Association Between Sociodemographic, Neighborhood Environment And Domain Of Physical Activity Among Middle-aged And Elderly Japanese.
Yoshinobu Saito,1 Yuko Oguma,2 Shigeru Inoue,2 Ayumi Tanaka2, Yoshihata Kobra1.1 Fujisawa City Health and Medical Center, Fujisawa, Kanagawa, Japan. 2Keio University, Tokyo, Japan. 3Tokyo Medical University, Shinjuku, Japan. 4Fujisawa City Health and Medical Center, Fujisawa, Japan. (No relationships reported)

Recent studies suggested the importance of neighborhood environment as physical activity determinants. However, few studies have been investigated in Japan.

PURPOSE: To examine the association of moderate-to-vigorous intensity leisure-time physical activity (LTPA), walking for recreation, walking for transportation with sociodemographic/health and neighborhood environmental factors among community dwelling middle-aged and elderly Japanese.

METHODS: The study included 2,449 adults aged 40-69 years living in Fujisawa city, located at 40km southwest of Tokyo, who had taken the Specific Health Checkups in 2009 and responded to the additional survey by mail in 2010. Sociodemographic/health factors (gender, age, education, working, economic, children in household, self-rated health, orthopedic disorders, body mass index), the long version of International Physical Activity Questionnaire and its Environmental Module were obtained. The adjusted odds ratios (OR) of high levels of LTPA, walking for active transportation/recreation were calculated in relation to these sociodemographic/health and neighborhood environmental factors using multiple logistic regression models.

RESULTS: Higher age and good self-rated health were significantly associated with high level of each physical activity outcome (p<0.05). Having work (OR=0.74), presence of children in household (OR=0.65), higher educational attainment (OR=1.58), higher economic status (OR=1.38), good access to recreational facilities (OR=1.26), and not owning household motor vehicles (OR=0.65) were associated with longer LTPA time. Women (OR=0.68), having work (OR=0.52), presence of children in household (OR=0.62), not having strong pain by orthopedic disorders (OR=1.58), seeing people being active (OR=1.41), and good aesthetics (OR=1.37) were associated with longer walking time for recreation. Higher economic status (OR=0.81), not owning household motor vehicles (OR=2.18), good access to shops (OR=1.35), and presence of sidewalks (OR=1.24) were associated with longer walking time for transportation.

CONCLUSION: The results suggest that different individual and neighborhood environmental variables are associated with different physical activity outcomes among community-dwelling middle-aged and elderly Japanese.

1419  Board #200  MAY 30  9:30 AM - 11:00 AM
Assessment of a Physical Activity Program in Low-Income Seniors Living in Independent Community Residences
Leticia Malavasi, Cathy Inouye. California State University, East Bay, Hayward, CA. (Sponsor: Calvin Caplan, FACS)

The Nutrition and Fitness program offered through the Senior Support Program of the Tri-Valley provides on-site free of charge physical activity classes for low-income seniors living in community residences. Their primary goal is to improve the quality of life in part by helping participants maintain their independence, of which fitness is a pivotal component. The following analysis of senior fitness assessments was conducted on data gathered from five community sites over a 9-18 month time period. Based on those findings, recommendations for programmatic changes will be implemented with oversight from the investigators and following the securement of grant funding.

PURPOSE: To analyze the effect of an on-site physical activity program for independent-living seniors and implement subsequent programmatic changes.

METHODS: Forty-two female (75±4.4 years) and 9 male (81±4 years) participants attended two 60-minute exercise classes per week. Classes were led by 3 different instructors and followed a program template that included a 5-10 min warm-up, 20-30 min aerobic, strength, and balance exercises, 5-10 min cool-down, and 5 min relaxation session. Pre to post-fitness assessments of balance, strength, muscular endurance, agility, and flexibility were analyzed using dependent t-tests. Post-test scores between sites was analyzed using independent t-tests.

RESULTS: Pre to post-strength (biceps curls/30 sec, 16.7±4.9 vs. 19.8±5.1 repetitions, p<0.05) and agility (8' Up & Go, 7.3±2.2 vs. 7.8±2.6 seconds, p=0.05) increased when data was combined for all sites. Comparison of post-strength scores between one versus multi-instructor site was also significant (22.6±5.8 vs. 18.8±6.6 repetitions, p=0.02)

CONCLUSION: The lack of change in several fitness parameters and on-site observation of individual classes has led to a number of programmatic recommendations including standardization of instruction, implementation of balance courses, incorporation of activities that utilize large muscle groups, and closer monitoring of exercise intensity.

1420  Board #201  MAY 30  9:30 AM - 11:00 AM
Habitual Physical Activity Is Associated With Cognitive Function And The Risk Factors For Hip Fracture In Older Adults
Hyuntae Park,1 Youchan Kwon2, Eunhee Kim2, Jinkee Park2, Sangkab Park2.1 National Center for Geriatrics and Gerontology, Aichi, Japan. 2Dong-A University, Busan, Korea, Republic of.

Regular physical activity is an important component of a healthy lifestyle; conferring many physical health benefits, including protection against, osteoporosis, sarcopenia and cognitive impairment. However, only a few study has reported actual daily physical activity levels in relation to the reduction of cognitive function and risk factors of hip fracture.

PURPOSE: In this prospective study, we examined the association between baseline physical activity and cognitive decline and risk factor for hip fracture in order adults.

METHODS: Using the KMMSE, we tested the cognitive function, and participants reported all previous hip fracture with circumstances leading to fracture between baseline and 2 year follow-up. Using an electronic accelerometer calculated total number of steps during a month. Body sway was measured by using the Dynamic Posturography (AMTI OR-6-7-2000, Massachusetts, U.S.A.). Each subject performed 10 m maximal walk speed, maximal step length, one-legged-stand, 40cm step up and down test, and functional reach and trunk flexion tests.

RESULTS: The risk of cognitive decline in the lowest two quartiles (lowest and low activity group, with respectively means of counts of about 3400 and 6800 steps/day) was 1.6-2.6 times higher than in the top quartile (highest group, taking means of about >10000 steps/day). We founded significant lineal associations between physical activity levels and the gait velocity. Compared with a lowest and low activity group, older adults reporting a high activity group (> 7000 steps/day) had a significantly lower risk of hip fractures such as a lateral body sway, functional reach and maximal step length.

CONCLUSIONS: In this study, we suggest that to improve cognitive decline and the risks of hip fracture older adults should be encouraged to undertake > 7000 steps/day.

1421  Board #202  MAY 30  9:30 AM - 11:00 AM
Evaluating Moderate Intensity Walking With A Hip-worn Accelerometer In Elders
Todd Manini, Jeff Knaggs. University of Florida, Gainesville, FL

PURPOSE: The National Health and Nutrition Examination Survey (NHANES) uses activity counts from accelerometers to objectively categorize the population’s physical activity level. It is unclear activity counts correspond to metabolic effort in older adults. This study set out to examine the association between activity counts derived from a hip-worn accelerometer and metabolic effort in older adults performing usual and rapid paced walking.

METHODS: Forty-five community-dwelling older adults (70-90 years) performed long-distance walking tasks at a self-selected usual and rapid pace in a laboratory setting. During each walking test, participants wore a portable metabolic unit to measure pulmonary gas exchange and a hip-worn accelerometer (Actigraph GT3M) to measure activity counts. Metabolic equivalents (MET) were calculated as ventilation of oxygen (VO2) / 3.5 mNkg-1•min-1. Values that surpassed 3.0 METs and 2020 counts/min were considered walking at or greater than moderate intensity. Participants were categorized as a “slow walker” if they had a usual pace < 1.0 meters/sec, a common cutoff used to designate an older person with functional impairments.

RESULTS: Activity counts recorded while walking at rapid (r = 0.62, p < 0.01), but not usual pace (r = 0.24, p = 0.11) was significantly associated with METs. Slow walkers attained only half the amount of activity counts during each walk condition (usual: 1125 ± 132 vs. 2242 ± 121; rapid: 1534 ± 214 vs. 3117 ± 219 counts/min, p < 0.01) while at the same time achieving between 82-323
Along with sarcopenia, obesity is an important cause of the development of functional impairment and frailty in older adults. Physical inactivity or low physical activity (PA) has been reported to be independently associated with sarcopenia and obesity. However, little is known about the impact of PA patterns on body composition phenotypes based on sarcopenia and obesity in older adults.

**PURPOSE:** This study examined the association between objectively measured PA patterns and body composition phenotypes based on sarcopenia and obesity in frail older women.

**METHODS:** A cross-sectional analysis was conducted on 109 community-dwelling frail older women with a mean age of 80.3 years (SD = 2.7, range = 75-88). Measurements of appendicular skeletal muscle mass and body fat percentage were assessed by dual-energy X-ray absorptiometry, which were used to characterize normal (N), sarcopenic (S), obese (O), and sarcopenic/obese (SO) body composition phenotypes. The objective assessment of physical activity was obtained for a 1-week period using a triaxial accelerometer (Activity Style pro). With intensity as sedentary (1.0-1.5 metabolic equivalent units, METs), light PA (1.6-2.9 METs), and moderate to vigorous PA (MVPA, ≥ 3 METs), average daily time spent being each PA was examined.

**RESULTS:** The O group was the most prevalent 36.7% in frail older women, followed by the S (29.4%), N (22.0%), and SO (11.9%) groups. On average, participants wore the accelerometer for 766.3 ± 102.8 min/day. Overall, participants spent 57.6% of their daily time being sedentary behavior, 39.7% in light PA, and 2.7% in MVPA. The time spent in sedentary behavior was significantly more in the O and SO groups than the normal group (p < 0.05). Time spent in light PA was similar between the O (292.7 ± 91.8 min/day) and SO (243.6 ± 88.1 min/day) groups but significantly less than the N (357.5 ± 97.1 min/day) group (p < 0.05), but not the S group. There was no difference in time spent in MVPA among body composition phenotypes.

**CONCLUSIONS:** These findings suggest that majority of daily time in frail older women spend being sedentary lifestyle, and obesity phenotypes are more strongly related to the light PA level, independent of sarcopenia.
and patients with cardiovascular disease. Although readily available from cardiopulmonary exercise testing, the O₂ Pmax depends on maximal volitional effort which may limit its measurement in older subjects with physical limitations.

PURPOSE: The aim of this study was to develop a model to estimate the maximal O₂ pulse without exercise in elderly subjects.

METHODS: The equation was derived from a sample of 67 older adults (69.4 ± 7.1 yrs; 41 men) through a hierarchical linear regression that included body weight, Veterans Specific Activity Questionnaire (VSAQ) score, gender, beta-blocker use and resting heart rate. The model was cross-validated against an independent sample (67.7 ± 6.4 years; N=30; 17 men). In order to detect the classification accuracy of the model, the estimated and actual O₂ Pmax were ranked in tertiles and treated by the gama (γ) nonparametric correlation in both groups (validation and cross-validation).

RESULTS: The model resulted in a R²=0.83 and standard error of estimate=1.68m/min. The comparison of the estimated against the actual O₂ Pmax in the independent sample was r=0.80. A high probability for the model to rank the values in the same tertile in both validation and cross-validation groups was observed (r=0.98; p=0.92, respectively).

CONCLUSION: Our findings suggest that O₂ Pmax can be estimated with reasonable precision without aerobic effort, being an alternative option for older subjects not able to perform maximal exercise testing.

Commercial Relationship: Paolo T.V. Farinatti, CNPq Research Grant Recipient.

1426 Board #207 MAY 30 9:30 AM - 11:00 AM
Group Pilates Program And Muscular Strength And Endurance Among Elderly Woman
Ina Shaw1, Marina Fourie2, Gertrude M. Gildenhuys2, Brandon S. Shaw2, Gregory A. Brown, FACSM1. 1Monash South Africa, Johannesburg, South Africa. 2Tshwane University of Technology, Pretoria, South Africa. 1University of Nebraska at Kearney, Kearney, NE. (No relationships reported)

Muscular strength and peak power output substantially decline with age and can lead to impairments in neuromuscular function, degradation of the hormonal system and intrinsic factors such as age-related alterations in calcium homeostasis.

PURPOSE: The purpose was to determine the effects of mat Pilates on muscular strength using dumbbell bicep curls and squats, and muscular endurance using chair squats in elderly woman.

METHODS: Fifty sedentary, apparently healthy females aged 60 and older were randomly assigned into a control (CON, n = 25) or an intervention (INT, n = 25) group. The INT took part in an eight-week supervised progressive Pilates exercise program with sessions being conducted by a qualified Pilates instructor. The programme consisted of three non-consecutive 60 minute sessions that were repeated for the eight-week period only increasing in intensity. All sessions commenced with breathing, followed by a flowing system from standing, to sitting, to lying down exercises and ended in the rest period. The CON did not take part in any structured exercises throughout the eight-week period and were instructed to continue their usual activities.

RESULTS: Significant (p ≤ 0.05) improvements in upper-body muscular strength (19.12 ± 5.13 repetitions (reps) - 27.84 ± 5.68 reps; p = 0.000), lower-body muscular strength (13.24 ± 3.23 reps - 7.52 ± 3.81 reps; p = 0.000) and muscular endurance (24.48 ± 11.62 reps to 44.6 ± 18.97 reps; p = 0.000) were observed following Pilates training.

CONCLUSIONS: Programs utilizing Pilates can improve muscular strength and endurance in the elderly and may assist in decreasing dependency and possibly lead to an improved quality of life in the elderly.

1427 Board #208 MAY 30 9:30 AM - 11:00 AM
Past Year Leisure Moderate to Vigorous Physical Activity is Associated with Calcaneal Bone Density and Stiffness in Perimenopausal and Postmenopausal Women
Heather C. Medema-Johnson1, Kathleen F. Janz, FACSM. 1St. Ambrose University, Davenport, IA. 2University of Iowa, Iowa City, IA. (No relationships reported)

Along with calcium intake, weight-bearing moderate to vigorous physical activity (MVPA) has been shown to decrease the rate of bone loss in peri- and postmenopausal women. However, the importance of domain- and time-specific characteristics of MVPA to bone remains unclear.

METHODS: For this cross-sectional study, 87 peri- and postmenopausal women (43-65 years) completed demographic/health questionnaires and the Block calcium and vitamin D screener. Participants wore a NL-1000 pedometer for one week to assess short-term MVPA (total steps/day and MVPA -min/day). Past year MVPA, past year leisure MVPA, past year occupational/household MVPA, past week leisure MVPA, and past week occupational/household MVPA were assessed with the Modifiable Activity Questionnaire. Calcaneal BMD and QUI were measured with a Sahara Quantitative Ultrasound (Hologic, Inc.). Pearson correlation coefficients and stepwise linear regression analyses were used to examine the relationships among measures of MVPA, calcium and vitamin D intakes, calcaneal BMD and stiffness (QUI).

RESULTS: Bivariate analyses revealed significant relationships between BMD and pedometer-measured MVPA-min/day (r = 0.23, p < 0.05). Past year MVPA (r = 0.25, p < 0.05), and past year leisure MVPA (r = 0.35, p < 0.01) measured via survey were associated with BMD. Significant relationships were found between QUI and past year MVPA (r = 0.23, p < 0.05) and past year leisure MVPA (r = 0.34, p < 0.01). For stepwise linear regression analyses, income, education, and past year leisure MVPA entered the models, collectively explaining 19% and 18% of the variance in BMD and QUI.

CONCLUSION: Past year MVPA performed in the leisure domain is associated with calcaneal BMD and QUI in peri- and postmenopausal women. Our results suggest the value of long-term measures of PA when considering bone health and the likelihood that women engage in more osteogenic activity during leisure when compared to other domains. These findings can be used to support future interventions and the continued need for multi-dimensional PA measures.

1428 Board #209 MAY 30 9:30 AM - 11:00 AM
Lumbar Lordosis Angle Predicts Walking Ability In Community-dwelling Elderly Men
Junya Miyazaki1, Shin Murata1, Jun Horie1, Tibor Hortobagyi, FACSM2, Shuji Suzuki3. 1Kobe International University, Kobe, Japan. 2Nishikyushu University, Kitakyushu, Japan. 3Kobe University of Gröningen, Groningen, Netherlands. 4Waseda University, Tokorozawa, Japan. (No relationships reported)

PURPOSE: Aging modifies the sagittal plane structural alignment of the human spine as measured with the gravity line method (Schwab F et al., 2006). At the 2010 ACSM meeting we reported that the physical function of elderly males correlated with the lumbar lordosis angle (LLA) but not with the thoracic kyphosis angle (TKA) measured in the sagittal plane. Here we examine the possibility that a structural measure of the spine, the LLA, predicts gait speed and distance in old adults.

METHODS: Subjects were 103 elderly male community residents (72.9 ± 7.2 yr, 1.59 ± 0.15m, 59.4 ± 8.7 kg). To characterize sagittal plane spinal alignment, we measured LLA in all participants using the Spinal Mouse (Idiag AG, Switzerland). The LLA (deg) was measured as the sum of the angles between each of the five lumbar vertebral bodies relative to the 1st sacral vertebral body. We also measured quadriceps femoris muscle strength (QMF) with a hand-held dynamometer (Anima Corp., Japan), one-leg standing (OLS) time with eyes open, maximum walking speed (MWS), and distance in the 6-min walking test (6MWT). In regression analyses we predicted MWS and 6MWT from LLA, QMS and OLS and used p < 0.05 for all analyses.

RESULTS: Mean (± SD) LLA was -13.1° (± 9.3). Mean QMF, OLS time, MWS, and 6MWT distance was, respectively, 39.9 kg (± 11.6), 34.1 s (± 36.8), 2.6 m/s (± 1.0), and 477.4 m (± 90.2). The regression analysis showed that LLA (p < 0.01, β = 0.43) and QMF (p < 0.01, β = 0.46) predicted strongly MWS. QMF (p = 0.01, β = 0.63) was also a strong predictor of walking distance.

CONCLUSION: Gait speed predicts mortality (Studenski et al., 2011) and here we show that not only a functional (muscle strength) but a structural factor (LLA) may also play a role in the regulation of gait in old age. Thus, interventions should target muscle strength and postural alignment to be most effective in preserving gait speed in old adults.
Effects of Fall Prevention PNF Program on Body Function and Fall Efficacy in Elderly Women

Seokhwan Kim1, Michael G. Bember, FACSM2, Daeyeol Kim1, Donghee Kim1, Youngkwon Kim1, Huyan Lee1, Doohong Kuk1, Meemyun Yang1, Gieun Jang1,
1Seoyeong University, Gwangju, Korea, Republic of.
2University of Oklahoma, Oklahoma, OK.

Methods: Subjects (n = 38, 65 - 70 years) participated this study were randomly assigned to an experimental (n = 18, EXP) or a control (n = 20, CON) group. The subjects in both EXP and CON performed the fall prevention training three times at pre, 6th and 12th week. Only subjects in the EXP completed PNF squat & skate program (40 - 60 min, 60 - 80% HRmax; three times per week for 12 weeks. The body function (Time up & go test, 2 min step test, balance by Tetrax and Berg balance scale, sit to stand test, one leg standing test, and instrumental activities of daily living) and fall efficacy (fall efficacy scale) were determined at pre, 6th and 12th week. Two-way repeated measure ANOVA was utilized to compare groups and times with statistical significance set at p<0.05.

Results: The Gait, balance, lower extremity power functions in the EXP were significantly higher than CON. The balance function in the EXP was significantly higher than CON. Also, Instrumental activities of daily and fall efficacy in the EXP were significantly greater than CON.

Conclusions: These results indicate that the fall prevention program with PNF was effective to prevent fall and to increase fall efficacy. Thus, the fall prevention program with PNF is considered to be helpful to prevent fall and the quality of life for elderly people by strengthening their body functions and fall efficacy.

Increased Sitting Time is an Independent Risk Factor for All-cause Mortality in Community-Dwelling Older Adults

Steven N. Blair, FACSM1, Xuemei Sui1, Ali Ahmed1, 2University of South Carolina, Columbia, SC.
2University of Alabama at Birmingham, Birmingham, AL.

Methods: Participants were 5060 community-dwelling older adults from the Cardiovascular Health Study. Age ≥65 years, with data on baseline history of hours spent sitting or lying. Participants were categorized into tertiles of hours per day spent sitting or lying: <11, 11-13, and ≥14 (reference). Cox regression models were used to estimate association of the 2 lower tertiles with all-cause mortality adjusting for other confounders. To study association with incident heart failure, a second cohort of 4833 participants free of prevalent heart failure at baseline was assembled.

Results: Participants had a mean (±SD) age of 73 (±6) years; 58% were women; and 16% were African American. Unadjusted, age-sex-race-adjusted, and multivariable-adjusted associations of the 2 lower tertiles of hours spent sitting or lying with all-cause mortality and incident HF during over 13 years of follow-up are displayed in the Table below.

Conclusions: Among community-dwelling older adults, those spending <14 hours sitting and lying, had lower risk of all-cause mortality but had no significant independent association with incident HF after multivariable adjustment for confounders.

Development and Evaluation of a Health Empowerment Program to Improve Depression and Meaning in Life

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1Dow Rummel Village, Sioux Falls, SD.
2South Dakota State University, Brookings, SD.
(Sponsor: Matthew D. Vukovich, FACSM)

Methods: Residents and selected staff at a residential living community partnered with researchers in exercise science and healthcare to develop and implement Project MILE. A random sample of 20 older adult residents (16 female, 4 male), mean age of 86.7 years, participated in this pilot study. Needs assessment, conducted through structured interviews between residents and exercise science students, was used to inform Project MILE activities. A descriptive-correlational study was used to evaluate reliability of measurement instruments and to determine cross-sectional relationships between multi-item measures of depression (Geriatric Depression Scale (GDS)) and meaning in life (Personal Meaning Index (PMI)). A paired samples t-test was used to compare baseline and follow up scores in these measures. Feasibility and acceptability of the intervention was evaluated through written/oral review of strengths, weaknesses, and suggestions by and with residents.

Results: Needs analysis identified themes that contribute to meaning and quality of life: learning new skills, volunteering, meaningful social engagement, and aesthetic experiences. Participants selected and planned weekly activities (e.g., computer class, reading to children, Mexican Day, cycling, going fishing) based on identified themes. GDS and PMI met acceptability criteria for reliability (η > .70) and construct validity. Baseline scores (mean ± SD) for GDS and PMI (6.8 ± 5.4, 86.2 ± 10.3) respectively were not significantly different (p > .05) at follow up (7.7 ± 5.1, 86.2 ± 10.3). Intervention strategies (i.e., activities and measurement instruments) were found acceptable to residents.

Conclusions: Although we saw no significant change in GDS and PMI scores, evaluation of this pilot study generated evidence to support the use of this health empowerment approach in a future randomized trial.

An Examination of the Survivability of Professional Wrestlers

Christopher W. Herman1, Anna S.C. Conlon1, Andrew R. Burghardt1, Stephen J. McGregor1, 2Eastern Michigan University, Ypsilanti, MI. 
1The University of Michigan, Ann Arbor, MI.
(Sponsor: Christopher J. Womack, FACSM)

Methods: Data required for this study was collected using public records and wrestling company publications. A comprehensive review of age, race, sex, BMI, cause of death (if applicable) and age at death (if applicable) of 625 wrestlers who were active between January 1, 1985 and September 30, 2011 was completed. Specifically, 557 males and 68 females were considered consistently active wrestlers during this time period. 2007 published mortality rates from the CDC were used to compare the general population to the wrestlers by age, race, BMI, and cause of death for both males and females. Additionally, a Kaplan-Meier survival analysis and Cox Proportional Hazards Models for survival data were performed using the R statistical software package (Vienna, AT) to determine the degree of professional wrestlers’ premature death.

Results: 65 wrestlers (61 males and 4 females) died during the observation period. Wrestler mortality rates calculated for age groups 25-34, 35-44 and 45-54 were approximately 22.9, 16.5 and 7.6 times greater than the mortality rates for the same three age groups of the general population. After controlling for age at which the wrestlers started wrestling and number of years wrestled prior to 1985, survival estimates and 95% confidence limits from the Cox hazard regression models indicated that sex and BMI are significantly associated with the hazard of death.
CONCLUSION: Professional wrestlers are more likely to die prematurely compared to the general population. Morbidly obese and male wrestlers are especially at risk for premature death. Results from this study may be useful for future corporate wellness policy implementation among professional wrestling companies.

A-39 Free Communication/Poster - Pacing Strategies and Time Trials

MAY 30, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

1433 Board #214 MAY 30 11:00 AM - 12:30 PM
Accumulated RPE: A Distance Independent Marker Of Effort During Cycle Time Trials
Carl Foster, FACSM, Jose Rodriguez-Marroyo, Annabel Splinter, Joyce van Tunen, Corey Speaker, Jana Hagen, Kayla Henslin, Blair Johnson, Trent Joseph, John P. Porcari, FACSM, Jos J. de Koning, FACSM. University of Wisconsin-La Crosse, La Crosse, WI.

Methods: Well-trained and task habituated cyclists performed freely paced (FP) time trials (2.5km, n=9, 3km, n=10, 5km, n=17, 10km, n=30) on a Velotron cycle ergometer. RPE was measured every 5% of the total distance, summated and normalized to the maximum value.

Results: The % distance remaining may not be an accurate representation of the % effort expended by the athlete (e.g. the classic expression that a marathon (42km) is 50% over at 32km (~75% distance)).

Conclusions: The RPE may provide a tool for measuring the relative effort expended during competitive effort that is superior to the % distance completed, with 50% effort being completed at ~60% distance.

1434 Board #215 MAY 30 11:00 AM - 12:30 PM
The Effect of Music on Cycle Time Trial Performance
Jana Hagen, Carl Foster, FACSM, Jos J. deKoning, FACSM, Charles R. Hendrix, Richard P. Mikat, FACSM, Jose Rodriguez-Marroyo, John P. Porcari, FACSM. University of Wisconsin-La Crosse, La Crosse, WI.

Methods: Well-trained, task habituated cyclists (n=18) performed two randomly ordered time trials, listening either to self-selected motivational music or no music (control). Performance markers including PO, HR, blood lactate ([BL] & RPE) were monitored.

Results: Music had no effect on maximal HR 174±11 vs 172±10, mean PO 222±56 vs 220±65 W, maximal RPE 8.4±1.5 vs 8.5±1.6, maximal [BL] 8.2±3.6 vs 8.2±3.5 mmol*l⁻¹ or time 17.2±2.1 and 17.9±2.1 min (p>0.05). Further, the pattern of PO during the trial did not suggest a change in pacing pattern consistent with arousal related template modification (e.g. increased early PO) or suppression of feedback (e.g. higher mid-trial PO).

Conclusions: The results show that, despite the subjects preferring the time trial with music, there were no significant differences in time trial responses relative to the presence of music.

1435 Board #216 MAY 30 11:00 AM - 12:30 PM
Effects of Warm-up Duration on Vo2 Kinematics and Lactate During a Cycling Time Trial
Jennifer Bunn. Campbell University, Buies Creek, NC.

Methods: Sixteen trained cyclists (41.0 ± 7.7 years, 76.5 ± 13.5 kg, 1.75 ± 0.11 m, 50.5 ± 11.7 ml/kg/min) completed a cycling graded exercise test to measured maximum oxygen consumption (VO2max) and lactate threshold, followed by an orientation session the TT. At subsequent visits, participants completed one of three warm-up protocols, in randomized order, and the TT. The warm-up protocols included: 1) a short duration three-minute warm-up at 60% max power (SW), 2) a long duration warm-up of 10 minutes at 60% max power (LW), and 3) no warm-up (NW). All cycle testing was completed using a stationary cycle simulator and the participant provided their own bicycle, and testing sessions were completed approximately one week apart. Data were analyzed to address differences amongst type of warm-up for VO2, TT time, and lactate at the 1K split and the entire 5K.

Results: There was no difference between type of warm-up (p>0.05) for VO2 (SW: 30.1±9.0, LW: 49.5±9.4, NW: 50.6±9.0 ml/kg/min), post-TT lactate levels (SW: 9.0±2.9, LW: 7.9±3.2, NW: 8.0±3.2 mmol/l), or TT completion time. There was also no difference between warm-ups (p>0.05) after completion of 1K for VO2 (SW: 41.5±7.6, LW: 46.1±10.3, NW: 37.4±5.2 ml/kg/min) or 1K split time.

Conclusions: This data conflicts current evidence that a warm-up may be beneficial during the initial phase of an endurance activity, but agrees with research that indicates no difference amongst warm-up types for the entire performance. This study limited the warm-up sessions to steady state exercise, but future research should address variations in intensity during the warm-up in addition to the duration.
Graded exercise test (GXT) results are commonly used to prescribe exercise. However, investigators have found that GXT power overestimates submaximal steady-state (SS) power.

PURPOSE: This study evaluated the physiological and performance values from a simulated 576 kJ (~20 km) time trial (TT) in comparison to the values at the respiratory compensation point (RCP) from a GXT.

METHODS: Eight (female n=1) well-trained cyclists [VO\textsubscript{2max}: 62.3±7.16 ml kg\textsuperscript{-1} min\textsuperscript{-1}, maximal power (W\textsubscript{max}): 374±54.5 W, BMI: 23.5±4.5 kg m\textsuperscript{-1}], Age: 32±8.7 years] served as volunteer participants for this investigation. Each volunteer first underwent a GXT on a cycle ergometer to exhaustion beginning at 70 W (female=50 W) and increasing at a rate of 35 W min\textsuperscript{-1} (female=25 W min\textsuperscript{-1}) to determine RCP and VO\textsubscript{2max}. On a separate day, a self-paced 576 kJ (~20 kilometer) TT was performed at an “all-out” effort, with only simulated distance revealed. A one-way ANOVA for RCP and TT variables; heart rate (HR), power, respiratory exchange ratio (RER), ventilation (Ve), and VO\textsubscript{2} (144 ± 5 K) indicated no difference between the TT and RCP (p>0.05). HR, power and VO\textsubscript{2} were significantly correlated to TT HR (r=0.92, p<0.05), power (r=0.90, p<0.05) and VO\textsubscript{2} (r=0.93, p<0.05).

RESULTS: The RCP HR, Ve and VO\textsubscript{2} from a GXT are similar to TT responses in well-trained cyclists, but RCP power and RER are overestimated compared to the TT. As expected, strong correlations were found between RCP and TT HR, power and VO\textsubscript{2}; and RCP power and VO\textsubscript{2} from this study are similar to others’ findings as a percentage of maximum (~85%). Interestingly, we found the RCP power to be much greater than TT power (67.8±23.6 W), with the difference being greater than that found between the ventilation threshold and equivalent sub-maximal SS exercise by previous investigators (45±12 W).

CONCLUSION: The RCP cannot be considered as equivalent to a well-trained cyclist’s TT power. The VO\textsubscript{2} from the RCP is at a higher intensity than the VO\textsubscript{2} from the TT.

PURPOSE: The purpose of this study was to examine the VO\textsubscript{2} plateau response during a series of VO\textsubscript{2max} trials in a group of well-trained untrained individuals who had no prior experience of completing incremental tests to exhaustion.

METHODS: Following University Institutional ethical approval, n=10 well-trained male athletes (WT) (age, 23.0 ± 3.16 yrs; height, 183.3 ± 5.5 cm; weight, 77.5 ± 11.1 kg; VO\textsubscript{2max}, 66.3 ± 5.7 ml kg\textsuperscript{-1} min\textsuperscript{-1}) and n=7 un-trained male subjects (UT) (age, 20.1 ± 0.9 yrs; height, 181.6 ± 6.2 cm; weight, 72.9 ± 10.0 kg; VO\textsubscript{2max}, 48.8 ± 5.3 ml kg\textsuperscript{-1} min\textsuperscript{-1}) volunteered and agreed to participate. The subjects completed four VO\textsubscript{2max} trials (Tr 1-4) at the same rate of day, each trial being separated by 72 hr. For each trial the subject completed a cycle-based incremental ramp starting at 100 W. After 60 s of cycling the workrate increased by 0.42 W s\textsuperscript{-1} while maintaining a constant cadence of 60 rpm (UT) and 80-90 rpm (WT). The incremental ramp test was terminated either when the cadence decreased by <10 rpm or when the subject stopped due to volitional exhaustion. Verbal encouragement was initiated after 360 s of cycling and re-introduced continuously once VE displayed a significant break from linearity. Throughout all trials, the VO\textsubscript{2} response to exercise was recorded on a breath-by-breath basis using a pre-calibrated metabolic cart. The first criterion for a plateau in VO\textsubscript{2} was determined according to a ΔVO\textsubscript{2} < 1.5 ml kg\textsuperscript{-1} min\textsuperscript{-1} over the final two consecutive 30 s sampling periods. Secondary criteria were RER ≥1.15, ARER ≥0.4, peak blood lactate ≥ 8.0 mM\textsuperscript{-1}, HR\textsubscript{max} ≥ 220-age ± 10 b min\textsuperscript{-1} and an RPE > 19.
RESULTS: In the WT group the ∆VO₂ (ml·kg⁻¹·min⁻¹) during the final two consecutive 30-s sampling periods was 2.52 ± 1.63 for Tr1, 1.68 ± 1.05 for Tr2, 1.68 ± 1.19 for Tr3 and 1.28 ± 0.87 for Tr4 (P = 0.083), there was no-significant difference across trials for UT (P = 0.699). Plateau incidence for WT was 20% Tr1, 50% Tr 2-3 and 70% Tr4, while for UT incidence it was 7% across Tr 1-4. For both WT (P = 0.295) and UT (P = 0.694) there was no-significant difference in VO₂max across Tr 1-4.

CONCLUSION: The data suggests that the incidence of plateau at VO₂max is influenced by other factors aside from anaerobic substrate metabolism. The results suggest that a form of pacing occurs in WT based on the prior knowledge and anticipation of the number of trials.

1440 Board #221 MAY 30 11:00 AM - 12:30 PM
Racing the Favourite: Effects of Competition During Laboratory Based 4,000-m Cycling Time Trials
Mark R. Stone1, Kevin Thomas2, Alan St Clair Gibson3, Michael Wilkinson1, Kevin G. Thompson2, 1Buckinghamshire New University, High Wycombe, United Kingdom. 2The University of Northumbria at Newcastle, Newcastle upon Tyne, United Kingdom. (No relationships reported)

Cyclists can achieve marginal reductions in the time taken to complete a time trial (TT) whilst racing against a simulated opponent compared with riding alone. However, in previous studies the opponent has typically mirrored the participants own previous performance. It is not known whether a simulated opponent whose exercise intensity is known to be greater than that previously achieved could ‘push’ participants to realise meaningful reductions in performance time.

PURPOSE: To assess whether trained cyclists could reduce the amount of time taken to complete a 4,000-m TT during head-to-head competition against a simulated opponent who they understood to be performing at a higher power output than their own previous performance.

METHODS: Ten trained male cyclists each performed four, 4,000-m TT with between three and seven days separating each trial. The first TT served to acclimatise participants and the second was used to form a baseline condition (BL). During TT three and four, two avatars were displayed on a video screen; one of these represented the progress of the participant and the other represented the progress of the simulated opponent. The power output of the simulated opponent was set at either 102% or 105% of the participants mean BL power output in a randomised and counter balanced order. Participants were briefed about the nature of the experiment and encouraged to try to beat their opponent. Heart rate was monitored continuously and session RPE was recorded on completion of each trial.

RESULTS: There were no significant differences between BL and either the 102% or 105% TT for time taken [(F = 1.201, p = 0.3), (359.4 ± 111, 360 ± 11.7 and 361.2 ± 12.8 s, respectively)]; mean heart rate [(F = 0.468, p = 0.6), (180 ± 15, 180 ± 13 and 179 ± 12 bpm, respectively)] or session RPE [(F = 0.536, p = 0.6), (18 ± 1, 18 ± 1 and 19 ± 1, respectively)].

CONCLUSION: The presence of a simulated opponent, known to be exercising at an intensity which was greater than participants achieved during BL, did not affect performance time or the physiological or perceptual responses during a 4,000-m TT. These findings indicate that the regulation of self paced exercise is a robust mechanism which is not readily influenced by the presence of a simulated opponent designed to ‘push’ the athlete to reduce the amount of time taken to perform a TT.
RESULTS: HOA demonstrated significantly lower ML COP velocity than the PD MAS and PD LAS groups (10.22 vs. 20.18 and 19.27 mm/sec, respectively; p = .011, p = .014). HOA also demonstrated higher RMSE values when compared to the PD LAS group but not the PD MAS group (33.49 vs. 14.62 and 22.00 mm, respectively; p = .016, p = .138). There were no significant differences between the PD MAS and PD LAS groups in any of the measures.

CONCLUSIONS: When compared to HOA, persons with PD exhibit higher ML COP velocity when the COP is displaced laterally from the COM during quiet stance. However, we did not observe an effect of leaning toward the MAS on postural control in persons with PD.

1443  Board #224  MAY 30  11:00 AM - 12:30 PM
Static And Dynamic Weight Shifting Ability In Children With Adolescence Idiopathic Scoliosis
Gozdle Gur, Songul Aksoy, Fatma Uygur, Yavuz Yakut, Hacettepe University, Ankara, Turkey.
(No relationships reported)

It is well known that postural control and balance is adversely affected in children with idiopathic scoliosis. Adequate weight shifting is an important element of postural control. Most studies have focused on the evaluation of somatosensory organisation and these studies have shown that there is an increase in lateral and sagittal and postural sway during still standing activities. We have not come across a study measuring the ability to shift weight in these children.

PURPOSE: To investigate static and dynamic weight shifting abilities of children with adolescence idiopathic scoliosis.

METHODS: Twenty six patients (17 girls 9 boys) with adolescence idiopathic scoliosis with a mean age of 14 ± 3.4 years were included in the study. The mean weight mass index of the subjects was 18.59 kg/m². The demographic characteristics of the subjects and characteristics of the scoliotic curve were recorded. The ability of the patients to bear weight in their right and left lower extremities during weight bearing squat was measured by means of “Neurocom Computerized Dynamic Posturography” at 0, 30, 60, 90 degrees of knee flexion. Also rhythmic weight shifting to the right and left, anterior and posterior directions was used to measure the centre of gravity by means of “Neurocom Computerized Dynamic Posturography”. The results were evaluated according to on-axis velocity and directional control.

RESULTS: The Cobb angle was found to be a mean of 21 degrees for thoracic curves and 24 degrees for lumbar curves. The most common curves were right thoracic left lumbar. In weight bearing squat test, no difference was found between the right and left extremities in the positions of 0, 30, 60 and 90 degrees knee flexion. During rhythmic weight shifting test, there was 30% decrease in on-axis velocity and 27% decrease in directional control ability.

CONCLUSION: While adolescence idiopathic scoliosis did not affect static weight shifting ability, there was a decrease in dynamic weight bearing ability. This result can be interpreted as an adverse effect of scoliosis.

1444  Board #225  MAY 30  11:00 AM - 12:30 PM
Increases in Energy Expenditure and Muscle Activation While Performing Clerical Work in Three Body Postures
Tibor Hortobagyi, FACSM,1 Caitlin Pearl2, Olivia Ratcliff3, Jennifer Streeter3, Patrick Rider3, Paul DeVita, FACSM2. 1University of Groningen, Groningen, Netherlands. 2East Carolina University, Greenville, NC.
(No relationships reported)

One cause for weight gain may be due to the increase in sedentary time leading to reduced energy expenditure, especially in the workplace. A preventative measure could be to perform clerical work in different postures that would increase the amount of active muscle such as sitting on a therapy ball or standing and accumulate excess energy expenditure throughout the day.

PURPOSE: We examined the hypotheses that the energy cost while performing clerical work standing or sitting on a therapy ball is higher than when sitting on a chair and this increase in energy cost is associated by an increase in muscle activation.

METHODS: Subjects (n = 10, mean age 21.2) copied printed text into a Word document under three randomized and standardized conditions: sitting on a chair, sitting on a therapy ball, and standing. EMG activation in two upper extremity muscles, four lower extremity muscles, and two trunk muscles, in addition to passive energy expenditure were recorded for 15 minutes during each condition. A basal measurement was taken while lying down for 15 minutes. Quality of typing was calculated by assessing correct word count.

RESULTS: Average VO2 was 3.70 ml/kg/min (SD ±0.23, lying) and lower (p < 0.05) than 4.40 (±0.88, chair) and both lower (p < 0.05) than 4.57 (±0.82, ball) and 4.60 (±0.58, standing). Average EMG in 8 muscles was 0.007 mV (±0.001, lying), lower (p < 0.05) than 0.022 mV (±0.006, chair), both lower (p < 0.05) than 0.034 mV (±0.009, ball) and 0.030 mV (±0.001, standing). Increase in EMG activity explained 52% of variance in increase in oxygen uptake. Average word count per minute was 48.5 (±9.7, ball), 46.5 (±12.4, chair), and 49.6 (±12.5, standing) (p > 0.05).

CONCLUSION: These preliminary data suggest that there is a parallel and correlated increase in energy expenditure and muscle activation while performing clerical work in non-standard postures.

1445  Board #226  MAY 30  11:00 AM - 12:30 PM
Balance Control During Transition From Double To Single-leg Stance In Subjects With Chronic Ankle Instability
(No relationships reported)

Subjects with CAI (chronic ankle instability) are slower in activating their leg muscles when shifting weight from double to single leg stance (DLS and SLS, Van Deun et al., 2007).

PURPOSE: Based on these results, the hypotheses tested were: (1) that in CAI the shift of the COP takes longer, (2) that this delay is associated with longer stabilization times when standing on one leg is achieved, and (3) that the largest delays in EMG onset are correlated with the lowest transfer in weight and/or greater instability in the SLS.

METHODS: 20 subjects with CAI and 20 controls were tested. A single force platform was used to monitor the anteroposterior (AP), mediolateral (ML) and vertical components of the foot-ground reaction (FGR) forces before and during a transition (TR) from DLS to SLS, either with the eyes open (EO) or closed (EC). Trajectory of the center of pressure (COP) was calculated to determine TTR (time of TR) and TTS (time to stabilization). TTR is the time from the onset of the TR until the zero crossing of ML COP velocity time series. TTS was estimated with the method of sequential estimation by taking a cumulative average of the ML COP displacement time series (Colby et al., 1999). The quasi-stable (QS) phase started at the end of TR and finished at the point of TTS. Electromyography (EMG) signals were recorded from ankle, knee and hip muscles.

RESULTS: The TTS was longer for the CAI than for controls (3.25 vs. 2.28 s in EO and 3.41 vs. 2.51 s in EC; P < 0.01). Similarly, the TTR was prolonged in CAI (1.48 vs. 1.14 s in EO and 1.53 vs. 1.20 s in EC; P < 0.05). These prolonged periods came in parallel with an increase in the ML sway in the QS period (mean displacement 2.20 vs. 1.75 cm in EO; 3.37 vs. 2.62 cm in EC; significant for EC, P < 0.01). The TTR in CAIs was positively correlated with time onset of the Adductor Longus during transitions with EC (R = 0.51, P = 0.03).

CONCLUSIONS: CAIs made slower transitions as indicated by longer TTR. These slower transitions in CAIs were associated with later onset time in the hip muscles and with larger instability in the ML direction in the period just after weight transfer (QS). The latter could indicate that for CAI the transfer was delayed because of anticipated instability. The present data support the use of a weight-shifting paradigm for the discrimination of stable and unstable ankles.

1446  Board #227  MAY 30  11:00 AM - 12:30 PM
Influence Of Visual Conditions And Leg Dominance On Balance Performance On Unstable Surfaces
Alison B. Regal, Karen Roemer, Erich J. Petushek, Louisa Raisbeck. Michigan Technological University, Houghton, MI.
(No relationships reported)

Maintaining stability on unstable surfaces in a quiet stance depends on the integration of afferent information (Peterka, 2002). It has been well documented how dynamic balance is affected by vision (Day et al., 1993), however the effect of vision impairment on dynamic balance is inconclusive (Houwen et al., 2009). Leg dominance has been reported to have no effect on full vision and no vision conditions (Hoffman et al., 1998). However, the research on impaired vision and balance performance is limited and inconclusive.

PURPOSE: To investigate the influence of vision and leg dominance for balance performance on an unstable surface.
Ankle instability is associated with mechanical and functional deficits. Appropriate foot position during functional, stressful movement is important to avoid dangerous loads on the ankle. Dynamic balance has previously been established as a risk factor for lower extremity injury during sport. One way to measure dynamic balance is by using the Lower Quarter Y-Balance Test (YBT-LQ), however, there is currently no research on how loading of the foot is altered for the three different reach directions that are part of this test. Purpose: To determine if total foot, rear foot (RF), medial midfoot (MMF), lateral midfoot (LMF), medial forefoot (MFF), middle forefoot (MidFF), lateral forefoot (LFF), hallux, and the lesser toes (LT) loading (defined by maximum force (MF)) were significantly different when performing the different reach directions of the YBT-LQ. The effect of gender on this outcome was also examined.

Methods: Plantar loading in 40 (20 men, 20 women) healthy, recreational athletes were evaluated using the Pedar-X in-shoe system collecting at 100Hz. Exclusion included any history of lower extremity injuries in the past 6 months. Subjects completed 3 trials bilaterally for each of the 3 reach directions of the YBT-LQ. Subjects were asked to reach as far as possible in the anterior (A), posteriormedial (PM), and posteriolateral (PL) directions. 6 practice trials on each leg in each of the 3 reach directions were executed prior to formal testing. Repeated measures ANOVA was used to compare differences between the ABC and factors affecting balance confidence in active older men. Previous work from our laboratory, which included a population of 59% women, indicated significant relationships between the ABC and fall history, physical activity status, 1-RM leg strength, and isokinetic peak torque (PT).

Results: Significance between full vision compared (df: 9.7± 2.6 mm/s, ndl: 9.0±1.6 mm/s) to no vision (df: 12.8± 3.1 mm/s, ndl: 12.5± 2.5 mm/s) and impaired vision (df: 10.8± 3.5 mm/s, ndl: 13.4± 4.5 mm/s, with p<0.001) were found. Significant differences between no vision and impaired vision (p= 0.925) were not observed. The dominant leg showed significantly reduced sway velocities compared to the non-dominant leg (p=0.012) for impaired vision.

Conclusions: Leg dominance influenced balance performance for impaired vision. These findings imply that with impaired vision the non-dominant leg may cause instability, which can lead to fall related injuries.

### 1447 Board #228 May 30 11:00 AM - 12:30 PM

Is the Activities-Specific Balance Confidence Scale Appropriate for Fall Screenings in Active Older Men?

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(No relationships reported)

Although frequently used for risk fall screenings, the Activities-Specific Balance Confidence Scale (ABC) lacks data regarding the relationships between the ABC and factors affecting balance confidence in active older men. Previous work from our laboratory, which included a population of 59% women, indicated significant relationships between the ABC and fall history, physical activity status, 1-RM leg strength, and isokinetic peak torque (PT).

### 1448 Board #229 May 30 11:00 AM - 12:30 PM

Changes in Plantar Loading During the Lower Quarter Y Balance Test

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(No relationships reported)

Dynamic balance has previously been established as a risk factor for lower extremity injury during sport. One way to measure dynamic balance is by using the Lower Quarter Y-Balance Test (YBT-LQ), however, there is currently no research on how loading of the foot is altered for the three different reach directions that are part of this test.

Purpose: To determine if total foot, rear foot (RF), medial midfoot (MMF), lateral midfoot (LMF), medial forefoot (MFF), middle forefoot (MidFF), lateral forefoot (LFF), hallux, and the lesser toes (LT) loading (defined by maximum force (MF)) were significantly different when performing the different reach directions of the YBT-LQ. The effect of gender on this outcome was also examined.

Methods: Seventy-one physically active, community dwelling men were recruited (67±7 yr, 84±15 kg, 27.1±4.1 BMI) to complete the ABC, a health history, and testing for concentric PT for knee extensors and knee flexors. Data were then dichotomized based on fall history.

Results: When comparing F (n=14, 69±6 yr, 27.8±3.3 BMI) to NF (n=57, 67±7 yr, 27.0±4.3 BMI), independent t-tests revealed significantly higher ABC scores for NF (94±7 vs. 87±12; p<0.01), but no group differences for age, BMI, or PT. A Spearman nonparametric test revealed that ABC significantly correlated with fall history (rho=0.264; p<0.05) and left knee extension PT (rho=-0.434; p<0.05), but did not significantly correlate with age, BMI, or medication use.

Conclusions: ABC scores correlated with fall history and left knee extension PT, and were significantly lower among active older men who had recently fallen. However, typical balance confidence correlates (age, BMI, and polypharmacy) were not observed. Clinicians should be cautious when interpreting male balance confidence profiles in gender-mixed studies.

### 1449 Board #230 May 30 11:00 AM - 12:30 PM

Effects of Ankle Instability on Ground Reaction Forces during a Landing with Sidestep

Matt Denning, Mark Coglianese, Matthew K. Seeley, J. Ty Hopkins, FACSM. Brigham Young University, Provo, UT.

(No relationships reported)

Ankle instability is associated with mechanical and functional deficits. Appropriate foot position during functional, stressful movement is important to avoid dangerous loads on the ankle. Whole-body center of mass motion, which is reflected by the ground reaction force, influences how loads are applied to the foot during movement.

Purpose: Compare certain ground reaction force characteristics between individuals who have functional ankle instability (ankle group) and those who do not (control group) during a functional, stressful movement.

Methods: 20 functionally unstable subjects were matched with 20 control subjects (gender, height, and weight). Subjects jumped forward (1m) and upward (± 5% of their averaged maximal height), landed on one leg on a force platform, and then quickly jumped laterally. Two-sample t-tests (α = 0.05) were used to evaluate the effect of ankle instability on peak vertical ground reaction force and loading rate, peak medial ground reaction force and loading rate, and average center of pressure distance from the midline of the foot while the subject contacted the plate.

Results: No significant between-group differences were detected (p ≥ 0.05). Peak vertical ground reaction force and loading rates for the ankle and control group were 2.9 ± 0.44 BW, 6.83 ± 1.53 BW/s, 2.91 ± 0.45 BW, and 7.2 ± 1.99 BW/s, respectively. Peak medial ground reaction force and loading rates for the ankle and control group were 0.44 ± 0.29 BW, 1.06 ± 0.75 BWs, 0.31 ± 0.32 BW, and 0.78 ± 0.84 BW/s, respectively. Center of pressure distances from the midline of the foot for the ankle and control groups were 0.007 ± 0.009 m and 0.007 ± 0.004 m, respectively.

Conclusions: No observed ground reaction force characteristic was different between groups, suggesting that certain characteristics of whole-body center of mass motion are not affected by ankle instability during this dynamic task. This lack of significance may be due to variability of the landing strategies used by the ankle group, or the nature of the jumping and landing task.
1450
Board #231 MAY 30 11:00 AM - 12:30 PM
Is Four Weeks Enough To Improve Balance And Mobility Function Of Older Adults Who Are Already Physically Active?
Kali J. Tupper, Brandi S. Row. Western Washington University, Bellingham, WA.
(No relationships reported)
PURPOSE: To determine the effectiveness of a brief balance-training (BT) program to improve the balance of physically active older adults.

METHODS: A 4-week BT program was conducted with physically active older men and women (Exercise [EX] group, n = 10, mean age [standard deviation, SD]: 77.2 [8.9] yr; waitlist control [EX2] group, n = 9, mean age [SD]: 75.8 [6.0] yr). The BT program focused on the multisensory, motor, and cognitive contributors to postural control & gait. During the EX2 group’s waitlisted participation phase, fewer seated balance ball multisensory exercises were included, replaced instead by more weight-bearing balance, stepping, & gait exercises.

Outcome measures included a modified Fullerton Advanced Balance Scale (modFAB), including three items from the Community Balance & Mobility Scale. Additionally, gait speed & Gait Stability Ratio (GSR) of cadence to velocity, Trail Making Test, the Activities-Specific Balance Confidence Scale, & Stair Climbing power. Acceleration measurements were made & are reported in a separate presentation.

For the initial 4-week intervention phase, repeated measures ANOVA (with factors Time [pre, post], Group [EX, EX2]) were conducted for measures that were suitable for parametric tests; otherwise, the Wilcoxon rank-sum (between groups) or Wilcoxon matched pairs (within group) tests were used. For the EX2 group’s waitlisted intervention analysis, a one-way ANOVA (with factor Time [pre, post, EX2-post]) was used for variables suitable for parametric tests; otherwise, the Friedman’s test was conducted.

RESULTS: Following BT, GSR decreased significantly during maximum gait speed trial for the EX group (EX: pre = 1.41 [SD 0.32], post = 1.32 [0.27]; EX2: pre = 1.18 [0.15], post = 1.21 [0.12]; p = 0.01). The EX2 group did not improve on GSR at EX2-post, but secondary analysis on each item of the modFAB revealed evidence of improvement in reactive postural control in this group at EX2-post. No differences on the other measures resulted.

CONCLUSIONS: Overall scores on the modFAB did not improve, but even in this small sample & brief intervention, there were some indications of a benefit of four weeks of BT regarding dynamic walking pattern (GSR) & reactive postural control. Evidence of improved frontal plane control is presented in an accompanying abstract from our lab.

1451
Board #232 MAY 30 11:00 AM - 12:30 PM
Effects Of Hyperthermia, Hypohydration And On Balance
Lindsay J. Di Stefano, Megan Van Sumeren, Rachel Karsto, Julie K. DeMartini, Rebecca L. Stearns, Robert Huggins, Lawrence Armstrong, FACSIM, Carl Maresh, FACSIM, Douglas J. Casa. FACSIM. University of Connecticut, Storrs, CT.
(No relationships reported)

Poor balance increases lower extremity injury risk. Fatigue, dehydration, and hyperthermia may impair balance, which could increase an individual’s injury risk.

PURPOSE: To evaluate the effects of hyperthermia, dehydration, and hyperthermia on balance ability.

METHODS: Twelve trained healthy male subjects (ages=20±2 yrs, height =182±8 cm, body mass=74±8.2 kg, body fat=9±3%, VO2max = 57.0±6.0 ml kg⁻¹ min⁻¹) completed four randomized test sessions in a climate controlled chamber. Sessions varied based on environmental conditions and hydration status (Euhydrated Temperate (EUT), Euhydrated Hot (EUH), Hypohydrated Temperate (HT), Hypohydrated Hot (HYH). Temperate and hot conditions were performed in 18±0.2°C, 50±3.5% relative humidity (RH), and 34±0.3°C, 45±4.5% RH, respectively. Dynamic balance during a 10-second unilateral landing task was assessed three times per session: before exercise (PRE), after exercise (POST), and after recovery (REC). The 90-minute treadmill exercise protocol required subjects to walk carrying a 20.5 kg backpack (1.34-1.78 m·s⁻¹; 5% grade). Subjects sat quietly in the test environment during a 60-minute recovery period. Mean sway velocity and elliptical sway area were calculated from force plate data (4060-NC Bertec Corporation). A repeated measures analysis of variance with a Tukey HSD post hoc test evaluated differences between time and condition for all dependent variables.

RESULTS: Body mass loss differed across sessions (HYH: -3.8% ± 1.22%, HYH: -5.66% ± 1.57%, EUT:0.10% ± 0.90%, EUH: -1.30% ± 0.85%). Regardless of time, HYH resulted in the highest values for sway velocity (p=0.024, 6.62±0.28 vs. 6.06±0.16 (HYH), 6.16±0.25 (EUT), 6.19±0.26 (EUH) m/s) and sway area (p=0.048, 3.40±0.35 vs. 2.71±0.19 (HYH), 2.65±0.21 (EUH), 2.72±0.24 (EUT) cm²). POST sway velocity (PRE: 5.89±0.21, POST: 6.53±0.27, REC: 6.35±0.21) was higher than PRE and REC, regardless of condition.

CONCLUSION: Regardless of hydration status and environmental conditions, fatigue appears to decrease balance ability. Dehydration in a hot environment also impairs balance ability. These findings suggest that hydration during physical activity in the heat may be critical to alleviate an increased risk of injury.

1452
Board #233 MAY 30 11:00 AM - 12:30 PM
The Relationship Between Dynamic Balance and Isokinetic Ankle Strength in College Female Athletes
Danika Evans, Barbara Warren, FACSIM. University of Puget Sound, Tacoma, WA.
(No relationships reported)

Conflicting results have been found between dynamic balance and isokinetic ankle strength as measured by peak torque.

PURPOSE: To investigate the relationship between ankle joint peak torque and dynamic balance. METHOD: Fifteen healthy female Division III varsity athletes (mean [SD] age = 20.53 yrs (.743), height = 170.02 cm (4.962), weight = 67.27 kg (9.183)) were tested on a Cybex NORM isokinetic dynamometer performing maximal ankle plantar and dorsiflexion for both right and left ankles. Dynamic balance was assessed using the Star Excursion Balance Test (SEBT). Isokinetic strength was assessed through 8 reciprocal maximal contractions of plantar and dorsiflexion at 60, 120, and 180% with a 60 second rest between each velocity set. Pearson’s correlations were used to assess the relationship between the dynamic balance score and peak torque at each velocity for each muscle group (alpha ≤ 0.05).

RESULTS: Moderate correlations were found between right ankle dorsiflexor peak torque and dynamic balance (60°/s: r = .476, 120°/s: r = .608, and 180°/s: r = .667), left dorsiflexor peak torque and dynamic balance at all velocities (60°/s: r = .499, 120°/s: r = .488, 180°/s: r = .445), and between left and ankle plantarflexor peak torque and dynamic balance (60°/s: r = .520, 60°/s: r = .454 ). Weak correlations were found between right ankle plantarflexor peak torque and dynamic balance at 120°/s and 180°/s (120°/s: r = .362, 180°/s: r = .274) and left plantarflexor peak torque and dynamic balance at 120°/s and 180°/s (120°/s: r = .237, 180°/s: r = .037).

CONCLUSION: In this population of female athletes, these results suggest that dynamic balance may be related more to dorsiflexion strength than plantarflexion strength.

1453
Board #234 MAY 30 11:00 AM - 12:30 PM
Heart Rate and Postural Stability Recovery are Similar after Aerobic and Anaerobic Exercise
(No relationships reported)

Postural stability (PS) assessment is an important component of sideline concussion testing and fatigue may influence PS independent of neurological insult. While studies found that PS is disrupted after both anaerobic (ANA) and aerobic (AER) exercise, the relationship between heart rate (HR) and PS recovery following exercise has not been determined.

PURPOSE: To compare PS and HR following maximal ANA and AER exercise using a cross-over study design.

METHODS: Physically active subjects (M=8, F=5, 23.5±3.5 yrs, 173±4.5 cm, 72.7±15.0 kg) participated in two test sessions, where PS and HR were assessed utilizing a single-leg balance task prior to and following ANA or AER exercise every 2 min for 20 min. Dominant-leg balance was measured with eyes open while standing on a foam pad on top of a force plate. A Wingate cycle power test induced ANA fatigue and a graded treadmill exercise test induced AER fatigue. Separate one-way repeated measures ANOVA with simple contrast compared standard deviations of ground reaction forces in the anterior-posterior (AP), medial-lateral (ML) and vertical (V) directions during post-fatigue time intervals to baseline in order to determine PS recovery for each condition (n=0.05). Paired t-tests compared % of max HR achieved during ANA and AER (%HRmax) between conditions at each post-fatigue time interval; adjustment for multiple comparisons set α=0.0045.

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RESULTS: AP was greater than baseline up to 8 min post-fatigue for ANA (7.2±2.9 vs 5.5±2.0 N) and AER (6.8±2.3 vs 5.5±2.1 N); ML and Y were greater than baseline at 0 min post-fatigue for ANA (ML: 6.1±2.9 vs 4.0±1.4 N, V: 23.3±2.2 vs 11.0±5.2 N) and AER (ML: 6.8±3.1 vs 3.7±1.2 N, V: 24.3±17.5 vs 12.1±3.4 N) (p<0.05). While max HR achieved during AER was significantly greater than ANA (193.4±10.6 vs 174.8±17.6 bpm, p<0.001), no significant differences in %HRmax were found between ANA and AER at any post-fatigue time interval (p>0.0045).

CONCLUSION: PS and HR recovered similarly following ANA and AER fatigue. Since PS recovered by 10 min post-fatigue with %HRmax at ~52.7%, future research should investigate the potential of using %HRmax to determine when fatigue may be ruled out as a confounding factor during sideline concussion PS assessment following intense sporting activities. Supported by the Freddie H. Fu, MD Doctoral Research Award

1454 Board #235 MAY 30 11:00 AM - 12:30 PM
The Effects of Core Strength Training on Static and Dynamic Balance in Female Collegiate Athletes
Kathryn E. Kramer, Sheila K. Kelly, Tina M. Manos, Justus D. Ortega. Humboldt State University, Arcata, CA.

The core muscles of the body are essential components to most kinetic chains in sport activities; therefore, control of core strength should improve controlled motion during dynamic and static balance tasks. Although it is well established that core strength training (CST) improves balance in untrained adults, it is unknown whether CST improves balance in trained athletes.

PURPOSE: To determine if a 6-week core strength-training program improves dynamic and static balance in Division II female athletes with prior core strength training experience.

METHODS: The Experimental (EXP) and Control (CON) groups were comprised of 33 Division II female athletes (19 softball, 2 basketball, 7 crew, and 5 cross-country); age 19±3.5 yrs, mass 72.3±12.3 kg, height 167±6.7 cm. Both EXP and CON groups performed baseline core strength tests [60-second max sit up, max time held in side plank (sec), and max number of medicine-ball twists] and balance tests [Functional Reach (FR), Single-Limb Dynamic Balance (SLDB), Single-Limb Eyes Closed (SLEC), and Single-Limb Eyes Open (SLEO) performed on a force platform and Star Excursion Balance Test (SEBT)]. For the core strength tests, T-scores were calculated for each test and then summed, resulting in a composite core strength score for each athlete (CS-T). For the four tests on the force platform, average COP velocity (AveVel in cm/s) and 95% of the total area ellipse (95% TAE in cm²) were calculated in addition to the maximum reach (cm) of the FR test and the combined maximum reach (sum of three directions) for the SEBT (cm). The EXP group completed a training program consisting of ten core strength exercises performed three times per week for 6 weeks. After the training, the EXP and CON groups performed the core strength and balance testing.

RESULTS: Prior to the core strength training there was no difference in strength or balance between the EXP and CON groups. After 6 weeks of core strength training, the EXP group improved in core strength (CS-T: 594.6±60% increase, p<0.001) and dynamic balance (SLDB: 95% TAE decreased 30.82%, p=0.049 and AveVel decreased 9.76%, p=0.005; SEBT: combined maximum reach increased 6.94%, p=0.001). Maximum functional reach and other measures of static balance did not change. Although the CON showed a modest improvement in core strength measures (10.76%, p=0.001), there was no improvement in balance except for a 10% decrease in the average COP velocity during the SLDB test (p=0.027).

CONCLUSION: Six weeks of supplemental core strength training improves core strength and dynamic balance but does not significantly affect static balance or functional reach in Division II collegiate female athletes.

1455 Board #236 MAY 30 11:00 AM - 12:30 PM
Effect of a Lower Extremity Fatigue Protocol on the Balance Error Scoring System
Rose L. Smith, Jessica Murphy, Kirk Rhein, Melissa Smith, Emanuel Werner, Daniel L. Carl. University of Cincinnati, Cincinnati, OH.

Concussion is one of the most common sports-related head injuries accounting for approximately 300,000 diagnosed cases yearly and with as many as 15% of those resulting in persistent long term symptoms. Current concussion assessment and return-to-play decisions rely on the athlete’s willingness to share self-reported symptoms. Missed diagnosis due to relying on subjective symptoms from athletes could lead to future complications, such as second impact syndrome. The Balance Error Scoring System (BESS) was developed in order to provide a cost-effective sideline assessment tool for evaluating deficits in postural stability following a concussion. To date the role of the athlete’s level of fatigue and how it may interact with Bess scoring is unclear.

PURPOSE: To determine if lower extremity (LE) exercise induced fatigue will result in elevated BESS scores.

METHODS: 28 subjects (20M, 8F; 18-25 yr) participated in the study. Each subject completed an informed consent and was familiarized with the error measurements of the BESS protocol. Subjects were tested (Pre), LE fatigued, tested immediate post (Post I) and tested 20min post exercise (Post II). The LE fatigue protocol consisted of in order a 1.5 mile run/walk, a Queen’s College step test, and 4 sets of squats based on the DAPRE technique. The BESS protocol consisted of a 20s trial for single leg stance, double leg stance and tandem leg stance. For the core strength tests, T-scores were calculated for each test and then summed, resulting in a composite core strength score for each athlete (CS-T).

RESULTS: BESS scores were significantly elevated immediate post-fatiguing exercise (Pre 38.4 ± 10.2 vs. Post I 54.3 ± 12; p<0.01) and returned to statistical baseline by 20 min. post exercise (Pre 38.4 ± 10.2 vs. Post II 31.9 ± 7.9). No statistical differences were identified between M & F or with regard to subject’s level of conditioning.

CONCLUSIONS: Fatigue adversely affected BESS scoring immediately post exercise. Although a return to statistical baseline was observed at 20 min post exercise, as many as 21% of the participants had not fully recovered. Additional studies are warranted to further elucidate the role of BESS in return-to-play decision making.

1456 Board #237 MAY 30 11:00 AM - 12:30 PM
Integrative Training Of Strength And Sensorimotor Control Enhances Vestibular And Proprioceptive Activation During Postural Challenges
Henrike Fischer, Hans Martin Sommer, Olaf Hoos, Ralph Beneke, FACSM. Philipps University of Marburg, Marburg, Germany.

Postural control depends on visual (VI), vestibular (VE) and proprioceptive (PR) feedback. Corresponding treatment effects usually do not discriminate between underlying sensory mechanisms.

PURPOSE: To discriminate between different adaptations of somatosensory control of a combined strength and sensorimotor intervention (EG) and a classical back school training (CG) in physically active subjects.

METHODS: EG (n=17, 25±9 yrs, 61.8kg, 170±5cm) received a specifically designed integrative strength and coordination program to promote joint extensions in supine and upright position (1h weekly for 3 months). CG (n=13, 26.5 yrs, 63.9kg, 175±7.5cm) performed an identical volume of trunk muscle strength training and balance exercises on stable and unstable surfaces. Postural sway was assessed in barefooted single-leg stance with eyes open on a force platform (1 kHz). Center of pressure sway area (COPA) and spectral powers of Fast Fourier transformation distinguishing between VI (0.1-0.3 Hz), VE (0.3-1 Hz) and PR (1-3Hz) frequency bands were computed for anterior-posterior (AP) and medio-lateral (ML) directions.

RESULTS: COPA were unchanged in EG (pre: 1.02±0.3cm², post: 0.89±0.24cm², ns) and in CG (pre: 1.17±0.48cm², post: 1.32±0.86cm², ns). In CG the distribution of spectral powers remained constant in ML (VI: pre 86.4±12.4%, post 89.9±15.6%, ns; VE: pre 10.4±8.5%, post 8.5±11.7%, ns; PR: pre 3 ±6.3%, post 2.6±3.9%, ns) and AP (VI: pre 95.4±2%, post 95.3±0.9%, ns; VE: pre 3.5±6%, post 3.6±0.7%, ns; PR: pre 1.1±0.3%, post 1.1±0.3%, ns). In EG the COP powers shifted in terms of a reduction in VI (ML: pre 86.6±8.9%, post 77.8±13.7%; p<0.05; AP: pre 96.0±6.9%, post 93.8±1.8%; p<0.01) and an increase in VE (ML: pre 10.4±7.4%, post 16.6±10.6%, p<0.01; AP: pre 3.1±0.5%, post 4.8±1.4%; p<0.001) and AP component of PR (ML: pre 3.0±2.9%, post 5.6±3.5%; ns; AP: pre 0.9±0.2%, post 1.4±0.4%; p<0.01).

CONCLUSIONS: Both interventions had no effect on COPA. However, the integrative strength and coordination program to promote joint extensions in supine and upright position reduced dependency of the VI system in favour of increased VE and PR control during postural challenges.
Association of Dynamic Postural Stability Index Scores and Clinical Impairments: A Preliminary Analysis

Timothy J. Gillen, Anthony Luke, FACSM, Richard B. Souza. UCSF, San Francisco, CA. (No relationships reported)

Recurent lateral ankle sprains (RLAS) are common injuries which may lead to impairments in postural control. A measure of dynamic postural stability was recently developed by Wikstrom. The relationships between the Dynamic Postural Stability Index (DPSI) and physical/functional impairments are currently unknown.

PURPOSE: To examine the relationships between the DPSI and selected clinical measurements.

METHODS: DPSI and clinical tests (questionnaires, ankle ROM and joint stability/mobility, hip and ankle strength, Y Balance and Lateral Hop tests) were performed on 15 subjects (3 male, 12 female, age: 28 ± 4.5) with RLAS. Forward, diagonal and lateral jumps were examined using GRF data acquired by a force platform (1000 Hz). Three successful trials averaged for DPSI calculations (described by Wikstrom) and clinical measures were entered into a correlation matrix (p<0.05).

RESULTS: Moderate correlations were observed between all DPSI scores and the FADI Sports questionnaire and ankle dorsiflexion ROM scores (Table 1); whereas, ankle mobility/stability and inversion ROM, ankle and hip strength, Lateral Hop tests and DPSI scores were non-significant and weakly correlated.

CONCLUSION: These data suggest DPSI scores are related to self-reported activity limitations and physical/functional impairments. The moderate association between DPSI and Y Balance scores may provide insight into dynamic postural stability in clinical situations where force plate data is not available. Supported by NIH/NCRR/OD UCSF-CTSI Grant Number TL1 RR024129.

<table>
<thead>
<tr>
<th>Test</th>
<th>Forward: FDPSI</th>
<th>Diagonal: DDPSI</th>
<th>Lateral: LDPSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>FADI: Activity Limitation</td>
<td>-0.709</td>
<td>-0.633</td>
<td>-0.783</td>
</tr>
<tr>
<td>Sports: Plan Limitation</td>
<td>-0.423</td>
<td>-0.398</td>
<td>-0.540</td>
</tr>
<tr>
<td>Clinical: Ankle DF_AROM KE*</td>
<td>0.692</td>
<td>0.759</td>
<td>0.708</td>
</tr>
<tr>
<td>Tests: Ankle DF_AROM_KF*</td>
<td>0.645</td>
<td>0.762</td>
<td>0.671</td>
</tr>
<tr>
<td>Functional Test</td>
<td>-0.433</td>
<td>-0.408</td>
<td>-0.263</td>
</tr>
</tbody>
</table>

Table 1: FADI - Foot and Ankle Disability Index; * Ankle DF AROM in weight bearing with knee extended (KE) and knee flexed (KF). Italicized values are significant (p<0.05).

Impaired standing balance performance (SBP) is a relevant intrinsic fall risk factor in seniors. Acute effects of endurance exercise (maximal and submaximal) on SBP have not yet been studied in elderly.

PURPOSE: To evaluate the acute effects of an exhaustive maximal exercise test and 2 km walking at moderate intensity on single and double limb SBP.

METHODS: 19 healthy seniors (10 women, 9 men, age = 64.6 (SD 3.2) yrs, height = 1.70 (0.10) m, weight = 69.6 (11.2) kg) completed 3 experimental conditions on separate days one week apart. After a maximal ramp-like treadmill test (duration = 23.1 (3.1) min, maximal oxygen uptake (VO2max) = 32.3 (4.8) ml/min/kg, maximal heart rate = 165 (9) (min) participants randomly completed a 2 km walking test on a treadmill at moderate intensity (27.5 (3.6) min at CR-10 Borg level 4 corresponding to 76 (8)% VO2max) and a resting control condition. During exercise tests heart rate and gas exchange data were continuously recorded. Ratings of perceived exertion (CR-10 scale) were assessed every minute (ramp test) as well as every 5 minutes (2 km walking test). Directly before and after maximal and submaximal exercise and the control condition, SBP was assessed by double leg stance with closed eyes (DLEC) and single leg exercise tests.

RESULTS: A significant condition x time interaction in COP path length data for both standing balance tests was observed (p < 0.001). Whereas COP path length during DLEC slightly decreased from pre to post test on the control day (-8%, effect size (d) = 0.21, p = 0.60), a small (+18%, d = 0.42, p = 0.05) and large (+52%, d = 1.04, p < 0.001) increase was observed after the 2 km and the ramp test, respectively. Similarly, COP path length during SLED was reduced on the control day (-22%, d = 0.47, p = 0.04), whereas it was slightly increased (+15%, d = 0.29, p = 0.65) after the 2 km test. A large significant increase was observed after the maximal exercise test (+88%, d = 1.24, p < 0.001).

CONCLUSIONS: SBP was considerably deteriorated after maximal exhaustive treadmill exercise in healthy seniors. The small changes after walking 2 km at moderate intensity (typical endurance tasks of everyday life or health-oriented cardiovascular training) were of minor relevance.

Progression Of Ankle Muscle Activation Performing Exercises With Different Types Of Balance Stability

Victor Tella, Julio Martin, Sebastien Borreani, Juan Carlos Colado, Fernando Martin, Joao Alves. University of Valencia, Valencia, Spain. (No relationships reported)

Ankle injury is one of the most prevalent in athletics. Rehabilitation protocol must include proprioception to improve the ankle stability and thus to the functional status. Proprioception and balance training equipments are used despite the insufficient knowledge about a proper progression with these devices.

PURPOSE: To compare ankle muscular activity performing 4 exercises performed in stable and unstable conditions using Thera-Band® devices.

METHODS: 18 physically fit and healthy male subjects took part in a randomized, within-subject design assessment. The maximum isometric voluntary contraction (MIVC) was evaluated for the normalization. Peroneus longus (PL), tibialis anterior (TA) and soleus (S) muscular activities were recorded, and then the average root mean square values of all of them were calculated. Surface electromyography activity was analyzed during the central 16 seconds of 20 of 4 isometric unipodal postures: Sitting on swissball and foot over the floor (SF), standing up on the floor (UF), standing up on a Rocker Board (UR) and standing up on a Stability Soft (US). All values, expressed as the mean of the 5 muscles %MVC, were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at p<0.05.

RESULTS:

<table>
<thead>
<tr>
<th>Test</th>
<th>Peroneus Longus</th>
<th>Tibialis Anterior</th>
<th>Soleus</th>
<th>Total Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF</td>
<td>36.22 (5.04)</td>
<td>4.30 (0.54)</td>
<td>15.71 (1.91)</td>
<td>18.74 (2.24)</td>
</tr>
<tr>
<td>UF</td>
<td>45.05 (6.56)*</td>
<td>11.79 (2.10)*</td>
<td>27.83 (3.06)*</td>
<td>26.22 (2.97)*</td>
</tr>
<tr>
<td>SR</td>
<td>46.39 (6.80)*</td>
<td>18.49 (3.38)*</td>
<td>28.62 (3.26)*</td>
<td>31.16 (3.24)*</td>
</tr>
<tr>
<td>SS</td>
<td>49.12 (6.11)*</td>
<td>19.38 (3.12)*</td>
<td>30.35 (2.75)*</td>
<td>32.95 (2.68)*</td>
</tr>
</tbody>
</table>

Table 1. Average muscular activation comparisons between conditions (n=18).

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CONCLUSION: Unipodal exercise performed sitting on the swissball generates the lower ankle muscles activation. Rocker Board and Soft Stability are unstable surfaces which increase significantly ankle muscle activity in comparison with stable surface. US provokes greater but not significant activation of all ankle muscles in comparison with the UR probably due to the direction of the unbalance which is multidirectional and unidirectional respectively.

RESULTS:

The Star Excursion Balance Test (SEBT) is a simple clinical test designed to measure dynamic balance. Determining which parameters are associated with SEBT performance can help therapists understand potential underlying impairments that lead to decreased or enhanced dynamic balance performance. Specifically, the association between SEBT performance and foot type is yet to be determined. The Arch Index (defined as the ratio between midfoot and total foot area) is a simple and reliable measure used to quantify foot type.

PURPOSE: To explore the association between the severity of past injuries and SEBT performance and to test the hypothesis that increased severity of past injuries will be correlated with decreased SEBT performance.

METHODS:

Participants with lower medial longitudinal foot arch reached significantly farther on all SEBT directions except for anterolateral. The Spearman correlation coefficient between arch index and the SEBT composite score was 0.55 and the R² was 0.31 (p = 0.02) indicating that arch index explained 31% of the variance in SEBT performance. Severity of injuries in the past was not associated with SEBT performance (p > 0.1) and was significantly associated with arch index (R² = 0.54, p = 0.056) towards more errors committed after fire suppression (1.4) when compared to baseline (0.9). A correlation was identified (r = -0.41, p=0.04) between VO2max and time to complete the test with high VO2max associated with faster completion times. No significant correlations were identified between VO2max and errors or between body fat (%) and either time to complete or errors committed.

CONCLUSIONS: Time to complete a test of functional balance and the number of errors committed during the test did not differ between either normal clothing and protective clothing conditions or after a single 20-minute bout of fire suppression. Maximal oxygen consumption, but not percent body fat, was correlated with time to complete the task.

1461

Board #242  MAY 30  11:00 AM - 12:30 PM

The Role of Foot Type in Dynamic Balance Performance

Anat Lubetzky-Vilnai, Patricia Ann Kramer. University of Washington, Seattle, WA.

METHODS:

20 healthy recreational runners (15 women, 5 men, aged 23-58 years) participated in this cross-sectional study. We interviewed the participants about their running habits and history of injuries. A pressure sensitive mat and associated software (Footscan USB plate, RSCan International, Olen, Belgium) was used to obtain the static footprints of all participants. Arch indexes were calculated from the footprints. Participants performed the SEBT.

RESULTS: Participants with lower medial longitudinal foot arch reached significantly farther on all SEBT directions except for anterolateral. The Spearman correlation coefficient between arch index and the SEBT composite score was 0.55 and the R² was 0.31 (p = 0.02) indicating that arch index explained 31% of the variance in SEBT performance. Severity of injuries in the past was not associated with SEBT performance (p > 0.1) and was significantly associated with arch index (R² = 0.54, p = 0.056) towards more errors committed after fire suppression (1.4) when compared to baseline (0.9). A correlation was identified (r = -0.41, p=0.04) between VO2max and time to complete the task with high VO2max associated with faster completion times. No significant correlations were identified between VO2max and errors or between body fat (%) and either time to complete or errors committed.

CONCLUSION: When using the SEBT to measure dynamic balance, researchers and clinicians need to be aware of potential differences in performance with different foot types. In the clinic, asymmetry in arch index may affect symmetry in SEBT performance. In the research setting, arch index may need to be adjusted for when comparing SEBT performance between groups.

Acknowledgements: This study was supported by NSC 99-2410-H-037-009-MY2
A History of Multiple Concussions Does Not Alter Dual Task Gait Stepping Characteristics

Thomas A. Buckley1, David A. Krazeise2, Barry A. Munkasy1, 1Georgia Southern University, Statesboro, GA. 2Webber International University, Babson Park, FL.
(Sponsor: Chris Hass, FACSM)
(No relationships reported)

Recent investigations have suggested that multiple concussions, typically identified as three or more, may have serious long term consequences including multiple cognitive and neurological pathologies resulting in impaired quality of life. A recent investigation identified alterations in gait performance in individuals with a concussion history; however, the specific threshold of three or more concussions has not been assessed.

PURPOSE: The purpose of this study was to identify changes in gait spatial and temporal characteristics in individuals with a history of at least 3 concussions.

METHODS: Ten individuals (age: 20.6 ± 1.2 years, ht: 1.76 ± 0.12m, wt: 83.6 ± 24.8kg) with a history of at least three concussions (3.5 ± 0.9), CONC group, were matched to ten individuals with no history of concussions (age: 20.5 ± 1.6 years, ht: 1.75 ± 0.11m, wt: 83.6 ± 23.9kg), No CONC group. All participants performed 5 trials of self-selected single task gait (ST) and dual task gait (DT) on a 4.9m instrumented walkway, previously identified as valid and reliable. The dual task group answered working memory challenges while walking. Stepping characteristics were compared using a 2 (group) x 2 (task) repeated measures ANOVA.

RESULTS: There were no interaction (p=0.243) or group effect (p=0.495) for gait velocity (CONC: ST; 1.30 ± 0.12m/s, DT; 1.18 ± 0.11m/s and No CONC: ST; 1.31 ± 0.08, DT; 1.27 ± 0.26m/s). Similarly, there was no interaction (p=0.230) or group effect (p=0.967) for stride length (CONC: ST; 1.36 ± 0.07m, DT; 1.31 ± 0.09m and No CONC: ST; 1.34 ± 0.7m, DT; 1.34 ± 0.15m). Further, there was no interaction (p=0.996) or group effect (p=0.838) in double support phase (CONC: ST; 23.8 ± 1.9%, DT; 24.7 ± 1.9% and No CONC: ST; 23.5 ± 2.0%, DT; 24.5 ± 2.6%). Finally, there was no difference between groups for the number of dual task challenges successfully completed.

CONCLUSION: The results of this study suggest there are no differences in gait spatial and temporal characteristics between individuals with a history of multiple concussions and those with no history of concussion when performing working memory dual task challenges during normal overground walking. This population of otherwise young healthy adults appeared to possess sufficient supraspinal compensatory resources to accomplish both a cognitive and postural task simultaneously.

Accelerometry Reveals Improvements In Frontal Plane Control After Only Four-weeks Of Balance And Mobility Training

Brandi S. Row, Kali J. Tupper. Western Washington University, Bellingham, WA.
(No relationships reported)

PURPOSE: To study the effects of balance-training (BT) on frontal plane control during gait.

METHODS: A 4-week BT program was conducted with physically active older men & women (Exercise group [EX], n = 10, mean age [standard deviation, SD]: 77.2 [8.9] yr; waitlist control group [EX2], n = 9, 75.8 [6.0] yr). The BT program focused on multisensory, motor, & cognitive contributors to postural control & gait. EX2’s training had less seated training & more weight-bearing exercise.

Four gait trials included: Normal (NORM) & Maximal (MAX) speed, and NORM & MAX speed with a cognitive distraction (COG). Average per-step peak medial-lateral (M-L) trunk acceleration (ACC) magnitude & variability (SD) were calculated.

For the initial 4-week intervention phase, repeated measures ANOVA (with factors Time [pre, post], Group [EX, EX2]) were conducted for measures appropriate for parametric tests, otherwise, the Wilcoxon rank-sum (between groups) or Wilcoxon matched pairs (within group) tests were used. For EX2’s waitlisted intervention analysis, a one-way ANOVA (with factor Time [pre, post, EX2-post]) was used for variables suitable for parametric tests; otherwise, the Friedman’s test was used.

RESULTS: No M-L trunk ACC changes occurred for EX or EX2 from pre to post. Though no changes occurred in gait speed, the waitlisted EX2 group had significant reductions in M-L ACC variables following their BT phase between post- & EX2-post (Table 1).

Table 1: Mean [SD] of acceleration results.

<table>
<thead>
<tr>
<th>ACC VARIABLE (m/s²)</th>
<th>PRE</th>
<th>POST</th>
<th>EX2-POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORM, mean per-step peak M-L ACC</td>
<td>EX: 3.23 [0.87]</td>
<td>EX: 3.00 [0.74]</td>
<td>EX: N/A</td>
</tr>
<tr>
<td>MAX, mean per-step peak M-L ACC</td>
<td>EX: 6.13 [2.19]</td>
<td>EX: 6.87 [1.05]</td>
<td>EX: N/A</td>
</tr>
<tr>
<td>MAX COG, mean per-p step M-L ACC</td>
<td>EX: 1.34 [0.47]</td>
<td>EX: 1.22 [0.48]</td>
<td>EX: N/A</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Reduced magnitude & variability of per-step M-L ACC following BT indicate improved frontal plane control during NORM & MAX walking & MAX COG gait. The latter result may also represent an improved ability to switch attention between walking & the cognitive task.

Differential Effects Of Foot Sole Sensory Impairment On Balance And Gait

Shuqi Zhang, Li Li, FACSM. Louisiana State University, Baton Rouge, LA.
(No relationships reported)

Foot somatosensation provides valuable feedback information to central nervous system to maintain balance. Acute reduced foot sensation would change the plantar pressure distribution during standing and gait. However, the effect of long-term foot sole sensory impairment on plantar pressure distribution is unclear.

METHODS: Twenty-four elderly PN suffers (7 male, 17 female) participated the study (average age/standard deviation = 73.0/6.9). The foot sole sensitivity was tested at big toe (BT), 1st and 5th metatarsal (M1 and M5), mid-foot (MF) and med-heel (MH) with a 5.07 monofilament and sties was divided into sensitive and insensitive groups based on test score. Relative peak pressure (RPP) of the five tested sites collected according to sensitivity of each of the five sites via an in-shoe pressure system during walking and standing. Walking was conducted on a treadmill at 0.07m/s and No CONC: ST; 1.34 ± 0.09m/s and No CONC: ST; 1.34 ± 0.09m/s and No CONC: ST; 23.8 ± 1.9%, DT; 24.7 ± 1.9% and No CONC: ST; 23.5 ± 2.0%, DT; 24.5 ± 2.6%).

RESULTS: No pressure distribution change observed due to insensitivity of other sites during standing. No pressure distribution changes observed during walking.

CONCLUSION: These results indicate feedback from foot sole sensation in gait is not as important as in standing. It suggests maintaining standing balance is more reliance on the feedback control mechanism, while gait control is more reliance on the feedforward control mechanism.

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Nearly 50% of diabetic patients also suffer from neuropathy, the most common form being diabetic peripheral neuropathy (DPN). DPN affects men and women with equal frequency, and symmetrically damages nerves of the limbs, especially the foot, leading to balance impairment. One mechanism that has been reported to be important for balance, yet has not been investigated in DPN patients, is the spinal reflex. The inhibitory or facilitatory behavior of the spinal reflex plays an important role in controlling static postural sway by filtering afferent nerve signals.

**PURPOSE:** To compare the differences in spinal reflex and balance in subjects with and without DPN to determine the influence of the spinal reflex on balance in DPN patients.

**METHODS:** Eight DPN patients (58±6 y) and eight normal subjects (59±7 y) participated in this study. Presynaptic inhibition (PI) and static postural sway were tested for each subject. The mean percent difference of the conditioned relative to the unconditioned spinal reflex amplitude was assessed to calculate PI. To quantify static postural sway, a balance index was determined for each subject from a single-leg balance assessment on a computerized balance-measuring device.

**RESULTS:** DPN patients showed less PI than the normal group (47±30% vs. 87±17%, p<0.05), as well as increased balance index (0.65±0.24 vs. 0.38±0.06, p<0.05) indicating increased postural sway. No significant correlation was found between PI and balance index (R=0.37, p=0.15).

**CONCLUSION:** DPN patients demonstrated decreased spinal reflex inhibition accompanied by a decrease in static balance compared to normal age-matched controls. Further research is necessary to explore the role of PI in the decreased balance seen in DPN patients.

**METHODS:** 90 subjects volunteered to participate in this study. The Xbus Master (Xsens Technologies B.V., The Netherlands) inertial parameter detector were carried by the subjects during various movements, including standing, sitting, supine, prone, lying, up/down stairs, sit-to-stand, stand-to-sit, running, jumping and walking.

**RESULTS:** An algorithm was developed for each decision node with hierarchy structure as binary tree method. A human motion classifier was constructed with best basis feature extraction, maximal likelihood classifier and the accuracy tested. Half of the sample data were used as the released-set and applied in constructing individual classifiers. The other half will be used as the withhold-set and employed in testing reliability of the individual classifiers. The results have shown that the level 3 static and transfer action have high sensitivity (95.6%-100%) and level 4 static and transfer action have high sensitivity (84.4%-93.3%). (Tab. 1)

**CONCLUSION:** The method has potential applications to apply in telemedicine and fall-risk analysis for the elderly, and long-distance monitoring and behavioral pattern analysis for daily activities modern of elderly people. There are clear limits in the calculation time on what can be achieved in a free-living monitoring environment.

**RESULTS:** The OA group demonstrated worse scores for all subscales of the KOOS (pain 5.2 [1.8]; KOOS symptom 5.7 [2.0]; KOOS ADL 2.1 [1.1]; KOOS sport/rec 3.8 [1.5]; KOOS QOL 3.9 [1.5]), increased knee varus (1.0 [0.9]), and slower stair ascent (1.0 [0.9]) than the healthy group. For other functional tests (TUG 0.5 [0.9]; Walk test 0.5 [0.9]; Stair descent 0.8 [0.9]), confidence intervals encompassed zero, indicating a need for caution when interpreting results. Lastly, there was no difference in balance between groups for either measure (Step Test 0.2 [0.9]; TTB mean of minima in the medial-lateral direction 0.6 [0.9]; TTB mean of minima in the anterior-posterior direction 0.1 [0.9])

**CONCLUSION:** Patient reports of functional deficits as a result of OA were not substantiated by laboratory testing of balance, and not well-associated with functional, clinical tests. Other objective methods for determining the extent in OA, which are also highly correlated with patient reports, are needed.

**RESULTS:** Statistic significance was shown in the more challenging conditions, i.e., conditions 5 and 6 of the SOT for the main icing pre-post effect, and condition 5 for the interaction effect. In sensory analysis, statistic significance was shown in the visual and vestibular ratios only for the main icing pre-post effect. For other functional tests (TUG 0.5 [0.9]; Walk test 0.5 [0.9]; Stair descent 0.8 [0.9]), confidence intervals encompassed zero, indicating a need for caution when interpreting results. Lastly, there was no difference in balance between groups for either measure (Step Test 0.2 [0.9]; TTB mean of minima in the medial-lateral direction 0.6 [0.9]; TTB mean of minima in the anterior-posterior direction 0.1 [0.9])

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**CONCLUSION:** In balance, icing may be effective of both the boxer and non-boxer groups, but more in the boxers. In general, maximal isometric strength scored higher but active ROM scored lower in the boxers than in the non-boxers. Icing may be also effective in both strength and flexibility of both groups, but more in the boxers. As a result, the detrimental effect in boxing and the beneficial effect of icing were demonstrated in terms of neck fitness and balance performance.
INTRODUCTION: The maintenance of posture is a constant contest for the human body, because it demands a system capable of responding quickly and efficiently, even in unstable situations, avoiding falls and maintaining balance. Objectives: to assess the influence of anthropometric characteristics and gender on postural balance of irregularly active adults in the upright, bipedal and semi-static posture, with eyes open and closed.

METHODS: 100 individuals of both genders were assessed, with age between 20 and 40 years, through an anthropometric measurements, bone densitometry (lean and fat mass, composition and bone mineral density), BMI, height, body mass, lower and head length limb and upper torso length, waist and hip, support base and postural balance test performed on a force platform.

RESULTS: The correlation analysis showed weak correlations of the postural balance and anthropometric measure. The multiple linear regression analysis demonstrated that in the whole group (female and male) height explained 12% of the medial-lateral displacement, 10% of the speed of oscillation and 11% of the scroll area. The torso circumference length explained 6% of the shift from anterior to posterior. In the eyes closed condition, height and base of support explained 18% of the medial lateral displacement, height explained 10% of the speed displacement and 5% of the scroll area.

CONCLUSION: Postural balance measured by posturography is little influenced by anthropometric variables with eyes open and closed. Postural balance is more influenced by anthropometric factors in the men than those of women. Height is the anthropometric variable that most influenced the postural balance among the three groups, with eyes open and closed. The balance between men and women measured by posturography is equal, except for the lateral displacement and average speed of oscillation, which are larger in women.

RESULTS: a. Because, as women age.

CONCLUSIONS: a. Despite the fact that the American Congress of Obstetricians and Gynecologists recommends pregnant women who are free of obstetrical complications engage in regular leisure physical activity for the benefits of fetal and maternal health.

INTRODUCTION: Postpartum Latinas have high rates of obesity and a risk for obesity-related metabolic disorders, yet their physical activity (PA) rates are often quite low. Chronic sub-clinical inflammation is associated with obesity. We determined mRNA expression levels of inflammatory markers Interleukin-6 (IL-6), Interleukin-8 (IL-8), and Tumor Necrosis Factor α (TNF-α) associated with obesity may exacerbate risk for metabolic disorders and pro-inflammatory cytokines released by fat tissue contribute to systemic inflammation.

METHODS: Postpartum Latinas have high rates of obesity and are at risk for obesity-related metabolic disorders, yet their physical activity (PA) rates are often quite low. Chronic sub-clinical inflammation associated with obesity may exacerbate risk for metabolic disorders and pro-inflammatory cytokines released by fat tissue contribute to systemic inflammation.

PURPOSE: To determine if fat tissue inflammation correlates with daily PA in postpartum Latinas.

METHODS: Fat tissue inflammation correlations with daily PA in postpartum Latinas. We determined mRNA expression levels of inflammatory markers Interleukin-6 (IL-6), Interleukin-8 (IL-8), and Tumor Necrosis Factor α (TNF-α) in fat tissue using Real Time PCR. Plasma concentrations of IL-6 and IL-8 were measured using Enzyme Linked Immunosorbent Assay. Data are presented as Mean±SD.

RESULTS: a. Postpartum Latinas have high rates of obesity and are at risk for obesity-related metabolic disorders, yet their physical activity (PA) rates are often quite low. Chronic sub-clinical inflammation associated with obesity may exacerbate risk for metabolic disorders and pro-inflammatory cytokines released by fat tissue contribute to systemic inflammation.

CONCLUSION: The correlation between the mRNA expression levels of inflammatory markers in fat tissue with sedentary time and, inversely, with light PA is strengthened by the inverse correlation between the two types of activity. These results indicate that even light PA incorporated in daily routine, independent of more intense PA, may already reduce inflammation in fat tissue in postpartum Latinas. Moderate-intensity intervention will likely further reduce fat tissue and systemic inflammation, thus minimize risk for obesity-related diseases.

CONCLUSIONS: a. Despite the fact that the American Congress of Obstetricians and Gynecologists recommends pregnant women who are free of obstetrical complications engage in regular leisure physical activity for the benefits of fetal and maternal health.

A-41 Free Communication/Poster - Pregnancy Postpartum

MAY 30, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall
activity, women who are pregnant engage in less physical activity than their nonpregnant counterparts. Pregnant women often report a lack of knowledge concerning the safety of exercising during pregnancy and believe that if they received information related to how to safely and effectively exercise during pregnancy it would facilitate their engagement in physical activity.

PURPOSE: To explore the relationship between healthcare providers’ beliefs that sedentary and/or overweight pregnant women should begin exercise and their current practices regarding exercise counseling.

METHODS: Obstetricians and certified nurse midwives who provide obstetric care for women residing in Denver-Aurora completed a cross-sectional survey, containing a total of 48 items, assessing their current beliefs and practices pertaining to antenatal physical activity.

RESULTS: The sample included 102 healthcare providers (HCPs) with the majority of respondents being obstetricians (70.6%), female (79.4%), non-Hispanic white (87%) and reporting an average of 18.7 years of healthcare experience (SD=10.2 years, range=3-41 years). Overall, HCPs reported that they discuss exercise with approximately 73% (SD=26.8%) of their patients. The majority of HCPs (92%) also believe that sedentary patients should begin an exercise program during pregnancy; however, only 47% reported that they always or often discuss physical activity with their sedentary patients. Further, HCPs more strongly believed that overweight and sedentary patients should begin an exercise program, compared to only sedentary patients (p=0.0042).

CONCLUSIONS: These data suggest that, in general, HCPs believe that women who are free of obstetric complications should engage in regular physical activity during pregnancy. However, many HCPs are not currently providing antenatal physical activity anticipatory guidance. Further analysis is warranted to determine other factors (e.g. perceived provider, practice, and patient level barriers) that may be influencing providers’ ability or decision to deliver physical activity counseling. Supported by AHRIQ #1R03HS018595-01A1.

### 1474 Board #255 MAY 30 9:30 AM - 11:00 AM

**The Effects of Supervised Exercise and Telehealth Support on Postpartum Health-Related Physical Fitness**


(No relationships reported)

Excessive gestational weight gain and failure to return to a healthy body weight within one year postpartum heightens a woman’s risk for obesity and related co-morbidities. Moreover, the transition to motherhood (including various barriers to physical activity participation) often leads to a decline in health-related physical fitness. Therefore, physical activity interventions tailored to the unique needs of postpartum women are needed.

PURPOSE: This prospective randomized intervention study examined changes in health-related physical fitness after participation in either supervised mom-and-baby fitness classes (Fit 4 Two) or telehealth physical activity support (the Physical Activity Line) versus control.

METHODS: Thirty-three women (6 wks to 11 mo postpartum) were assigned randomly to one of three conditions for 10 wks: 1) the Fit 4 Two group (twice/wk, n = 11), 2) the Physical Activity Line group (twice/wk, n = 11), or 3) a usual activity control group (n =11). Health-related physical fitness (BMI, grip strength, push-ups, flexibility, and aerobic fitness) was measured pre- and post-intervention.

RESULTS: In both the Fit 4 Two and the Physical Activity Line group, key changes included a similar reduction in BMI (-2.1 ± 2.4% and 1.6 ± 2.2%, respectively), greater change in flexibility (8 ± 9% and 9 ± 9%, respectively), significant increases in aerobic capacity (4 ± 5% and 3 ± 5%, respectively), and an increase in number of push-ups completed in comparison to the control group. There was no significant change in grip strength in the three conditions.

CONCLUSION: Fit 4 Two and telehealth physical activity support are effective at improving health-related physical fitness in postpartum women. A novel telehealth program can lead to similar changes in various indicators of health-related physical fitness versus supervised exercise.

### 1475 Board #256 MAY 30 9:30 AM - 11:00 AM

**Exercise During Pregnancy Decreases Cesarean Rate In Nulliparous Women**

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Exercise during pregnancy may influence the course of labor and mode of delivery by affecting metabolic and hormonal changes, uterine contractility, endurance, and muscle strength. Given the worldwide rising cesarean delivery (CD) rates over the past decades, the search for modifiable factors associated with CD is needed.

PURPOSE: To investigate the association between exercise during pregnancy and CD, both acute and elective, in nulliparous women.

METHODS: We used data from a population based pregnancy cohort study, involving 25,160 nulliparous women with a singleton pregnancy who were enrolled in the Norwegian Mother and Child Cohort Study (MoBa) between 2000 and 2006. Acute and elective Cesarean deliveries obtained from the Medical Birth Registry of Norway were the main outcome variables. Information on exercise frequency and type was assessed by two questionnaires in pregnancy weeks 17 and 30. From the generalized linear model, adjusted risk differences (RD) with 95% CI for different frequencies and types of exercise during pregnancy were reported.

RESULTS: The total CD rate was 15.6% (n=3928), in which 67.8% (n=2663) was acute CD. CD rates, both acute and elective type, were reduced in women exercising during pregnancy compared to non-exercisers. The greatest risk reduction was observed for acute CD among women reporting a high weekly frequency of exercise (76 times per week) during pregnancy weeks 17 and 30 (-3.8%, 95% CI -5.7, -2, and -4.5%, 95% CI -6.5, -2.4, respectively). Participation in high impact exercises such as jogging, running, ballgames orienteering or high-impact aerobics in weeks 17 and 30, was associated with the largest reductions in risk (-5.1%, 95% CI -6.9, -3.3, and -6.2 %, -9.4, -3.0, respectively) compared to non-exercisers. For elective CD, exercising 1-2 per week in week 17 showed the greatest RD (-2.2%, -3.0, -1.4), whereas women had to exercise at least 6 times a week in week 30 to reach comparable risk reductions (-2.1%, -3.3, -0.9).

CONCLUSIONS: Nulliparous women exercising during pregnancy had a substantially reduced risk of having a CD, in particular acute CD. A "can do" attitude towards labor and self-efficacy may also play a role here.

### 1476 Board #257 MAY 30 9:30 AM - 11:00 AM

**Comparison of Two BodyMedia Algorithms for Estimating Energy Expenditure During Mid-Pregnancy.**

Katie M. Smith, Lorraine M. Lanningham-Foster, Gregory J. Welk, FACSM, Christina G. Campbell. Iowa State University, Ames, IA.

(No relationships reported)

Excessive gestational weight gain (GWG) is an independent risk factor for future maternal chronic disease. Accurate assessment of physical activity (PA) is required to appropriately control for energy expenditure (EE) when evaluating GWG. Metabolic alterations during pregnancy complicate the assessment of PA and EE in pregnant women. The BodyMedia SenseWear® Mini armband monitor has been shown to provide accurate estimates of EE in adults but has not been tested in pregnancy.

METHODS: The purpose of the study was to evaluate the accuracy of the SenseWear® Mini physical activity armband (SWA) in predicting EE in pregnant women performing activities of daily living (ADLs). A secondary aim was to assess how a new proprietary algorithm (v5.2) performed relative to an older algorithm (v2.2).

RESULTS: Twenty-three women completed a series of ADLs between 22-24 weeks of pregnancy. Activities included typing, folding laundry while standing, sweeping, and treadmill walking at speeds of 2.0, 2.5, 3.0 mph, 0% incline and 3.0 mph, 3% incline. Participants wore the SWA on their left arm and had oxygen consumption measured by indirect calorimetry (IC). Data from both IC and SWA were processed on a minute-by-minute basis. Correlation analyses and a mixed model analysis of variance were used to examine agreement between the measures.

RESULTS: Average individual correlations between IC and SWA were 0.857 and 0.865 for the old and new algorithm respectively. The model analysis showed significant main effects for the algorithm (F-Value 6.98, P < 0.01) and activity (F-Value 21.5, P < 0.0001). Both algorithms significantly overestimated EE for all activities except walking at 3.0 mph, 3% incline; however, follow-up tests showed that the new algorithm had significantly less error than the old algorithm (0.594 kcal/min vs 0.804 kcal/min, respectively). Post-hoc analysis for the activities showed non-significant differences between algorithms for all activities except sweeping (P = 0.0304).

CONCLUSION: Both algorithms significantly overestimated EE compared to IC but the newer algorithm had less error. Additional training of the algorithms with pregnancy-specific data could minimize the overestimation of EE for this population.
Recall questionnaires use MET values from the Compendium of Physical Activities (Compendium: Ainsworth, et al. 2011) to assess energy expenditure (EE) for pregnant women, but the validity of this practice has not been well-established.

**PURPOSE:** The purposes of this study were 1) to compare actual EE in pregnant women to MET values listed in the Compendium, and 2) to evaluate EE longitudinally across pregnancy and postpartum periods.

**METHODS:** Fifteen pregnant women were tested at 20 and 32 weeks gestation, seven of whom were also evaluated at 12 weeks postpartum. Participants were 18-35 years old, nonsmokers, and considered low-risk by their healthcare providers. Each participant was tested in our laboratory, and equipped with a portable gas analyzer to measure EE via indirect calorimetry. Resting EE was determined during ten minutes of left lateral/supine rest. Women performed a series of five-minute activities ranging from light to vigorous. MET values were calculated for each activity by dividing steady state relative VO_{2s} by actual resting EE measured at each time point. MET values for each activity at 20 and 32 weeks gestation were compared to MET values listed in the Compendium using a one sample t-test. For the women with postpartum data, EE across the three time points were evaluated using repeated measures ANOVA.

**RESULTS:**

- **Compared to the Compendium,** observed MET values for laundry, dusting, sweeping, and aerobics were lower (range= -0.2 to -2.8 METS, effect sizes (ES)= 0.6 to 4.1; p<0.05) at both pregnancy time points, while child care and walking were higher (range=0.4 to 1.1 METS; ES=0.6 to 1.9; p<0.05). Longitudinal analysis revealed that resting EE was significantly higher (0.2 METS; ES=0.55) and dusting was significantly lower (-0.5 METS; ES=0.75) at 32 weeks gestation compared to 12 weeks postpartum (p<0.05). Average MET values for all other activities were lower at 32 weeks gestation than at 12 weeks postpartum, however these differences were not statistically significant.

**CONCLUSION:** Compendium MET values may not be accurate during pregnancy, and the direction of measurement errors do not appear consistent. Future research with larger samples is needed to corroborate these results.

**A-42 Free Communication/Poster - Renal**

MAY 30, 2012 7:30 AM - 12:30 PM

**Measurement of Energy Expenditure During Pregnancy and Postpartum**

Rebecca A. Schlaff, Alaina K. Vince, Karin A. Pfeiffer, FACSM, Kimberly Maier, James M. Pivarnik, FACSM. Michigan State University, East Lansing, MI.

(No relationships reported)

Studies have shown that exercise training improves arterial stiffness in healthy populations, but there is little research investigating the relationship between physical function and arterial health in hemodialysis patients. The few studies that have assessed this relationship have used indirect measures of arterial stiffness, such as central pulse wave velocity and augmentation index, and the results from these studies have been equivocal.

**PURPOSE:** The purpose of this study was to evaluate the relationship between physical function and arterial stiffness in hemodialysis patients using β-stiffness via ultrasound, which is a direct measure of arterial stiffness.

**METHODS:** Forty-nine hemodialysis patients were recruited (29 men, 20 women; 54.7±1.9 years). Arterial stiffness index (β) was measured by applanation tonometry and ultrasound. Physical function was measured by a validated shuttle walk test and a battery of objective physical performance tests. Patients were divided into high function (HF; n=26) and low function (LF; n=23) groups according to the scores of the physical function tests. One-way analysis of variance (ANOVA) was used to evaluate the difference between groups. Bivariate analyses were performed to assess the associations between β-stiffness and physical function tests.

**RESULTS:** Among 49 subjects, β-stiffness was significantly correlated with physical function tests, including gait speed, shuttle walk distance, and time on 8-foot up-and-go test (r=0.33, -0.30, and 0.34, respectively; p<0.05), but not with repetitions of arm-curl and chair-stand. B-stiffness was greater in the LF group (13.9±1.2) compared to the HF group (10.1±0.9; p<0.05).

**CONCLUSION:** In contrast to previous studies showing equivocal evidence that exercise training improves arterial stiffness, we found a close relationship between reduced physical function and increased arterial stiffness in hemodialysis patients. The increased arterial stiffness observed in the LF group suggests that the patients with lower fitness level may have increased cardiovascular disease risk. We have an ongoing longitudinal clinical trial to confirm these findings, and assess if exercise training improves β-stiffness in hemodialysis patients.
RESULTS: it was utilized the t student test with value of \( P<0.05 \).

CONCLUSIONS: and 60% of 1MR in the other weeks. Each session was composed of 3 series of 12 repetitions with two minutes resting intervals between the exercises. For data analysis (mean± standard error)

CONCLUSIONS: and leg extension 10± 1.32 vs 7± 0.70.

BACKGROUND: Then, it was realized the 1 maximum repetition test (1MR), during the hemodialysis, before and after the training, in order to obtain strength values and exercise load estimative for

CONCLUSION: Although higher BMI is associated with lower mortality in patients undergoing hemodialysis, this study differentiated the contributions of BMI, LM and FM to CVD risk in this population. We found that increased LM is a predictor of reduced arterial stiffness, and higher percent body fat is associated with decreased functional performance in hemodialysis patients. However, longitudinal studies are needed to confirm these findings.

CONCLUSION: Low exercise capacity is associated with poor myocardial and vascular function in patients with CKD.

RESULTS: The lowest fitness group (VO\(_2\) peak) had worse diastolic function (\(E'/e'\) 16.0a10.0 vs. 11.5a5.2), central (aPWV 11.1a3.5 vs. 8.5a1.8) and systemic arterial stiffness (Alx 22.2a7.8 vs. 17.2a8.2) than the highest fitness group (VO\(_2\) peak 28.2a7.7) (p<0.05). Whilst the middle fitness group (VO\(_2\) 21.7a4.2) had significantly worse central (aPWV 10.2a2.5) and systemic arterial stiffness (Alx 23.6a7.8) compared to the highest fitness group (p<0.05). Patients who achieved age predicted VO\(_2\) peak had significantly lower cIMT, reduced aPWV and were less likely to have myocardial ischaemia (p<0.05). Clinical associates of VO\(_2\) peak were BMI (r =-334, p<0.001), diabetes (r =-380, p<0.001), phosphate (r =-334, p<0.001), HbAlc (r =-306, p<0.001), physical activity (r =-219, p=0.026) and LDL cholesterol (r =-239, p<0.016). VO\(_2\) peak was negatively associated with outcome; atheroma (cIMT, r =-219, p=0.028), diastolic function \(E'/e'\) r =-283, p=0.004), arterial stiffness (aPWV, r =-373, p=0.001) and (Alx, r =-373, p=0.001).

CONCLUSION: Exercise Capacity Is Associated With Myocardial And Vascular Function In Patients With Chronic Kidney Disease

CONCLUSION: The loss of body mass is common in chronic kidney disease (CKD) patients, and it is a great predictor of mortality in this population. Around 91% of the patients with CKD need hemodialysis as substitutive renal therapy (SRT). In Brazil the number of patients utilizing this treatment in 2009 was 77,589. The decrease of life quality in this population can also be attribute to other factors as psychological alterations, comorbidities, biological aging, malnutrition, oxidative stress, use of corticosteroids and the hemodialysis process itself. Studies show that resistance training (RT) can be efficient on power gain and improve to life quality in CKD patients, analyzed by questionnaires and functional capacity tests. PURPOSE: To determine the relationship between exercise capacity (VO\(_2\) peak), clinical factors and myocardial and vascular parameters in patients with CKD.

METHODS: To determine the relationship between exercise capacity (VO\(_2\) peak), clinical factors and myocardial and vascular parameters in patients with CKD.

METHODS: There were recruited 11 patients in hemodialysis clinic Oswaldo Ramos (UNIFESP), we included both male and female patients with age between 20 and 76 yrs and dialysis treatment >3 months. The body mass index (BMI) was 25.2a5.2 characterizing overweight. Previous RT, the patients were submitted to exercise test, echocardiography and physical evaluation. Then, it was realized the 1 maximum repetition test (1MR), during the hemodialysis, before and after the training, in order to obtain strength values and exercise load estimative for each exercise. The RT was constituted of seven exercises, being: 3 to upper limb and 4 to lower limb realized on 6 weeks period, with exercise intensity of 40% of 1MR on the first 3 weeks and 60% of 1MR in the other weeks. Each session was composed of 3 series of 12 repetitions with two minutes resting intervals between the exercises. For data analysis (mean± standard error) it was utilized the t student test with value of p<0.05.

RESULTS: On the 1MR tests we found strength increase (kg) after training, on the following exercises: shoulder press \(8a.0.55\) vs \(7a.0.51\); biceps \(8a.0.47\) vs \(7a.0.61\), triceps \(5a.0.56\) vs \(4a.0.82\) and leg extension \(10a.1.32\) vs \(7a.0.70\).

CONCLUSIONS: Intradialysis resistance exercise promotes power increase in CKD patients which may improve their life quality.

CONCLUSION: Intradialytic protein supplementation reduces inflammation and improves physical function

METHODS: Sixty MHD patients were randomly assigned to receive whey protein, soy protein, or placebo. On days separated by one week, blood was drawn both immediately after initiation of dialysis and again three hours later and analyzed for serum Interleukin-6 (IL-6). For the first day, subjects received no study beverage to measure baseline response to a single dialysis session. One week later, the subject consumed their study beverage immediately prior to the start of dialysis and blood was again collected as described. A subset of subjects (n=29) continued
to receive their respective study beverage during dialysis sessions for six months. Standard clinical laboratories were drawn monthly and High Sensitivity C-reactive protein (CRP), IL-6, and measures of physical function were measured at baseline and six months.

**RESULTS:** When no study beverage was provided, IL-6 increased during a single dialysis session in all groups. The rise in IL-6 was attenuated by intradialytic protein supplementation (p<0.05). At six months, repeated measures ANOVA revealed a time by treatment effect for reduced IL-6 with protein supplementation in relation to the control group (p<0.05). A similar but non-significant trend was observed for CRP (p>0.089). For functional measures, there was an interaction effect for shuttle walk with the Wistar group improving over six months (p<0.05).

**CONCLUSION:** Intradialytic protein supplementation attenuates the rise in inflammation during an individual dialysis session. Chronic supplementation reduces inflammation and improves physical function, suggesting intradialytic protein supplementation may represent a low-cost intervention to reduce inflammation and improve function in MHD patients.
Myostatin is a negative regulator of muscle growth and a member of the transforming growth factor-β family partly by being a negative regulator of satellite cells proliferation and differentiation and plays thereby a critical role in development, repair and regeneration of ‘adult’ muscle. It is produced within the muscle cell thereafter transported out of the cell and binds to the activin receptor 2b, which is located in the cell membrane. The binding to act2b receptor activates the type 1 receptor enhancing SMAD-signaling. Myostatin gene expression has been shown, by others, to increase following periods of muscle inactivity and decrease following acute resistance training. We have found that myostatin also decreases after sprint exercise (unpublished observation). How the myostatin gene expression is regulated in these situations is not known. From cell studies, it has been shown that myostatin auto-regulates its own expression through a SMAD7-dependent negative feedback loop.

**PURPOSE:** To test the hypothesis that SMAD7 is involved in the regulation of the gene expression of myostatin in human skeletal muscle after sprint exercise.

**METHODS:** Healthy, physically active and young men and women (n=17) performed three bouts of sprint exercise with 20 minutes rest in between. Muscle biopsies were obtained from quadriceps femoris vastus lateralis at rest and 140 minutes after third bout of exercise. The gene expression of myostatin and SMAD7 was related to rp18 (housekeeping gene) and analyzed by real time-PCR technique. The myostatin at the protein level was analyzed by Western blot technique.

**RESULTS:** Gene expression of SMAD7 increased by 53 % (p=0.0006) and gene expression of myostatin decreased by 52 % (p=0.013). Myostatin at the protein level, did not change by sprint exercise.

**CONCLUSION:** This is, to our knowledge, the first study analyzing SMAD7 in human skeletal muscle after exercise. The increased SMAD7 together with the decreased myostatin gene expression in skeletal muscle after sprint exercise support earlier cell studies showing that SMAD7 is involved in the auto regulation (feed-back regulation) of myostatin gene expression.

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**RESULTS:**

Increased mitochondrial and capillary densities are central components of skeletal muscle remodeling in response to exercise. The transcription co-activator pereoxisome proliferator-activated receptor γ coactivator-1α (PGC-1α) has been shown to be important for this coordination of multiple processes in training-induced skeletal muscle remodeling. Recently, our lab showed for the first time that at least two splice variants of PGC-1α (PGC-1α-a and PGC-1α-b) exist in human skeletal muscle and that they are highly regulated with exercise.

**PURPOSE:** To investigate the temporal resolution of PGC-1α and its splice variants after one acute bout of cycle exercise. Also, to study transcription factors important for mitochondrial biogenesis regulated by PGC-1α, namely NRF-1, Tfm and TFβ1M.

**METHODS:** Healthy men (n=4) and women (n=3) performed one hour of cycling exercise at 70 % of their VO2max. Skeletal muscle biopsies were obtained before and after exercise (pre, 30’, 2h, 6h and 24h).

**RESULTS:** PGC-1α-b mRNA increased significantly at 2h and 6h after exercise compared to pre-values (p<0.01), and had returned to baseline levels at 24 h after the exercise bout. Neither PGC-1α-a nor total PGC-1α-b showed a significant change in mRNA levels in response to exercise. There was no significant change in NRF-1, Tfm or TFβ1M mRNA levels after one bout of cycle exercise.

**CONCLUSION:** This study shows that an upstream promoter of PGC-1α (PGC-1α-b) is massively induced up to 6 h after exercise by a single exercise bout, and that the levels were back to baseline at 24 h after exercise. This implies that the exercise-induced PGC-1α response is more complex than previously suggested. The lack of significant change in PGC-1α-a and total PGC-1α-b is likely due to the low number of subjects.
phosphorylation was increased by 117% and a 14%, respectively, (P<0.05). The Akt phosphorylation was elevated 1.4-fold just after the Wingate test and remained elevated during the first 2 hours after the test (P<0.05). p38-MAPK and ERK1/2 phosphorylations did not change significantly after the sprints. Compared to rest, AS160 phosphorylation was 50% greater 30 minutes after Wingate performed in hypoxia (P<0.05).

CONCLUSIONS: Isokinetic sprint exercise in severe acute hypoxia elicits an essentially similar signaling response to that observed in normoxia, with the exception of a slightly higher AS160 phosphorylation.

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1491 Board #272 MAY 30 11:00 AM - 12:30 PM
Molecular Responses in Skeletal Muscle to Resistance Training in Older Men
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(No relationships reported)

IGF-1 and its splice variant mechano growth factor (MGF) has been suggested to be involved in skeletal muscle regeneration via Erk and/or Akt pathways. Both of these pathways can control protein translation by p70S6K1. Effects of heavy resistance training (RT) on these regulating proteins are still, however, mostly unknown.

PURPOSE: To determine changes in skeletal muscle MGF, Erk, Akt and p70S6K1 protein concentrations and IGF-I and MGF mRNA expression following RT, and their associations with RT-induced changes in muscle strength and mass.

METHODS: Healthy untrained older men (n=12; 5.5 ± 6.5 yrs, 178 ± 3 cm, 80 ± 5 kg, 24 ± 3 fat %) were recruited for the study. RT comprised whole body resistance exercises twice a week with a progressively increased training load for 21 weeks. Maximal concentric strength of leg extensors (1RM), fat free mass (FFM; by bioimpedance) and m.vastus lateralis (VL) thickness (by ultrasound) were measured pre- and post-RT. Experimental heavy resistance exercises (RE; 5 x 10RM leg presses with 2-minute recovery periods) were performed pre- and post-RT. Muscle biopsies were obtained before and 48h after the REs from VL to determine molecular responses during the regeneration phase after RE.

RESULTS: RT led to increases in 1RM (20.8 ± 8.7 %, p < 0.001), FFM (1.6 ± 2.0 %, p < 0.05) and VL thickness (13.6 ± 5.0 %, p < 0.001). Present muscle proteins or mRNAs were not systematically influenced by the REs or RT, except MGF mRNA expression was increased (p < 0.01) after RE before the RT. Changes in IGF-I correlated with changes in VL thickness (r = 0.74, p < 0.05). When RE-induced changes at pre- and post-RT were averaged, MGF protein (r = 0.70, p < 0.05) and Erk (r = 0.67, p < 0.05) were related to changes in 1RM. Changes in pre-to post-RE responses in p70S6K1 were related to changes in FFM (r = 0.71, p < 0.05). Changes in Akt from pre- to post-RT were related to changes in FFM (r = 0.72, p < 0.05).

CONCLUSIONS: Present study demonstrated that the basal levels or RE-induced responses in skeletal muscle MGF, Erk, Akt and p70S6K1 protein concentrations or IGF-I and MGF mRNA expression did not change systematically due to RT in older men. However, individual changes in MGF and Erk protein concentrations may be related to RT-induced changes in muscle strength, and changes in Akt and p70S6K1 may be associated with RT-induced changes in lean body mass.

1492 Board #273 MAY 30 11:00 AM - 12:30 PM
Contraction-Induced rpS6 Phosphorylation Is Attenuated After Chronic Resistance Training But Recovered After Short-Term Detraining
Riki Ogasawara1, Yi-Wei Zhang2, Hidetaka Doi1, Arata Tsutaki3, Chiharu Komatsu1, Takashi Abe1, Satoshi Fujita1, Koichi Nakazato2, Naokata Hibi3.
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(No relationships reported)

Resistance training-induced muscle anabolism and subsequent hypertrophy is most rapid during early phase of training, and it becomes progressively slower with time. However, little is known about the intracellular signaling mechanisms underlying such changes in muscle to training stimulus.

PURPOSE: To investigate the changes in exercise-induced activation (phosphorylation) of signaling proteins associated with muscle protein anabolism during chronic resistance training and subsequent detraining.

METHODS: Twenty male SD rats were divided into 4 groups: one bout group (1B), 12 bouts group (12B), 18 bouts group (18B), and detraining group (DT). In the DT group, rats were detrained for 12 days after completion of 12 exercise sessions and then completed one exercise session before sacrificed. The right gastrocnemius muscle was isometrically trained (maximal isometric contraction was produced via percutaneous electrical stimulation) every other day, whereas the left gastrocnemius muscle served as an internal control (CON). Muscles were removed 24h after the last exercise session. Phosphorylation and total protein levels of p70S6K, 4E-BP1, rpS6, and p90RSK were determined by Western blotting.

RESULTS: The wet weight of exercised muscle increased by 8.6% in 12B and 10.7% in 18B group (P<0.05 vs CON). Twelve days of detraining did not decrease muscle wet weight (8.8% above the weight of CON; P>0.05 vs CON). 12B vs 12D group. Acute exercise increased p70S6K (1.3-fold), 4E-BP1 (1.8-fold), rpS6 (3.1-fold), and p90RSK (1.8-fold) phosphorylation 24 h after exercise in 1B group (all P<0.05 vs CON). However, repeated bouts of exercise blunted the phosphorylation of rpS6 and p90RSK in 12B or 18B groups (rpS6: 0.9- and 1.8-fold, p90RSK: 1.0- and 1.6-fold, all P>0.1 vs CON). Interestingly, the phosphorylation of rpS6 and p90RSK were restored following 12 days of detraining in DT group (pS6: 2.6-fold, p90RSK: 2.0-fold, both P<0.05 vs CON). Phosphorylation of p70S6K and 4E-BP1 were not altered with chronic training and detraining.

CONCLUSION: These results suggest that with chronic resistance training, specific signaling become less sensitive to resistance exercise stimulus even muscle is contracted maximally but those are restored after a short detraining period without attenuation of muscle mass.

1493 Board #274 MAY 30 11:00 AM - 12:30 PM
Botanical Supplement Effects On Nuclear Factor Kappa B (NF-kB) DNA-binding Activity Following Eccentric Exercise
Ling Xin1, Shiyam Ramakrishnan1, Robert D. Hyl dra1, Karen L. Riska1, Stuart Chipkin1, Monica J. Hubal, FACSM2, Mary A. Murray2, Valerie Gregor3, Prakash Prabhakar4, Karen Shaver4, Priscilla M. Clarkson, FACSM2, 1UMASS at Amherst, Amherst, MA. 2Nutrilite Health Institute, Buena Park, CA. 3Children’s National Medical Center, Washington, DC. 4Interleukin Genetics, Inc., Waltham, MA.

(No relationships reported)

Inflammation and oxidative stress contribute to exercise-induced muscle damage (EIMD). NF-kB is an important redox-sensitive molecule that increases gene expression of many pro-inflammatory mediators. Because evidence has shown that NF-kB signaling pathway is activated after exercise, antioxidant supplements may exert beneficial effects against EIMD via inhibiting NF-kB activation.

PURPOSE: To examine the effects of two novel botanical supplements containing mixtures of plant extracts with anti-inflammatory and antioxidant properties on NF-kB DNA-binding activity following eccentric exercise.

METHODS: 26 healthy men (18-30yrs) were randomly assigned to receive the placebo (N=8), Supplement 1(N=10), or Supplement 2 (N=8) for 35d. Stage 1 - subjects exercised one leg (knee extendors) and a muscle biopsy of both legs (vastus lateralis) was taken at ~3.5h post-exercise. Stage 2 - subjects took supplements or placebo for 28d. Stage 3 - subjects repeated the exercise and tests with the contralateral leg. NF-kB DNA-binding activity of biopsies samples was measured using ELISA-based TransAM NF-kB p65 assay kit (Active Motif, Carlsbad, CA). Data were expressed as either absorbance at 450 nm or the percentage of p65 DNA-binding activity of eccentric exercised (ECC) leg relative to control (CON) leg. Paired t-test and repeated measures ANOVA were performed to analyze the data.

RESULTS: p65 DNA-binding activity was increased following eccentric exercise in both Stage 1 (ECC 0.24 ± 0.01 vs CON 0.20 ± 0.01(Means SE); p<0.001) and Stage 3 (ECC 0.22 ± 0.01 vs CON 0.21 ± 0.01; p<0.05). Compared with Stage 1(122.9% ± 2.6%), NF-kB DNA-binding activity was significantly decreased in Stage 3 (109.1% ± 3.0%; p<0.002). There was no significant Treatment effect or Treatment X Stage interaction.

CONCLUSION: The botanical supplements had no effect on changes in NF-kB DNA-binding activity following eccentric exercise. However, the increased response of NF-kB DNA-binding activity post-exercise was attenuated in Stage 3. This attenuation effect may be due to a blunted systemic inflammatory response following a repeated bout of eccentric exercise with the contralateral leg.

Supported by Interleukin Genetics, Inc, Waltham, MA and Nutrilite Health Institute, Buena Park, CA.
Rapid Ryanodine Receptor-1 Phosphorylation Responds Differently Between Concentric And Eccentric Workload In Rat Skeletal Muscle

German Sport University Cologne, Cologne, Germany.

METHODS: Six healthy male subjects (age: 23 ± 2 years, height: 185 ± 7 cm, and weight: 82 ± 5 kg) performed 3 sets with 8 repetitions of maximum eccentric knee extensions. Muscle biopsies were taken PRE exercise, 15 min, 30 min, and 60 min post EX. Immunohistochemistry, western blots and confocal microscopy were used to determine pRyR1Ser2844 and pAMPKThr172 phosphoryl. levels at the respective time points.

RESULTS: pRyR1Ser2844 phosphoryl. increased rapidly at 15 min in both type I and II myofibers (p<0.01) and further showing a sustained phosphoryl. pattern up to 30 min (p<0.01) post EX. Compared to baseline levels, type I fibers showed higher increases in phosphoryl. levels of pRyR1 up to 60 min post EX (p<0.05) than type II myofibers. pAMPKThr172 phosphoryl. showed significant increases 15 to 30 min post EX (p<0.01) in type I and II myofibers with a higher increase in phosphoryl. levels in Type I myofibers.

CONCLUSION: Severe resistance exercise contributes to temporarily increased phosphoryl. of RyR1 and AMPK due to active recruitment of myofibers. This result supports the hypothesis that RyR1 can be rapidly phosphorylated by resistance exercise and very likely contributes to muscle fatiguing by a decline in calcium handling properties. Enhanced phosphoryl. of RyR1 is sustained up to 60 min post EX in both myofibers what may contribute up to this time point to impaired skeletal muscle contraction abilities.

Rapid Ryanodine Receptor-1 Phosphorylation In Response To High Intense Resistance Exercise In Human Skeletal Muscle

German Sport University Cologne, Cologne, Germany.

METHODS: 34 healthy male subjects (age: 23 ± 2 years, height: 185 ± 7 cm, and weight: 82 ± 5 kg) performed 3 sets with 8 repetitions of maximum concentric knee extensions. Muscle biopsies were taken PRE exercise, 15 min, 30 min, and 60 min post EX. Immunohistochemistry, western blots and confocal microscopy were used to determine pRyR1Ser2844 and pAMPKThr172 phosphoryl. levels at the respective time points.

RESULTS: pRyR1Ser2844 phosphoryl. increased rapidly at 15 min in both type I and II myofibers (p<0.01) and further showing a sustained phosphoryl. pattern up to 30 min (p<0.01) post EX. Compared to baseline levels, type I fibers showed higher increases in phosphoryl. levels of pRyR1 up to 60 min post EX (p<0.05) than type II myofibers. pAMPKThr172 phosphoryl. showed significant increases 15 to 30 min post EX (p<0.01) in type I and II myofibers with a higher increase in phosphoryl. levels in Type I myofibers.

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Igf-1 Downstream Signaling Response To Protein Rich Supplementation During Hindlimb Suspension

Taejeong Song. University of Texas at Austin, Austin, TX.

METHODS: It was examined whether high protein supplementation would elevate phosphoryl. of Akt and downstream pathways and maintain muscle function during hindlimb suspension (HS).

RESULTS: fortified HS-PRO compared to HS and CON at 28 days after HS, -19 and -22.5% respectively (P <0.01). However, in- situ peak tetanic force (Po) of HS-PRO was significantly higher than HS by 12% (P<0.05) but lower than CON by 25% (P<0.01). Phosphorylation of Akt in HS-PRO was significantly increased to CON, and pFOXO3a was also elevated in HS-PRO compared to CON and HS (P<0.05 and P<0.01 respectively). In addition, the supplementation prevented the reduction of mTOR phosphoryl. during HS, -31 and -34% compared to CON and HS-PRO respectively (P <0.05), but there was no difference in p70S6K phosphoryl. between groups. Total protein contents of all detected proteins were not changed.

CONCLUSION: Although protein rich supplementation was not able to prevent the loss of muscle mass during prolonged HS, it reduced the decrease of contractile function, and elevated pAkt and pFOXO3a while maintained pmTOR.

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Influence Of Age On Leptin Induced Skeletal Muscle Signalling

Amelia Guadahpe-Grau, Steen Larsen, Borja Guerra, Flemming Della, Jørn W Helge.
University of Copenhagen, Copenhagen, Denmark.

METHODS: Lower limbs of female rats were subjected to unloaded by tail suspension for 28 days. During this period, one group (HS-PRO) was provided high protein supplementation (5ml/kg body weight), but others (HS) was received water via gavage twice per day, and ambulatory rats were served as control group (CON). After 28 days, contractile function of lateral gastrocnemius (LGAS) was evaluated, and both LGAS were excised and stored at -80°C. Total and phosphoryl. levels of Akt, mTOR, p70S6K, and FOXO3a were measured from the sampled muscle by Western blot analysis.

RESULTS: LGAS weight was significantly decreased in HS and HS-PRO compared to that of CON at 28 days after HS, -19 and -22.5% respectively (P <0.01). However, in- situ peak tetanic force (Po) of HS-PRO was significantly higher than HS by 12% (P<0.05) but lower than CON by 25% (P<0.01). Phosphorylation of Akt in HS-PRO was significantly increased to CON, and pFOXO3a was also elevated in HS-PRO compared to CON and HS (P<0.05 and P<0.01 respectively). In addition, the supplementation prevented the reduction of mTOR phosphoryl. during HS, -31 and -34% compared to CON and HS-PRO respectively (P <0.05), but there was no difference in p70S6K phosphoryl. between groups. Total protein contents of all detected signals were not changed.

CONCLUSION: Although protein rich supplementation was not able to prevent the loss of muscle mass during prolonged HS, it reduced the decrease of contractile function, and elevated pAkt and pFOXO3a while maintained pmTOR.

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METHODS. Muscle biopsies were obtained in fourteen young (YG), seventeen middle-aged (MG), and eight aged (AG) healthy lean men (age: 25 ± 2, 46 ± 1, 62 ± 2 yrs, and BMI: 24.3 ± 0.5, 25.5 ± 0.3, 25.0 ± 0.7 kg/m², respectively). Protein expression of OBRβ, STAT3, AMPK, PTP1B and SOCS3 was measured by Western Blot. Plasma leptin, glucose, insulin and FFA were measured by conventional assays. Insulin sensitivity was estimated by HOMA. Body composition was measured by DXA.

RESULTS. Fat mass, FFA and leptin plasma concentrations were higher in MG and AG group than YG (P < 0.05), whereas HOMA values did not differ between the groups. OBRβ protein abundance was similar among groups; however, Thy705STAT3 phosphorylation was lower in AG and MG compared to YG (0.29 ± 0.05; 0.32 ± 0.11 and 0.63 ± 0.20 a.u., respectively, P < 0.05). Surprisingly, Thr172AMPK phosphorylation was 2-fold higher in AG than in MA and YG groups (2.94 ± 0.05; 1.32 ± 0.29 and 1.74 ± 0.17 a.u., respectively, P < 0.05). SOCS3 expression remained unchanged, whereas PTP1B expression was higher in the AG compared with MG and YG (P < 0.05).

CONCLUSION. Skeletal muscle 170 KDA OBRβ protein amount is not affected by aging. However, a lower basal phosphorylation of Thy705STAT3 and a higher abundance of PTP1B suggest that leptin resistance is increased with aging in healthy lean males. It is possible that increased phosphorylation of Thr172AMPK is a compensatory mechanism to attenuate this change.
CONCLUSION: Sex-based differences exist in skeletal muscle transcriptional regulation that may play a major role in the muscle’s aging process in women but not in men. Moreover, given that immune activation, ECM remodeling, lipids storage, mitochondrial dysfunction, and muscle atrophy have all been implicated in muscle insulin resistance, altered transcriptional regulation in these biological pathways may represent novel mechanisms for age-associated insulin resistance, especially in women.

1501 Board #282  MAY 30  11:00 AM - 12:30 PM
Erk and p38 Phosphorylation Following Three Different Maximal Velocity Squat Protocols
Rebecca Kudrna1, Nicole Moodie2, Michael Prewitt1, Andrew Fry1, Phillip Gallagher3. 1DeSales University, Center Valley, PA. 2Rockhurst University, Kansas City, MO. 3University of Kansas, Lawrence, KS.
(No relationships reported)

Changes in the cellular signaling molecules within skeletal muscle are believed to account for the specific adaptations that occur following various types of exercise. Mitogen activated protein kinases (MAPKinas) including extracellular regulated kinase1/2 (ERK1/2) and stress-activated kinase (p38) that likely play a role in muscle adaptation. While it has been shown that these kinases are affected by aerobic and anaerobic exercise, less is known about how these molecules are affected by different resistance training protocols.

PURPOSE: The purpose of this study was to determine the effect of low, moderate, and high intensity exercise protocols as are commonly used by athletes on the phosphorylation of ERK1/2 and p38 MAPKinas.

METHODS: Nine recreationally trained males (21.4 ± 1.67 yrs, 92.23 ± 9.72 kg), completed each of three speed squats (emphasizing speed of the concentric phase) protocols in randomized order and on non-consecutive days. The three testing protocols consisted of a low relative intensity (LI; 5 sets of 10 repetitions at 30% 1RM); moderate intensity (MI; 5 sets of 5 repetitions at 70% 1RM); and high Intensity (HI; 5 sets of 3 repetitions at 90% 1RM). Muscle biopsies were taken before and after each exercise bout and examined by western blot analysis. Separate 3x2 repeated measures ANOVAs compared differences between the phosphorylation of the three protocols and at the pre- and post- exercise time points for ERK1/2 and p38 respectively.

RESULTS: For ERK1/2, there was a significant main effect for time(F(2,16) = 6.86, p = 0.031). Ratio of phosphorylated to total ERK1/2 increased by 33%, 36%, and 43% for the HI, MI, and LI respectively but was not significantly different between protocols (F(2,16) = 0.186, p>0.05). There was no interaction between protocol and timepoint for ERK1/2. There were no significant main effects or interactions for p38 phosphorylation (p>0.05).

CONCLUSIONS: ERK1/2 phosphorylation was equally elevated following each of the three lower body resistance training protocols examined. Though not measured in this study, force production under these three different circumstances may have been more similar than the external exercise load indicates due to the maximal velocity contraction. p38 phosphorylation did not change following the short bouts of exercise in this study.

1502 Board #283  MAY 30  11:00 AM - 12:30 PM
A Polymorphism Of Angiotensin-converting Enzyme Gene Does Not Affect Exercise-induced Muscle Damage Following Eccentric Muscle Contractions
Joyoung Kim1, Kyu-Wan Lee1, Changsun Kim1, Jooyoung Lee1, 1Kookmin University, Seoul, Korea, Republic of. 2Dongduk Women’s University, Seoul, Korea, Republic of.
(No relationships reported)

It is well demonstrated that angiotensin-converting enzyme (ACE) is one of the critical factors for renin-angiotensin system leading to vasoconstriction. It is also known to be related to exercise metabolism and performance including muscle strength and endurance. A recent study showed that ACE genotype may be related to creatine kinase activity following eccentric exercise but other muscle damage markers were not compared.

PURPOSE: To investigate whether ACE genotype can affect exercise-induced muscle damage to explain a large inter-subject variability shown after eccentric muscle contractions.

METHODS: Total 80 male subjects who had not participated in any exercise program in the past six months were recruited. A polymorphism of ACE gene was determined using real-time polymerase chain reaction. Each subject performed 2 sets of 25 eccentric contractions of the elbow flexors in the non-dominant arm. Maximal isometric force (MVC), muscle soreness (SOR), and blood markers including creatine kinase (CK) activity and myoglobin (Mb) were measured at pre, immediately after, 24, 48, 72 and 96 hours after exercise. A recent study showed that ACE genotype may be related to creatine kinase activity following eccentric exercise but other muscle damage markers were not compared.

RESULTS: The frequency distribution of I allele and D allele was 62(78%) and 18(23%) respectively corresponding to Hardy Weinberg’s equilibrium (p=0.887). There were no significant differences in MVC, SOR, CK activity(p>0.05), and Mb levels(p=0.399) among the three protocols.

CONCLUSIONS: Our data showed that there is no effect of ACE gene polymorphism on exercise-induced muscle damage suggesting that ACE may not be the factor to explain inter-subject variability of muscle damage markers.

1503 Board #284  MAY 30  11:00 AM - 12:30 PM
Small Differences in Exercise Intensity May Impact Muscle Glycogen Without Concurrent Changes in Metabolic Gene Expression.
Matt Hessisch1, Dustin Siviglia1, Charles Damke1, FACSM2, John C puddy2, Walter Haile1, Brent Ruby1, FACSM2. 1University of Nebraska at Omaha, Omaha, NE. 2University of Montana, Missoula, MT.
(No relationships reported)

Intensity in exercise studies is often established relative to VO2 peak. However, when there is an experimental manipulation of altitude, the intensity may be different depending on the altitude at which VO2 peak is measured.

PURPOSE: To determine the impact of different absolute intensities associated with 60% VO2 peak, when VO2 peak is measured at 975 m or at a simulated altitude of 3000 m on metabolic gene expression.

METHODS: Twelve recreationally trained males (age 23.8 ± 3.8 y, mass 81.6 ± 11.6 kg, body fat 14.6 ± 7%) had their VO2 peak measured on a cycle ergometer at 975 m and 3000 m. Participants then completed two trials consisting of cycling at 965 m elevation for 60 min at 60% VO2 peak as measured at (A) 975 m and (B) 3000 m. Skeletal muscle biopsies were obtained from the vastus lateralis before exercise (PRE) and after 4 hours of recovery (POST4). Gene expression was measured using real-time RT PCR and expressed using the ∆∆CT method.

RESULTS: VO2 peak was statistically similar when measured at 975 m and 3000 m (p=0.139; 4.24 ± 0.89 L·min-1 and 4.03 ± 0.60 L·min-1). The absolute intensities were 174 ± 33 watts for trial A and 158 ± 23 watts for trial B (p>0.05). The VO2 during trial A (2.48 ± 0.40 L·min-1) was not significantly different than during trial B (2.43 ± 0.56 L·min-1). Skeletal muscle glycogen was similar between trials at PRE but was at 37.6% higher in trial B at POST4 (p<0.05). There were no differences between trials for COX, HIF, PGCl, FIS, MFN, HK and PFK (p>0.05) gene expression. However, COX, HIF, PGCl, FIS, MFN, HK and PFK increased as a result of exercise regardless of trial (p<0.05) while Mb did not.

CONCLUSION: These data indicate that small differences in exercise intensity created by completing initial VO2 peak tests at 975 m versus 3000 m environment have an effect on muscle glycogen but not on select metabolic genes.

1504 Board #285  MAY 30  11:00 AM - 12:30 PM
Alterations in the Exercise-Induced Transcriptional Response Following Short-Term Aerobic Exercise Training
J. Matthew Hinkle1, Adam R. Konopka1, Miranda K. Undern2, Bozena Jermiolo1, Todd A. Trappe1, Scott W. Trappe1, FACSM, Matthew P. Harber. Human Performance Laboratory, Ball State University, Muncie, IN.
(No relationships reported)

An acute bout of exercise induces transient changes in mRNA expression that, with training, lead to specific adaptations. Interestingly, little is known about the effects of short-term training on the exercise-induced transcriptional response of markers associated with skeletal muscle adaptation.

PURPOSE: To examine the effects of short-term training on whole body performance and associated exercise-induced molecular adaptations in skeletal muscle.
METHODS: Ten recreationally active subjects (25 ± 2 yr, 79 ± 3 kg) were studied before and after a ten day cycling protocol consisting of both steady state and interval days. Prior to training and 24 hours after the last exercise bout, subjects completed a 20 km cycle time trial. Skeletal muscle biopsies were taken from the vastus lateralis at rest and 3h following the time trial in both conditions to measure mRNA expression.

RESULTS: Time trial performance improved (P<0.05) by 5 ± 1% following training, which was associated with an enhanced power output (P<0.05). Mitochondrial (MTC) and PGC-1α mRNA were elevated (P<0.05) after exercise before and after training, with an attenuated response (P<0.05) following training (11-fold vs. 3-fold and 33-fold vs. 12-fold for MTC and PGC-1α, respectively). NFKB was elevated (P<0.05) 2-fold following the pre-training time trial, and unaltered after the post-training time trial. A significant interaction (P<0.05) was found for the exercise-induced mRNA expression of myostatin and TNF-α, suggesting a greater reduction in myostatin after training and a greater response in TNF-α prior to training.

CONCLUSION: These data suggest that short-term high-intensity aerobic exercise training alters the exercise-induced transcriptional response of genes involved in the regulation of skeletal muscle. Specifically, markers of myofibrillar degradation were attenuated, suggesting less susceptibility to post-exercise protein breakdown after training.

Supported by NIH Grant AG032127

1505 Board #286 MAY 30 11:00 AM - 12:30 PM DNA Methylation is Altered in Human Skeletal Muscle in Response to Exercise Training

DNA methylation is an epigenetic modification, which is influenced by environmental stimuli (e.g., exercise), and can play an important role in the adaptive process involving altered gene expression. Currently, little is known on DNA methylation status in muscle undergoing remodeling in response to exercise training.

PURPOSE: To determine if exercise training would induce alteration in DNA methylation in human skeletal muscle.

METHODS: Thirty three subjects, 20-26 y/o, were assigned to one of two 5-week exercise protocols: a) Resistance Exercise (RE), 4x7 squats, 2 days a week, or b) Combined Aerobic and RE (AE+RE), 5 days a week: 3 days of AE: 4, 4-min bouts of rowing at ~90% VO2max interspersed with 4, 4-min bouts of rowing at ~50% VO2max, and 2 days of RE. DNA was extracted from the vastus lateralis muscle, treated with sodium bisulfite, and analyzed for methylation using the Illumina HumanMethylation450 BeadChip (Illumina). Statistical analysis was done using Partek Genomics Suite (version 6.6).

RESULTS: Both exercise protocols altered the methylation status of the vastus lateralis muscle, however the AE+RE protocol had a greater effect (6976 CpG sites compared to 970 CpG sites in the RE only (P<0.0005). These altered CpG sites correspond to 3323 and 692 genes respectively. Of these, only 197 genes were common in both paradigms. In the AE+RE group we identified Kegg pathways that were enriched with genes with altered methylation; e.g., insulin signaling, focal adhesion, phosphatidylinositop, MAPK, Notch signaling, and regulation of actin cytoskeleton (EASE=0.05). We scanned for 1000bp regions that were enriched with ≥2 CpG altered methylation sites (P<0.005) and found 47 regions in the AE+RE group and only 3 regions in the RE group.

CONCLUSION: Two different exercise protocols generated differential response in DNA methylation. The altered genes are part of important signaling and structural pathways that are involved in muscle plasticity. This is the first study demonstrating that only five weeks of training can alter DNA methylation in human skeletal muscle. This information can enhance our understanding of complex molecular mechanisms leading to muscle plasticity in response to exercise stimulus. Supported by NSBRI NCC 9:58-7, and by NIH grants #R24HD050846-06 and UL1RR031985

1506 Board #287 MAY 30 11:00 AM - 12:30 PM The Effect Of Lactate On Primary Human Myoblasts And Potential Signalling Pathways
Raphael Jung, Lena Willkorn, Sebastian Borosch, Sebastian Gehlert, Frank Suhr, Wilhelm Bloch. Institute of cardiovascular research and sports medicine, Cologne, Germany.

Satellite cells (SCs) play a crucial role in embryonic myogenesis and skeletal muscle regeneration and adaptation. SCs can be activated by different stimuli and underlie a number of regulatory factors and proteins. In the past decades lactate (La) has been considered as a metabolic waste product, being responsible for the decrease in muscle pH and hence causing muscle fatigue. Nowadays La is better known as an intermediate of glucose metabolism and its ability to stimulate molecular pathways essential for skeletal muscle adaptation.

PURPOSE: The aim of this study was to analyse to what extent and how La can influence myoblast behaviour.

METHODS: Human myoblasts (HMB) were isolated from muscle biopsies, cultured and incubated with different La concentrations (0, 10, and 20 mM). Immunostainings and Western Blots were carried out for Kip1 (proliferation), activated Caspase-3 (apoptosis), Myogenin (early differentiation) and Myosin Heavy Chain (MHC; late differentiation). To investigate which signalling pathways are involved, activated beta-catenin, a molecule important in Wnt-mediated signalling, has also been analysed.

RESULTS: The results showed significant changes in proliferation and differentiation behaviour of the La treated cells. Regarding proliferation, La reduced the activity in a dose-dependent manner. Differentiation of primary HMB seemed to be timely delayed by La. Analysis of beta-catenin showed a decrease in its activation if cells were treated with La in a dose-dependent manner.

CONCLUSIONS: La has a negative or time-delaying influence on proliferation and differentiation of HMB. Although the literature suggests a strong involvement of redox signalling pathways, activated by La-dependent reactive oxygen species (ROS) production, beta-catenin could also play an influential role in the observed effects. However, further investigations are necessary to allow for a more precise estimation of La-induced regulation of proliferation, apoptosis, and differentiation in myogenic cell culture.

1507 Board #288 MAY 30 11:00 AM - 12:30 PM Skeletal Muscle Mitochondrial Respiration And Type 2 Diabetes Duration

(Sponsor: Kenneth M. Baldwin, FACSM) (No relationships reported)

Type 2 diabetes (T2DM) resolution following Roux-en Y gastric bypass (RYGB) surgery is poorer in patients with longer duration T2DM and lower pre-RYGB insulin sensitivity. Skeletal muscle mitochondrial function is impaired in T2DM.

PURPOSE: It was hypothesized that skeletal muscle mitochondrial respiration (JO2) would be lowest in T2DM patients with long-duration (LD; ≥ 8 y) compared to medium-duration (MD; 4-7) and short-duration (SD; ≤ 3 y).

METHODS: Vastus lateralis biopsies were obtained from T2DM patients (N = 12). Muscle mitochondrial JO2 was measured using the permeabilized fiber technique under basal (State 2) and ADP-stimulated (State 3) conditions with glutamate-malate (GM) or palmitoylcarnitine-malate (PM) as substrate. Respiratory control index (RCI), an index of mitochondrial coupling, was calculated as State 3/State 2 JO2.

RESULTS: There was a non-significant (p = 0.10) trend of lower GM State 2 JO2 with longer T2DM duration (LD: 9.7 +/- 1.7; MD: 13.5 +/- 1.0; SD: 17.8 +/- 4.7 pmol/sec/mg dry wt.). GM RCI was greater in LD than MD or SD (LD: 21.3 +/- 1.8; MD: 12.6 +/- 2.4; SD: 13.8 +/- 1.3). There was a significant correlation between T2DM duration and GM RCI (r = 0.59; p ≤ 0.05). There was no difference in JO2 or RCI for PM conditions between groups.

CONCLUSIONS: Skeletal muscle mitochondrial coupling is higher in longer compared to shorter duration T2DM patients. There may be a trend toward lower basal skeletal muscle mitochondrial respiration in patients with longer compared to shorter duration T2DM. Supported by a Grant from the East Carolina Diabetes and Obesity Institute (ECDOI).
Impairments of the mitochondrial reticulum or network, and its function have often been associated with aging. A decline in mitochondrial biogenesis and mitochondrial protein quality control in skeletal muscle, directly contributes to this problem, but exercise training has been suggested as a possible cure.

**PURPOSE:** In this report, we tested the effects of moderate intensity exercise training on young and old rats, and assessed mitochondrial biogenesis and mitochondrial protein quality control.

**METHODS:** Twelve young (three mo) and twelve old (26 mo) male Wistar rats were used in the study and grouped into young control (YC), young exercised (YE), old control (OC) and old exercised (OE). The investigation was carried out according to the requirements of The Guiding Principles for Care and Use of Animals, EU. Exercised rats were trained on treadmill for 6 weeks, 5 times per week, where the running speed and duration of the exercise were gradually increased. We examined in this study the gastrocnemius muscle by Western blot and fluorometric assays.

**RESULTS:** Exercise training prevented or attenuated significant age-associated (detrimental) declines in SIRT1 activity (43±174 v. 116±109 rel. act. p<0.05), AMPK (0.21±0.11 v. 1.05±0.29 rel.dens. p<0.01), peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1alpha) (0.35±0.04 v. 0.87±0.08 rel.dens. p<0.01) and the Lon protease, in the gastrocnemius muscle of rats. Exercise training also prevented the age-related (detrimental) increases in NRF1 (1.11±0.17 v. 0.67±0.16 rel.dens. p<0.01), TFAM, Mfn1 (0.98±0.31 v. 0.48±0.16 rel.dens. p<0.01), Fis1 and poly nucleotide phosphorylase (PNPase) (1.52±0.25 rel.dens. p<0.01) levels.

**CONCLUSION:** Our data suggest that regular exercise training can help minimize detrimental skeletal muscle aging deficits stimulating mitochondrial biogenesis through the PGC1α/Unfolded Protein Character - Symbol Font system, rejuvenating the mitochondrial network via fission and fusion, and improving quality control of mitochondrial proteins by the Lon protease. All of these properties, working in conjunction with one another, would improve the overall functionality of mitochondria in aged cells.

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**1508 Board #289 MAY 30 11:00 AM - 12:30 PM**

**Age-associated Declines In Mitochondrial Biogenesis And Protein Quality Control Are Minimized By Exercise Training**

Erika Koltai,1 Nikolett Han1, Albert W. Taylor,2 Satoro Goto1, Jenny K. Ngo,2 Kelvin J A Davies3, Zsolt Radak.1 Semmelweis University, Budapest, Hungary. 2University of Southern California, Los Angeles, CA. (Sponsor: L. L. J, FACSM) (No relationships reported)

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**1509 Board #290 MAY 30 11:00 AM - 12:30 PM**

**Interaction Of Mitochondria And Oxygen Binding Protein In L6, Rat Skeletal Muscle Cell Line**

Tatsuya Yamada1, Nobumasa Iwanaka1, Yasuro Furuichi1, Yukio Kato1, Takeshi Hashimoto2, Thomas Jue3, Kazumi Masuda1.1 Kanazawa University, Ishikawa, Japan. 2Ritsumeikan University, Shiga, Japan. 3University of California Davis, Davis, CA. (No relationships reported)

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**1510 Board #291 MAY 30 11:00 AM - 12:30 PM**

**Effects Of Endurance Training And Immobilization On The Localization Of Myoglobin In Skeletal Muscle**

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**1511 Board #292 MAY 30 11:00 AM - 12:30 PM**

**Effect of Hydrogen Peroxide on Mitochondrial Motility Protein Miro1 in C2C12 Cells**

Yong Zhang1, Huijun Liu1, Ning Jiang1, Fei Zhao1, Hu Ding1, Li Li Ji, FACSM2.1 Tianjin University of Sport, Tianjin, China. 2University of Minnesota, Minneapolis, MN. (Sponsor: Li Li Ji, FACSM) (No relationships reported)

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**Objective:** The dynamic changes of mitochondria morphology and regulation with moderate oxidative stress caused by exogenous H2O2 in present research.

**Methods:** C2C12 myoblast model of mild oxidative stress was induced by exogenous H2O2. Cell survival rate was detected by MTT. The colorimetry was used for measure of MDA. Oxygen consumption rate and ATP content were detected by using Oxynorm liquid oxygen electrode and fluorospectrophotometer. The western blotting and realtime-PCR were used to measure the contents of Miro1 protein and mRNA express in C2C12 myoblast. ETA2 was used as chelator for Ca2+. RESULTS: Cell survival rate of myoblast stimulated by low concentration (1-100µM) H2O2 had no obvious change, and showed significantly low level when stimulated by higher concentrations of H2O2(1mM or 10mM). The MDA level showed the
same trend. 2) The rates of respiration of myoblast cells were transient reversibly inhibited when stimulated by low concentrations of H$_2$O$_2$(0.05M–1mM). H$_2$O$_2$ of 100µM–10mM decreased the ATP content, nevertheless there were no significantly effects when myoblasts were treated with 1µM or 10µM H$_2$O$_2$. 3) MiR01 mRNA of C2C12 cells treated with 10µM / L H$_2$O$_2$ for 0.5h, 1h, 1.5h increased by 44.1%, 49.0%, 54.9% respectively compared with the control group. The MiR01 protein expression increased 26.7% (P<0.05) after the treatment with the 10µmol / L H$_2$O$_2$ for 1h. But the miro1 mRNA and protein expression in the EGTA+H$_2$O$_2$ treated group decreased significantly(P<0.05) compared with the H$_2$O$_2$ treated group.

CONCLUSIONS: H$_2$O$_2$ had bidirectional for mitochondrial motility in myoblast. Lower H$_2$O$_2$ promoted mitochondrial motility, high H$_2$O$_2$ inhibited those. Ca$^{2+}$ involved in mitochondrial motility induced by H$_2$O$_2$. Supported by NSFC(No. 31071040).

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1512  Board #293  MAY 30  11:00 AM - 12:30 PM  
Reactive Oxygen Species Markers After Multiple Wingate Bouts in Trained and Untrained Subjects


(No relationships reported)

Reactive oxygen species (ROS) are reactive molecules in the body that contain oxygen and unpaired valence electrons. Previous research has shown that ROS increase with acute exercise, but levels in untrained (UT) vs. trained (T) subjects vary in the literature in cross sectional vs. longitudinal studies.

PURPOSE: To study changes in ROS markers over time following multiple 30 s supra-maximal efforts in UT and T subjects.

METHODS: All procedures were approved by the Eastern Michigan University Human Subjects Review Committee. 11 UT subjects (22 ± 4 yr, weight 83.8 ± 11.8 kg, VO$_{2peak}$ = 405.0 ± 6.96 ml/kg/min) and 9 T cyclists (age 25 ± 4 yr, weight 77.8 ± 9.26 kg, VO$_{2peak}$ = 59.56 ± 5.66) performed three consecutive Wingates with 4 min of rest between each bout (MW). Exercise was performed on an electronically braked ergometer (Velotron, Racermate WA). Blood was collected by antecubital venipuncture: pre, immediate, 1 hr, 24 hr & 48 hr post MW. Samples were quantitatively analyzed for malondialdehyde (MDA) and 4-hydroxynonenal (4-HNE) with enzyme-linked immunosorbent assays (ELISAs; Cell Biolabs, inc., CA). Differences between the blood draw time points were analyzed using ANOVA. MDA and 4-HNE concentrations for all time points were compared using a 2 x 5 analysis of variance (ANOVA) to account for differences by training status as well as time (SPSS, IBM, NV).

RESULTS: Lactate values were higher on average in T vs. UT, but increased significantly and similarly between groups immediately post for both the UT and T groups (1.14 ± 0.78 to 12.58 ± 1.75 mmol, 1.34 ± 0.54 to 12.62 ± 0.95 mmol, respectively; p<0.05). There was a significant difference in MDA and 4-HNE levels between the UT group (7.45 ± 1.66 µg/mL, 6.73 ± 2.83 µg/mL) and T group (17.32 ± 2.07 µg/mL, 7.88 ± 0.81 µg/mL) at basal and across all the time points (p = .001; p = .015). There was no significant change from basal MDA and 4-HNE levels over the course of the blood draws in either the UT or T group. There was no significant interaction between the groups.

CONCLUSION: MDA and 4-HNE blood serum levels do not change acutely after multiple Wingate efforts, but are higher in T subjects than UT subjects at basal levels and after exercise. This indicates that ROS levels may change with chronic training over longer time frames than were examined in this study.

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1513  Board #294  MAY 30  11:00 AM - 12:30 PM  
Aged Skeletal Muscle Inflammation Susceptibility

Edward K. Merritt, Anna Thalacker-Mercer, Michael J. Stee, David P. Shelley, Marcos M. Bamman, FACSM. University of Alabama at Birmingham, Birmingham, AL.

(No relationships reported)

BACKGROUND: The regenerative response of skeletal muscle to mechanically induced damage is impaired with age. Previous work in our laboratory indicates that the impairment likely results from a differential inflammatory response in old relative to young, although the specific signaling mechanisms and their magnitudes are unknown.

PURPOSE: To examine the effects of age on the mRNA expression and protein signaling of putative pro-inflammatory and catabolic pathways in skeletal muscle at rest and after mechanically induced damage.

METHODS: Young (40.4 ± 1.1 yr), older (61.2 ± 0.6 yr), and old (75.5 ± 0.7 yr) adults performed nine sets x 10 repetitions of unaccustomed, high-intensity leg extensions to induce modest muscle damage. A blood sample and a biopsy of the vastus lateralis muscle were obtained before and 24 h after the bout. Muscle mRNA expression and protein signaling within the interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) pathways were determined by qPCR and Western blot analysis.

RESULTS: All subjects experienced similar levels of muscle damage as indicated by serum creatine kinase levels. Baseline expression of several analyzed genes was higher in older and old adults relative to young: IL-6 (1.64 ± 2.70 fold higher); TNF-α (1.38 - 4.06 fold higher); and TWEAK (1.30 - 1.74 fold higher). TWEAK receptor expression was significantly increased in all groups after muscle damage and tended to be higher in older and old. STAT3 and NFkB protein expression were 17% and 35% higher in the old at baseline. Of all the markers of inflammation, none were higher in young adults at baseline or after muscle damage.

CONCLUSION: The overall lower inflammatory state of skeletal muscle before and after muscle damage in young adults indicates that a higher sensitivity to inflammation signaling occurs in the muscle with age. Higher muscle inflammation susceptibility likely contributes to the impaired regenerative capacity of skeletal muscle in the older population, and should be considered when designing exercise programs to promote skeletal muscle recovery following damage or surgery.

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1514  Board #295  MAY 30  11:00 AM - 12:30 PM  
Effects Of H2O2 On Oxidant Generation And NF-kB Pathway Activity In C2C12 Muscle Cells

Kevin S. O’Fallon, Lawrence M. Schwartz, Priscilla M. Clarkson, FACSM. University of Massachusetts, Amherst, MA.

(No relationships reported)

Reactive oxygen and nitrogen species (RONS) production increases during exercise and following muscle injury. In vitro studies have shown that H2O2 activates the canonical NF-kB pathway involved in transcription of antioxidant defenses in response to exercise. However, the effects of RONS on the alternative NF-kB pathway, which is involved in mitochondrial biogenesis, are currently unknown. Understanding the mechanisms of RONS-induced NF-kB activation will elucidate how NF-kB regulates the responses to exercise and muscle injury.

PURPOSE: To test the hypothesis that elevated RONS by H2O2 induces changes in alternative NF-kB pathway activation in cultured muscle cells.

METHODS: C2C12 myotubes were loaded with a fluorescent probe to quantify intracellular RONS levels. Culture media was supplemented with 100µM H2O2, and fluorescence was measured hourly for 1-4 hrs, then again at 24 hrs. In a separate experiment, myotubes were exposed to H2O2 for 1, 5 and 24 hrs and then harvested for total nuclear protein. Changes in the DNA binding activity of canonical (via the p65 subunit) and alternative (via the Rel B subunit) NF-kB pathways were quantified via ELISA assay.

RESULTS: Myotubes treated with H2O2 showed higher RONS levels at 1 hr (42%), 2 hrs (33%), 3 hrs (30%), 4 hrs (28%), and 24 hrs (14%) relative to untreated controls (p<0.05). Fold changes in DNA binding activity of p65 (1.96 fold at 1 hr) and Rel B (0.71 fold at 1 hr and 0.61 fold at 5 hrs) were observed relative to controls (p<0.05).

CONCLUSIONS: H2O2 stimulates RONS production in cultured muscle cells and alters the DNA binding activities of canonical and alternative NF-kB complexes within 5 hrs of exposure. The decrease in Rel B DNA binding indicates that elevated RONS reduces the transcriptional activity of the alternative NF-kB complex, which may be intended to temporarily restrict processes involved in mitochondrial biogenesis while intracellular redox homeostasis is being restored.

Funding Source: US Army

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Increased skeletal muscle nuclear apoptosis has been suggested to be involved with age-related pathological remodeling that contributes to sarcopenic states.

PURPOSE: The purpose of this study was to determine if apoptosis plays a role in age-dependent adaptive remodeling and maladaptation in young and old skeletal muscle of rats, respectively, following chronic high-intensity mechanical loading via stretch-shortening contractions (SSCs).

METHODS: Left dorsiflexor muscles of young (3 mo, N=6) and old (30 mo, N=6) Fischer 344 x BN rats, were loaded 3 times/week for 4.5-weeks using a protocol of 80 maximal SSCs per exposure in vivo. Twenty-four hours after the last training session, tibialis anterior (TA) muscles were harvested and individual muscle regions were allocated for biochemical or histological analyses. TA muscle was homogenized and prepared for cell death enzyme-linked immunosorbent assay (ELISA), while histomorphology was conducted on transverse sections of the TA muscle mid-belly prepared for terminal dUTP nick-end labeling (TUNEL) and laminin dual immunofluorescence and quantified via standard stereology.

RESULTS: Cell death was increased in both old rats (~50%) and old SSC-loaded (~105%) skeletal muscle versus young muscle, as quantified by ELISA (p < 0.05). Moreover, ELISA data revealed chronic SSC-loading increased cell death ~95% in young rats’ skeletal muscle, while old rats’ cell death significantly increased ~105% (p < 0.05), compared with control muscle. Additionally, aging increased the volume density of TUNEL-positive myonuclei in both control (~125%) and SSC-loaded (~200%) TA muscles compared with young rats (p < 0.05). Interestingly, no increase in TUNEL-positive myonuclei was observed following chronic SSC loading in young or old rats.

CONCLUSION: Our data suggest that adaptation and maladaptation following chronic SSC loading is significantly impacted by apoptosis; however apparent differences exist with the individual cell types undergoing apoptosis; specifically, nuclei distinct from skeletal muscle may contribute to these findings. Collectively, these results indicate that apoptotic-related events contribute significantly to age-dependent adaptive and maladaptive remodeling in young and old soft tissue, respectively, following chronic mechanical loading.
RESULTS: Electroporation efficiency was >50% (green fluorescent protein). The Six1 vector increased Six1 mRNA expression 11.2-fold (±2.7, p<0.01) compared to control, and the siRNA vector decreased Six1 mRNA expression 1.37-fold (±0.09, p=0.04). Preliminary analysis suggests that the proportion and cross-sectional area of IIB fibers decrease in response to decreased Six1.

CONCLUSIONS: A decrease in Six1 expression affects the expression of different muscle fiber types and may be responsible for fiber type conversions after exercise.

1519 Board #300 MAY 30 11:00 AM - 12:30 PM Fast-To-Slow: Muscle Fiber Type Transformation In Response To Altered Six1 Gene Expression
Brittany C. Collins, Bradley S. Gordon, Matthew C. Kostek. University of South Carolina, Columbia, SC. (Sponsor: James Carson, FACSM)

Muscle activation patterns, like exercise and disuse, can cause alterations in muscle fiber type proportions in skeletal muscle. However, little is known of the molecular events that cause this shift. Six1 is a developmental gene that has been shown to be altered by exercise in humans. Further, Six1 causes a fiber type shift in mice. Yet, little is known of how it functions.

PURPOSE: Examine the effect of Six1 expression on the myosin heavy chain (MyHC) genes during muscle fiber formation.

METHODS: C2C12 mouse myoblasts were grown in standard conditions. When cells reached 80% confluence, they were transfected with Six1 expression vectors, to increase Six1 expression, or empty vector control. 24 hours later, cells were switched to differentiation medium. After four days, cells were harvested. Six1 and MyHC gene expression was analyzed by qRT-PCR.

RESULTS: Six1 expression vector (A) increased Six1 expression 700 ± 243.4 fold (p = 0.02) and Six1 expression vector (B) increased Six1 expression 875 ± 83.7 fold (p < 0.01). MyHC-IIb expression decreased 2.12 fold (p = 0.01) and 3.02 fold (p < 0.01) by vectors (A) and (B) respectively, MyHC-Ix decreased 1.5 0.09 fold (p = 0.05) and 1.5 0.05 fold (p = 0.02) by vectors (A) and (B) respectively. MyHC-IIa expression was not affected.

CONCLUSION: Six1 overexpression alters the muscle fiber-type gene program during the formation of a muscle fiber. This suggests that altered Six1 expression, in response to exercise, controls muscle fiber-type in humans.

1520 Board #301 MAY 30 11:00 AM - 12:30 PM Modification Of Skeletal Muscle Fiber Type Induced By Aerobic Exercise. Proposal Of A Peripheral Marker
Paula Tavares. Faculty of Sport Science and Physical Education, University of Coimbra, Coimbra, Portugal.

It is known that exercise has the ability to change the skeletal muscle fiber type. In sport these changes may result from the applied training, which brings athletic advantage. However, the only technique available for fiber type monitoring is the muscle biopsy. In addition to the ethical issues, we also believe that this invasive method has a low accuracy in certain types of muscle evaluations.

PURPOSE: The aim of this work is to propose a peripheral marker that can show the skeletal muscle fiber type dominance in a subject. In order to achieve our goal we looked for changes in the nitric oxide synthase (NOS) that is expressed in skeletal muscle fibers and platelets.

METHODS: We used male Wistar adult rats that were trained during 8 weeks with a treadmill aerobic protocol. The animals were divided in two groups: exercise and control. The group was submitted to a slight exercise just to maintain motor skills and avoid central nervous system interferences. Platelets were isolated from blood collected in the jugular vein (after anesthesia) before and at the end of the exercise protocol. At the end of the experiments the animals were sacrificed by anaesthetic overdose, and the skeletal muscles (soleus and gastrocnemium) were removed for histological analysis and determination of NOS expression. The histological analysis included a hematoxylin-eosin staining and an ATPase staining to identify and measure the different fiber types. The expression of both NOS isoforms, in skeletal muscle and platelets, was determined by Western-blot with NOS specific antibodies.

RESULTS: The results showed that aerobic exercise changes the muscle fiber type. These changes were more evident in the soleus muscle which is mainly composed by type I muscle fibers. Moreover, our results also suggest that exercise induces muscle fibre necrosis and the consequent formation of new fibers through satellite cells division. This stimulation is induced by exercise, and allows the replacement of the damaged fibers.

CONCLUSIONS: The result stresses the correlation between NOS expression in muscle and platelets, suggesting the usefulness of cNOS in platelets for the study of exercise induced fibre change without the need for muscle biopsy. Other studies are needed to confirm our findings. This project was partially financed by FCT.

1521 Board #302 MAY 30 11:00 AM - 12:30 PM Satellite Cell And Myonuclear Content In Older Adults Following 7 Days Of Inactivity
Dillon Walker, Micah Drummond, Jared Dickinson, Elena Volpi, Blake Rasmussen. UTMB, Galveston, TX. (Sponsor: Elizabeth Protas, FACSM)

Skeletal muscle atrophy is linked to a number of pathological and physiological conditions and is characterized by a loss of protein and muscle nuclei. However, it is not known if changes in satellite cell and myonuclear content occur as early as 7 days following inactivity in older adults.

PURPOSE: To determine if changes occur in satellite cell (SC) and myonuclear content following 7 days of physical inactivity in older adults.

METHODS: Healthy, older adults participated in a strict best rest model for 7 days. Muscle biopsies were collected from the vastus lateralis before and after best rest. Immunohistochemical analysis was used to assess satellite cell content (anti-Pax7), muscle nuclei (Hoechst 33342), basal lamina (anti-laminin), and slow twitch fibers (anti-MHC type I).

RESULTS: In slow twitch fibers, we observed no change in SC/fiber, % SC, and myonuclear domain after 7 days of inactivity; however, myonuclei/fiber decreased by 18% and the % of fibers with centrally located nuclei decreased by 69%. In fast twitch fibers, SC/fiber increased by 50% and % SC increased by 79% whereas % fibers with centrally located nuclei, myonuclei/fiber, and myonuclear domain were unaffected after 7 days of inactivity.

CONCLUSIONS: Short-term physical inactivity results in the loss of muscle nuclei and appears to impair ongoing regeneration as indicated by a reduction in the % of fibers with centrally located nuclei in slow twitch muscle fibers. On the other hand, in fast twitch muscle fibers, an increase in satellite cell content may play a role in the bed rest induced transition of slow to fast twitch fibers. Future studies are warranted to determine the role of satellite cells in the regulation of physical inactivity induced muscle atrophy.

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1522 Board #303 MAY 30 11:00 AM - 12:30 PM Training Effect on Satellite Cell Response after Exhaustive Exercise in Thoroughbred Horses
Minako Kawai1, Atsushi Hiraga2, Hiroko Aida1, Hirofumi Miyata1.1 Yamaguchi Univ., Yamaguchi, Japan. 2Japan Racing Association, Utsunomiya, Japan.

Training on the short-term response of satellite cell activation in thoroughbred horses.

METHODS: Six horses (3 years old) had acclimatized to exercise on a treadmill before experiments and then were subjected to conventional training for 10 weeks. Before (PRE) and after (POST) training, an incremental exercise test (IET) was performed on a 6% inclined treadmill to measure maximum oxygen consumption (VO2max) and the velocity at a plasma lactate of 4 mmol/l (VLA4). Biopsy samples from gluteus medius muscle were obtained before and at 1 min, 3 (3h), 6 (6h) and 24 hours (24h) after each IET. Total RNA was extracted from each muscle sample and the levels of SDHa, Pax7, MyoD, myogenin, PCNA, IGF-I and HGF mRNA expression were determined using real time RT-PCR.

RESULTS: Ten-week training increased the mean values of VO2max (from 144 to 168 ml/ min/ kg, P<0.05) and VLA4 (from 7.3 to 8.5 m/s). IL-6 mRNA expression increased remarkably at 6h after IET (P<0.05) in both PRE and POST. Unexpectedly, MyoD mRNA was significantly decreased at 6h after IET in both PRE and POST (P<0.05), and myogenin mRNA was also decreased at 3h after IET in POST (P<0.05). PCNA mRNA was increased at 24h (P<0.05) in both PRE and POST. In addition this mRNA in POST was also increased at an earlier point (3h) than that in PRE. When the correlations between performance level (VO2max and VLA4) and mRNA expressions of each horse was investigated in PRE, the horses with higher VO2max had...
higher expression levels of MyoD and myogenin mRNAs \((r = 0.97 \text{ and } 0.85, P<0.05, \text{ respectively})\). In addition, the horses with higher VLA4 had higher expression level of IGF-I mRNA \((r = 0.85, P<0.05)\). After the 10-week training, interestingly, the horses with a greater VO\(_{2\text{max}}\) improvement had a greater increase in the expression level of IL-6 mRNA \((r = 0.82, P<0.05)\) at 1d after IET.

**CONCLUSIONS:** The activation and proliferation of satellite cells in response to exhaustive exercise were slightly different between pre and post training. There were significant correlations between the performance level of each horse and these mRNA expression patterns in response to exhaustive exercise.

**1523 Board #304 MAY 30 11:00 AM - 12:30 PM \(^{1}\)**

**Transient Satellite Cell Response to Acute ‘Non-Injurious’ Resistance Exercise in MHC I and MHC II Skeletal Muscle Fibers**

Nicholas Laden, Lyle Babcock, Matt Escano, Andrew D’Lugos, Kent Todd, FACSM, Kevin Murach. *James Madison University, Harrisonburg, VA.*

\(^{1}\) No relationships reported.

Skeletal muscle satellite cells (SC) have been implicated in the hypertrophic response to resistance training. Satellite cell proliferation is also likely involved in repair processes following skeletal muscle injury. Elevated satellite cell counts have been documented as early as 6 hours and as late as 8 days following acute resistance exercise. However, these studies have exclusively utilized exercise protocols characterized by a high volume of supramaximal eccentric muscle contractions.

**PURPOSE:** To assess the general and fiber-type specific [Myosin Heavy Chain (MHC) I and II] SC response to a more conventional, ‘non-injurious’, exercise protocol at 4 and 10 days following exercise.

**METHODS:** Immediately following one-repetition max (1RM) testing, eight recreationally active college-aged males (23 ± 1 yr, 83 ± 4 kg, 49 ± 2 ml/kg/min) performed 4 sets of unilateral leg-extensions and presses (4 sets of 10 repetitions at 75% 1RM). Skeletal muscle biopsies were obtained from the vastus lateralis immediately before, 4 days, and 10 days following exercise. Muscle samples were cross-sectioned, stained with NCAM, Ki-67, and MHC I antibodies, counterstained with DAPI, and analyzed via immunohistochemistry to determine SC density (SC per muscle fiber), satellite cell activation and muscle fiber type.

**RESULTS:** SC density (not fiber type specific) was elevated 4 days following exercise but returned to baseline at 10 days post-exercise. MHC I muscle fiber SC density remained unaltered with exercise when compared across all three time points, whereas MHC II muscle fiber SC density tended to be elevated at 4 days \((p = 0.09)\), but not 10 days post-exercise. No alterations in the quantity of activated SC were observed.

**CONCLUSIONS:** Our data indicate that a single session of one-legged resistance exercise increases the SC population at 4 but not 10 days following exercise. Further, this response seems to be primarily manifested in MHC II muscle fibers. These data have implications for future satellite cell research, as the SC proliferative response to acute exercise is not detectable 10 days following a relatively conventional exercise protocol.

**1524 Board #305 MAY 30 11:00 AM - 12:30 PM**

**Concurrent Aerobic Exercise Interferes With the Satellite Cell Response to Acute Resistance Exercise in MHC I Muscle Fibers**

Lyle Babcock, Matt Escano, Andrew D’Lugos, Kent Todd, FACSM, Kevin Murach, Nicholas Laden. *James Madison University, Harrisonburg, VA.*

\(^{1}\) No relationships reported.

The addition of aerobic exercise (AE) to a resistance exercise program (RE) (concurrent exercise; CON) can interfere with maximum muscle fiber size gains achieved with RE alone. Further, CON appears to interfere with myosin heavy chain (MHC) I, but not MHC IIa muscle fibers. The underlying mechanism responsible for this ‘interference’ is unknown. The magnitude of satellite cell (SC) proliferation following exercise has been shown to influence muscle adaptation, but these dynamics have not been examined following concurrent exercise.

**PURPOSE:** To assess the fiber-type specific SC response to RE, AE, and CON exercise.

**METHODS:** Eight recreationally active college-aged males completed the following two exercise trials separated by a 10-day washout: RE - unilateral leg-extensions and presses (4 sets of ≥10 repetitions at 75% 1RM); AE/CON - immediately following an identical RE protocol with the opposite leg, subjects completed 90 min of cycling (60% VO\(_{2\text{max}}\)). Skeletal muscle biopsies were obtained from the exercised vastus lateralis immediately before and 4 days after each session. Muscle samples were cross-sectioned, stained with NCAM, Ki-67, MHC I antibodies, counterstained with DAPI, and analyzed via immunohistochemistry to determine SC density (SC per muscle fiber), satellite cell activation and muscle fiber type.

**RESULTS:** SC density increased to a greater extent \((p<0.05)\) following RE \((38 ± 10%)\), compared to AE \((10 ± 10%)\) and CON \((-9 ± 10%)\). Similarly, MHC I muscle fiber SC density displayed a greater increase following RE \((46 ± 16%)\), compared to AE \((-22 ± 10%)\) and CON \((-7 ± 17%)\). No exercise mode differences were observed among MHC IIa fibers.

**CONCLUSIONS:** Our data indicate that CON blunts the SC response to RE, specifically in MHC I muscle fibers. The satellite cell response observed here mimics the fiber type growth response to RE and CON training. This suggests that SC physiology contributes to the interference effect that concurrent AE has on MHC I fiber growth.

**1525 Board #306 MAY 30 11:00 AM - 12:30 PM**

**Therapeutic Ultrasound Affects Muscle Cell Proliferation: Implications For Muscle Rehabilitation**

Diana C. Delgado-Diaz, Matthew C. Kosteck. \(^{1}\) University of South Carolina, Columbia, SC. \(^{2}\) University of South Carolina, Columbia, SC.

\(^{1,2}\) No relationships reported.

Therapeutic ultrasound (TUS) is a common modality in the rehabilitation of muscle injuries. In vivo models of skeletal muscle have demonstrated that TUS increases satellite cell proliferation, a requirement for skeletal muscle repair. Current studies have attempted to determine the autonomous response of muscle cells to TUS; however their results are controversial due to the diversity of techniques and parameter used to deliver TUS (indirect sonification).

**PURPOSE:** To examine the dose-response of muscle cell proliferation due to TUS.

**METHODS:** C:\C2\C2 cells were propagated in 10% FBS growth medium and incubated under sterile standard conditions. Equal numbers of cells were seeded in 100-mm culture dishes. Once cells achieved 50% confluence, TUS was delivered for 5 consecutive days. 24-h after the last treatment, cells were collected and counted with a hemocytometer. TUS delivery (continuous; 3MHz) was performed under sterile conditions; the ultrasound probe was positioned perpendicular to the dish and lowered to full contact with the medium (distance between the probe and the bottom of the dish = 4-5 mm). Nine combinations of output intensities and treatment durations were studied. Intensities: 0.2, 0.5 and 1.0W/cm\(^2\). Treatment durations: 2, 5, and 10 min. The sham cells was exposed to TUS as described with output intensity of 0W/cm\(^2\).

**RESULTS:** Temperature increased only in response to the highest intensity \((1.0W/cm^2)\) when delivered for 5 or 10 min. TUS increased cell proliferation when compared to Sham and control in all groups, being greater at lower output intensities \((0.2 \text{ and } 0.5W/cm^2)\).

**CONCLUSION:** These data demonstrate that the direct delivery of ultrasonic waves to muscle cells in culture is feasible and produces positive effects. TUS enhances muscle cell proliferation in an autonomous manner by a mechanism other than heating. Our results support an evidence-based mechanism for the use of TUS for the treatment of skeletal muscle injuries.

**1526 Board #307 MAY 30 11:00 AM - 12:30 PM**

**Essential Amino Acid Ingestion After Exercise Enhances Amino Acid Transporter Expression In Human Skeletal Muscle**

Jared M. Dickinson, Micah J. Drummond, Jennifer R. Coben, Elena Volpi, Blake B. Rasmussen. *University of Texas Medical Branch, Galveston, TX.* (Sponsor: Elizabeth Protas, FACSM)

\(^{1}\) No relationships reported.

An increase in amino acid transporter expression is a proposed mechanism contributing to increases in muscle protein synthesis following essential amino acid ingestion (EAA) or resistance exercise (RE).

**PURPOSE:** To determine whether the expression of amino acid transporters in human skeletal muscle is increased in response to the combination of RE and EAA ingestion, and whether a differential response occurs with aging.

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METHODS: Young (n=7, 30±2 yr) and older males (n=6, 70±2 yr) ingested 20g of EA 1 h before performing a single bout of leg extension RE (8 sets, 10 reps, ~70% 1RM). Muscle biopsies (vastus lateralis) were obtained at rest and at 3 and 6 h postexercise for examination of amino acid transporter mRNA and protein expression via qPCR and immunoblotting, respectively.

RESULTS: In both young and older males, the combination of RE+EAA elicited an increase in mRNA expression (fold change) of L-type amino acid transporter 1 (LAT1)/solute linked carrier (SLC7A5) (Y: 3h, 4.0±0.8; 6h, 3.7±0.9; O: 3h, 3.9±1.4; 6h, 5.9±2.3) sodium-coupled neutral amino acid transporter 2 (SNAT2)/SLC38A2 (Y: 3h, 2.0±0.4; O: 3h, 1.79±0.5), and cationic amino acid transporter 1 (CAT1)/SLC7A1 (Y: 6h, 3.9±0.9; O: 3h, 3.5±0.9; 6h, 5.0±1.2) (P<0.05), whereas no changes were observed for proton-assisted amino acid transporter 1 (PAT1)/SLC6A1 or CD98/SLC3A2 in either group (P>0.05). Additionally, SNAT2/SLC38A2 protein was increased only in young adults at 3 and 6 h postexercise (P<0.05), whereas older adults maintained higher LAT1/SLC7A5 protein expression compared to young following exercise (P<0.05).

CONCLUSION: These results suggest that both young and older males experience an increase in skeletal muscle amino acid transporter expression following the combination of RE+EAA, however, there appears to be a differential response with aging for SNAT2/SLC38A2 and LAT1/SLC7A5. These data support the hypothesis that amino acid transporters are involved in the regulation of human skeletal muscle protein synthesis in young and older adults.

Funding: NIAMS R01 AR049877, NIA P30 AG024832 and R01 AG018311, NIH T35 AG038048, and NCRR U1LRR029876

1527 Board #308 May 30 11:00 AM - 12:30 PM
Low Magnitude Vibration To Improve Muscle Health In A Mouse Model Of Muscle Disease
Susan A. Novotny, Brian C. Eby, David J. Nuckley, Jarrod A. Call, Michael D. Eckhoff, Dawn A. Lowe, FACSM. University of Minnesota, Minneapolis, MN.
(Sponsor: Dawn Lowe, FACSM)

Low-magnitude, high-frequency vibration (VIB) can benefit bone and skeletal muscle. These beneficial effects arise from the application of mechanical loads equivalent to those produced during postural muscle contraction. Therefore, VIB is particularly attractive as a therapeutic modality in diseases such as Duchenne muscular dystrophy (DMD) to preserve muscle and bone strength, as patients are often advised to minimize exercise.

PURPOSE: We devised and constructed a vibration platform for mice and using the mdx model of DMD, our initial experiments were aimed to: 1) select the frequency and acceleration of VIB that provoked an osteogenic response, 2) determine if three bouts of VIB are injurious to diseased muscle and 3) assess the myogenic potential of VIB.

METHODS: Mdx mice were exposed to VIB for 15min/day for 7d at either 30, 45, or 90 Hz with an acceleration of either 0.3 or 0.6 g. Tibial bone mass was extracted and compared to non-vibrated mice for genes along the osteoblast lineage. At 15min/day for 7d VIB. Mdx mice received three bouts of VIB (45 Hz, 0.6 g), non-VIB mice, and eccentrically-injured mdx mice. The myogenic potential of VIB was assessed by RTPCR (MyoD, myogenin, BMP-1) in VIB and non-VIB mice.

RESULTS: Tibial bone mass was significantly increased in mdx mice exposed to 90 Hz VIB (24% vs. 21%), whereas no change was observed in non-VIB mice. VIB increased expression of MyoD (Y: 45 Hz, 0.6 g, 3.1±0.5 vs. 2.9±0.4; O: 45 Hz, 0.6 g, 3.1±0.5 vs. 2.9±0.4), myogenin (Y: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3; O: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3), and BMP-1 (Y: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3; O: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3) in VIB mice. These results suggest VIB is not injurious to diseased muscle. Following 7d of VIB, MyoD expression was elevated 7% (P<0.05) in VIB mice compared to non-VIB mice. VIB increased expression of MyoD (Y: 45 Hz, 0.6 g, 3.1±0.5 vs. 2.9±0.4; O: 45 Hz, 0.6 g, 3.1±0.5 vs. 2.9±0.4), myogenin (Y: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3; O: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3), and BMP-1 (Y: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3; O: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3) in VIB mice. These results suggest VIB is not injurious to diseased muscle. Following 7d of VIB, MyoD expression was elevated 7% (P<0.05) in VIB mice compared to non-VIB mice. VIB increased expression of MyoD (Y: 45 Hz, 0.6 g, 3.1±0.5 vs. 2.9±0.4; O: 45 Hz, 0.6 g, 3.1±0.5 vs. 2.9±0.4), myogenin (Y: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3; O: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3), and BMP-1 (Y: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3; O: 90 Hz, 0.6 g, 2.9±0.4 vs. 2.5±0.3) in VIB mice. These results suggest VIB is not injurious to diseased muscle.

CONCLUSIONS: These data highlight that VIB exposure at 45 Hz and 0.6 g in the mdx mouse is not injurious to muscle and has the modest potential to elevate the expression of genes involved in osteogenesis and myogenesis. Chronic studies of VIB in mdx mice are in progress to further determine the therapeutic potential of VIB for muscular skeletal health.

1528 Board #309 May 30 11:00 AM - 12:30 PM
Effects Of Pre-habilitative Conditioning On Unloading-induced Remodeling Of Young And Aged Neuromuscular Systems.
Michael R. Deschenes, FACSM, Emily K. Glass, Elizabeth G. Sherman. College of William & Mary, Williamsburg, VA.

(Sponsor: Emily K. Glass, FACSM)

PURPOSE: To determine if pre-habilitative conditioning effectively mitigates adaptations to muscle unloading in young and aged neuromuscular systems.

METHODS: Forty young (9 mo), and 40 aged (25 mo) rats were randomly assigned to one of four treatment groups within each age category (N=10/group). Treatment groups were: 1) hindlimb suspension for 2 wks (HS); 2) pre-habilitative exercise (i.e. treadmill running) for 2 wks prior to 2 wks of hindlimb suspension (PH); 3) 2 wks of treadmill running without hindlimb suspension (PH); or 4) no intervention (CTL). Neuromuscular junctions (NMJs) of soleus muscles were stained with Bungaroxin (postsynaptic acetylcholine receptors) and RT 97 (presynaptic nerve terminals), and fluorescently stained images were captured with confocal microscopy. Myofiber profiles of those same muscles were assessed with histochemical staining for ATPase activity.

RESULTS: In neither age group did NMJ morphology differ (P>0.05) among the 4 treatment groups. However, young and aged rats displayed different patterns of myofiber remodeling as a result of the various experimental treatments. Among young rats, HS resulted in a 22% decline (P<0.05) in myofiber cross-sectional area; this atrophy was significantly exacerbated in the PH-HS group (40% decrease), while PH training alone had no significant effect on myofiber size. But among aged rats, PH training significantly attenuated unloading-induced myofiber atrophy (32% vs. 45%), and average myofiber size of PH rats was 14% larger than the CTL group (P<0.05).

CONCLUSIONS: Two weeks was too brief a period to elicit reconfiguration of the NMJ regardless of age, or treatment. Instead, myofibers were significantly remodeled following the 2 wk intervention, with age significantly influencing those adaptations. Among young rats, pre-habilitative endurance training exaggerated unloading-induced fiber atrophy, but among aged rats - where sarcopenia was evident - the same pre-habilitative protocol significantly abated unloading-induced atrophy. We conclude that not all components of the neuromuscular system (NMJs and myofibers) are equally sensitive to unloading, and that among myofibers, aging impacts the value of pre-habilitative conditioning prior to muscle unloading.

Supported by NIH Grant R15 AG017440.

1529 Board #310 May 30 11:00 AM - 12:30 PM
Nuclear Factor-KappaB Activity in Human Primary Pericytes Affects Proliferation and Differentiation of Co-Cultured Skeletal Muscle Myoblasts
Robert D. Hyldahl, Lawrence M. Schwartz, Priscilla M. Clarkson, FACSM, 1 University of Massachusetts Amherst, Sunderland, MA. 2 University of Massachusetts Amherst, Amherst, MA.

(Sponsor: Michael R. Deschenes, FACSM)

METHODS: Human primary pericytes (HPPs) were transiently induced to express NF-kB signaling pathways using immunochemistry and Western blot.

RESULTS: The DNA vectors were effective at both increasing and decreasing NF-kB activity in HPPs. When HPPs with increased NF-kB activity were co-cultured with myoblasts, we observed a 50% increase in myoblast proliferation (p<0.001), and inhibition of myoblast differentiation, evidenced by a 32% reduction in myotube diameter (p<0.001) and a decrease in myotube nuclei. Western blot also showed a decrease in the expression of the muscle specific marker myosin heavy chain when HPPs with increased NF-kB activity were co-cultured with myoblasts.

CONCLUSIONS: Taken together, these data suggest that NF-kB dependent signaling in pericytes may indirectly regulate the regenerative response following damage by promoting proliferation of muscle precursor cells.

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RESULTS:
Supported by NSFC (No. 31000523) and Natural Sciences Foundation of Tianjin (No.11JCYBJC13600).

The abilities of autophagy accompanied with the higher level of mitochondrial fission and lower fusion level.

OBJECTIVE:
To further investigate the mechanism of action of these drugs.

METHODS:
Vastus lateralis biopsies obtained before and ~72h following the last training bout were analyzed for mRNA levels of components of the COX pathway (arachidonic acid synthesis: cPLA2 and dPLA2-X; prostaglandin (PG)F2α synthesis: AKR1C3 and CBR1; PGE2 synthesis: PTGES, PTGES-2; PGE2α and PGE2β receptors: FP and EP4), regulators of muscle protein (muRF1, MuRF2, Atrogin-1, FOXO3A, IKBKα) and growth (Myogenin, MRF4, myostatin), and cytokines involved in skeletal muscle adaptation (TNF-α, IL-1β, IL-6, IL-8, IL-10).

RESULTS:
Several components were increased with training (cPLA2, AKR1C3, CBR1, EP4, IKBKα, TNF-α, IL-1β, IL-8). However, IL-6, IL-10, and MuRF1 were differentially upregulated (P<0.05) in the placebo group compared to both drug groups, and FP was upregulated (P<0.05) only in the drug groups.

CONCLUSION:
Considering PGE2 stimulates the production of IL-6, which has been shown to promote muscle atrophy, suppression of IL-6 and MuRF-1 in both drug groups support our previous hypothesis that inhibition of COX-derived PGE2 and muscle proteolysis following the repeated exercise bouts may have been the basis for the additional muscle mass gains. Thus, we extend our hypothesis to suggest acetylcarnitine and ibuprofen-suppressed IL-6 production contributed to the additional muscle mass gains in the drug groups. Finally, the drug-induced PGE2 receptor upregulation may have restored or enhanced the protein synthesis response after each exercise bout and influenced the muscle mass gains in the drug groups.

NIH Grant AG020532

1531 Board #312
MAY 30 11:00 AM - 12:30 PM
Effect of Prior Physical Exercise on Autophagy During MPTP-Induced Parkinson’s Disease in Mice

Ning Jiang1, Wei Cao1, Chao Song1, Jing Jing Guo1, Yong Zhang1, Li Li Ji, FACSM2, Tianjin University of Sport, Tianjin, China. University of Minnesota, Minneapolis, MN. (Sponsor: Li Li Ji, FACSM)

OBJECTIVE:
To investigate if prior chronic treadmill running could be a protective way in delaying the procedure of PD in mice. To find the corresponding mechanism(s) about autophagy and mitochondrial fusion and fission.

METHODS:
40 C57BL/6 (6-8weeks) mice were randomly divided into sedentary or exercise group (12m/min, 20 minutes/day, running on treadmill for 6 weeks). After 6 weeks each group were divided into two groups which were injected with moderate dose of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) (30mg/kgx2, ip, 16 hour apart) or saline. Finally mice were divided into the following groups: (1) saline injected (N); (2) exercise and saline injected (NE); (3) MPTP injected (M); (4) exercise and MPTP injected (ME). Behavioral tests (pole climbing, hanging and swimming) were conducted in succession 1 day before MPTP injection, and 2, 5, 8 day after MPTP injection. Then all animal was sacrificed. Brain mitochondrial respiratory capacity (state3, state4, RCR) was measured. The expression of proteins (LC3, Beclin1, Drp1, Fis1, OPA1) were detected by western-blotting. TEM was used to observe the autophagic vacuole in brain. Two-way ANOVA with repeated measures was used for statistics.

RESULTS:
The behavioral outcomes showed from the second day after MPTP injection, M got the lower score compared with N (p<0.05 ) and the figures showed a continuous rising. ME got higher score than M. Mice brain mitochondrial RCR attenuated in ME compared with M (p<0.05). Drp1 protein expression elevated notably in exercise groups compared with non-exercise groups (increasing 13% for NE vs. N and 11% for ME vs. M, p<0.05), which was similar with Fis1, whereas OPA1 indicated an opposite pattern (reducing 37% for NE vs. N and 39% for ME vs. M, p<0.01). LC3 and Beclin1 Protein increased without significance in NE vs. N .But they increased 13% (p<0.05) and 30%(p<0.01)respectively in ME vs. M. No typical autophagic vacuole was found in each group.

CONCLUSIONS:
Prior moderate exercise may delay the development of PD by enhancing the mice brain mitochondrial respiraitory capacity in PD mice ,which may due to exercise up-regulate the abilities of autophagy accompanied with the higher level of mitochondrial fusion and lower fusion level.

Supported by NSFC(No. 31000523) and Natural Sciences Foundation of Tianjin (No.11JCYBJC13600).

1532 Board #313
MAY 30 11:00 AM - 12:30 PM
MARCH-V: A Possible Regulator of Mitochondrial Fusion and Fission in Aerobic Training Reducing Insulin Resistance?

Fei Zhao1, Qingsun Jin1, Hairong Qiao1, Yong Zhang1, Lili Ji, FACSM2, Tianjin University of Sport, Tianjin, China. University of Minnesota, Minneapolis, MN. (No relationships reported)

OBJECTIVE:
To explore the MARCH-V gene expression changes in long-term aerobic training improving insulin resistance induced by high fat diet. It might have an essential role in the control of mitochondrial dynamics as a dual modulator of MFN2 and DRP1 which regulate mitochondrial dynamics and function.

METHODS:
40 mice were randomly divided into normal Chow and high-fat diet group. After 8 weeks, each group was divided into 2 groups: normal diet control (NC), normal diet plus exercise (NE), high-fat diet control (HC) and high-fat diet plus exercise (HE). Mice were fed and/or trained for another 8 weeks. Respiratory control ratio and ATP synthesis activity in isolated skeletal muscle mitochondria were detected. Skeletal muscle mRNA and Protein levels of MARCH-V, MFN2 and DRP1 were measured by Realtime PCR and Westernblot respectively.

RESULTS:
1) The Fins, HOMA-IR of HC group mice were significantly lower than NC group. HE group were significantly lower than HC and significantly higher than NC (p<0.01). 2) Skeletal muscle mitochondrial in HC group mice showed lower state 3 respiration and higher state 4 respiration with lower RCR than NC group (p<0.01). HE group had higher state 3 respiration and RCR than HC group (p<0.05, p<0.01), and had no difference with NC (p<0.05). 3) The size and number of mitochondria are decreased in HE group and increased in NE,HE group. 4) MFN2 mRNA and protein in HC group were higher than that of NC group (p<0.05, p<0.01). HC group were lower than NC and NE group (p<0.01). HE group were higher than HC and NC group (p<0.01). 5) DRP1 mRNA and protein in HE group were higher than the NC group (p<0.05, p<0.01). HC were also higher than NC (p<0.05, p<0.01). HE were significantly higher than HC and NC group (p<0.01). 6) MARCH-V mRNA and protein expression in HE group were significantly higher than NC group (p<0.01), HE group were higher than HC and NC group (p<0.01).

CONCLUSIONS:
MARCH-V may be one of the regulators for mitochondrial dynamics and function in the mechanism of aerobic training reducing IR. But it may not participate in the regulation the mitochondrial fusion and fission during development of diet induced IR.

Supported by NSFC (No. 30872114) and Natural Sciences Foundation of Tianjin (No. 09JCYBJC12000)

1533 Board #314
MAY 30 11:00 AM - 12:30 PM
The Effect Of Aerobic And Resistance Exercise On Cardiac And Mitochondrial Function In OLETF Rats

Tae hee Ko, Daeyun Seo, Sung Ryul Lee, Hyoung kyu Kim, Na ri Kim, Byoung Doo Lee, Kyung Soo Ko, Jin Han. Inje University, Busan, Korea. Republic of. (No relationships reported)

Type 2 diabetes (T2DM) is the metabolic disease from the failure of insulin secretion and accompanied by obesity and hyperlipidemia, cause cardiovascular disease. To prevent or cure, exercise helps regulate blood sugar and also significantly reduced the risk of cardiovascular disease (CVD).

PURPOSE:
The purpose of this study was to investigate the effect of aerobic exercise and resistance exercise on cardiac and mitochondrial function in OLETF rats.
METHODS: OLETF (Osaka Long-Evans Tokushima Fatty) rats, an animal model of T2DM are occurred at 25 weeks. Twenty four OLETF rats were divided into treadmill exercise (EXT, 5%), resistance exercise (EXR, 5%) and control (SED, 8%) groups after 25 weeks. EXT and EXR groups were exercised 5 day/week for 12 weeks. EXT groups were exercised at 5min for 10minutes as adaptation for 2 weeks. And then, speed and duration were increased gradually. EXR groups were climbed ladder 5 repetition without weight as adaptation for 2 weeks. And then, repetition and weight were increased gradually.

RESULTS: The left ventricular (LV) function of diastolic in echocardiogram, EXT groups are improved EDV (End of Diastolic Volume, EXT: 1.24±0.06 vs SED: 0.68±0.05, p<0.005), LVIDd (Left Ventricular internal Dimension, diastolic, EXT: 8.2±0.16 vs SED: 6.6±0.19, p<0.005) and SV (stroke volume, EXT: 1.09±0.04 vs SED: 0.6±0.04, p<0.005) compared with SED rats. In EXT, LVPWd (Left Ventricular Posterior Wall Thickness, diastolic, EXT: 1.48±0.09 vs SED: 2.02±0.05, p<0.005) was decreased, and EDV (EXT: 0.99±0.04 vs SED: 0.68±0.05, p<0.005), LVIDd (EXT: 7.4±0.26 vs SED: 6.6±0.19, p<0.005) and SV (EXT: 0.86±0.08 vs SED: 0.6±0.04, p<0.005) were increased compared with SED rats. In mitochondria function, oxygen consumption was higher in EXT and EXR without significance. In ROS production, there was no significant change. Mitochondria membrane potential was not significantly different among OLETF groups.

CONCLUSION: We are suggested that improved by aerobic and resistance exercise may be positive effects on inhibiting aberrant morphology of diabetic heart. Different function in echocardiogram between aerobic and resistance exercise, it may be different function physiologically in T2DM. However, more precise evaluations on change in cardiac mitochondria will be required.

1534 Board #315
MAY 30  11:00 AM - 12:30 PM
Exercise Enhances Myogenic Differentiation through Regulating Reactive Oxygen Species Mediated Mitochondrial Fusion
Hai Bo1, Xun Wang1, Qixiang Chen1, Yong Zhang1, Li Li Ji, FACSM1. Tianjin University of Sport, Tianjin, China. 2.University of Minnesota, Minneapolis. (Sponsor: Li Li Ji, FACSM)

(Metrics reported)

Muscle precursors (MPC) proliferation and differentiation has been shown to play a key role in muscle plasticity following exercise. During myogenic differentiation the short mitochondria of myoblasts change into the extensively elongated network observed in myotubes, suggesting that mitochondrial fusion may have a role in myogenesis.

PURPOSE: To determine the functional relevance and the molecular mechanisms driving the formation of this mitochondrial network.

METHODS: MPC were isolated from both trained (T) and sedentary (S) mouse skeletal muscle with a high degree of myogenic purity. Mitochondrial membrane potential, ROS generation, ATP amount, fusion protein (OPA1 and Mfn2), p-mTOR and mitochondrial prohibitin2 expression were measured. We also examined the effects of exogenous low doses H2O2 (100 μM) exposure for 1h on differentiation of cultured MPC isolated from 3-month-old C57BL/6J mouse.

RESULTS: MPCs isolated from T mouse exhibited increased differentiation into myotubes and demonstrated increased myosin heavy chain (+117%, p<0.01) and creatine kinase (+135%, p<0.01) expression compared with S mouse. Mitochondrial membrane potential (+18%, p<0.05), ROS generation (+169%, p<0.01), ATP amount (+53%, p<0.05), OPA1 (+85%, p<0.01), p-mTOR (+34%, p<0.05) and mitochondrial prohibitin2 (+85%, p<0.01) were higher in MPC isolated from T mouse than from S mouse. We also demonstrated that H2O2-enhanced MPC differentiation, while treatment with a ROS trapping agent (N-acetyl-L-cysteine, NAC) slowed MPC differentiation. H2O2 exposure increased mTOR phosphorylation (+75%, p<0.01), mitochondrial membrane potential (+19%, p<0.05), ROS generation (+169%, p<0.01), ATP amount (+53%, p<0.05) and OPA1 expression (+85%, p<0.01) mTOR antagonist (Rapamycin) inhibits H2O2-induced mTOR phosphorylation (185±17% vs. 95.9±11.2, p<0.01). MPC differentiation and OPA1 expression (142.4±15.4 vs. 110±6±13.3, p<0.05).

CONCLUSION: OPA1-mediated mitochondrial fusion is required for exercise induced myogenic differentiation, and this event depends on generation of ROS and mTOR activation. Supported by NSFC(No. 31070403, 3111010391).

1535 Board #316
MAY 30  11:00 AM - 12:30 PM
NAD-Linked Isocitrate Dehydrogenase Activity is Phosphate Dependent in Sparrow Mitochondria
Doree Lynn Gardner, Sarah Kuzmiak, Wayne T. Willis. Arizona State University, Tempe, AZ.

(Metrics reported)

Flying birds are highly aerobic athletes, yet literature values indicate low activities of NAD-linked isocitrate dehydrogenase (IDH) in avian flight muscle. IDH is an important locus of rate control in the citric acid cycle (CAC) in most species, but calculations revealed that literature values of avian IDH Vmax could account for < 5% of the energy consumed by avian mitochondria oxidizing pyruvate + malate. Therefore carbon flux through the CAC might fundamentally differ in avian compared to mammalian mitochondria. It is conceivable that NAD-linked IDH plays a more important role in the routine flux of the avian CAC or that NAD-linked IDH of avian flight muscle may have different kinetic requirements than its mammalian counterpart.

PURPOSE: To determine physiologic co-factors which might influence NAD-IDH activity in avian skeletal muscle and to assess NAD- and NADP-IDH activity in whole muscle homogenate and isolated mitochondria from avian and mammalian locomotory muscles.

METHODS: Rat mixed hindlimb and English sparrow pectoralis muscle were excised and mitochondria were isolated. Mitochondrial membrane potential, ROS generation, ATP amount, fusion protein (OPA1 and Mfn2), p-mTOR and mitochondrial prohibitin2 expression were measured. To determine the functional relevance and the molecular mechanisms driving the formation of this mitochondrial network.

RESULTS: Mitochondrial membrane potential (+19%, p<0.05), ROS generation (+169%, p<0.01), ATP amount (+53%, p<0.05) and OPA1 expression (+85%, p<0.01) were higher in MPC isolated from T mouse than from S mouse. We also demonstrated that H2O2-enhanced MPC differentiation, while treatment with a ROS trapping agent (N-acetyl-L-cysteine, NAC) slowed MPC differentiation. H2O2 exposure increased mTOR phosphorylation (+75%, p<0.01), mitochondrial membrane potential (+19%, p<0.05), ROS generation (+169%, p<0.01), ATP amount (+53%, p<0.05) and OPA1 expression (+85%, p<0.01). mTOR antagonist (Rapamycin) inhibits H2O2-induced mTOR phosphorylation (185±17% vs. 95.9±11.2, p<0.01). MPC differentiation and OPA1 expression (142.4±15.4 vs. 110±6±13.3, p<0.05).

CONCLUSION: OPA1-mediated mitochondrial fusion is required for exercise induced myogenic differentiation, and this event depends on generation of ROS and mTOR activation. Supported by NSFC(No. 31070403, 3111010391).

1536 Board #317
MAY 30  11:00 AM - 12:30 PM
Electron Conductance in Rat and Sparrow Skeletal Muscle Mitochondrial Electron Transport Chain
Sarah Kuzmiak, Wayne T. Willis. Arizona State University, Tempe, AZ.

(Metrics reported)

Flying birds utilize fat for fuel during flight, a moderate-high intensity exercise, while mammalian reliance on carbohydrate increases with increasing exercise intensity. Previous investigations in our lab have shown this pattern of fuel selection persists even when saturating fuels are provided to the intact respiring mitochondria, suggesting a fuel selection mechanism at the level of the matrix.

PURPOSE: To determine the functional relevance and the molecular mechanisms driving the formation of this mitochondrial network.

METHODS: Mitochondria were isolated, provided saturating fuels (pyruvate, glutamate, and malate), and the maximal rate of oxygen consumption (Jmax) was measured. Mitochondria were then sonicated and maximum NADH oxidation was measured following the rate of oxygen reduction to water. The slope of the oxidation/reduction (redox) potential difference (Δ(HE)) relationship, a measure of the conductance of electron flow down the ETC, was also determined.

RESULTS: Intact maximal Jmax were 636 ± 87 and 641 ± 83 nmol·mg−1·min−1 in rat and sparrow, respectively, while the ETC Vmax were 731 ± 76 and 1020 ± 108 nmol·mg−1·min−1 Combined, these data indicate greater relative ETC activity in the sparrow; the (oxidase pathway) concentration ratio was 86 ± 4.0 in the rat and 65 ± 0.7 in the sparrow. Additionally, the slope of the Δ(HE) Jmax relationship was 1.7x greater in sparrow than the rat mitochondria, 12306 ± 1338 and 7196 ± 924, respectively.

CONCLUSIONS: These data indicate avian mitochondria have greater ETC “excess capacity” as well as greater conductance down the ETC compared to mammalian mitochondria. As a high reduction level of the mitochondrial matrix has been associated with an inhibition of β-oxidation, we posit rat fatty acid oxidation is inhibited by high reduction in the mitochondrial matrix while birds, via a high ETC conductance, are able to maintain lower matrix reduction, allowing fatty acid oxidation to proceed.

356

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A maximal exercise test on a treadmill is commonly used to assess aerobic capacity (VO_{2\text{max}}). In the presence of salicylate, ET and CIHH decreased basal state 3 (NS-249 vs. NE-161, HS-168, HE-170 katomsO/min/mg, p<0.05) and state 4 (NS-74 vs. NE-46, HS-33, HE-45 katomsO/min/mg, p<0.05). Neither ET nor CIHH altered the susceptibility to calcium-induced MPTP. CIHH lowered MnSOD (NS-12 vs. NE-11, HS-8, HE-8 katomsO/min/mg, p<0.05) and increased aconitase (NS-0.63 vs. NE-0.24, HS-0.85, HE-0.80 katomsO/min/mg, p<0.05) activities. ET and CIHH decreased caspase 8 activity (NS-1150 vs. NE-864, HS-545, HE-537 katomsO/min/mg, p<0.05) whereas no effect was observed on caspase 3. The levels of SIRT3 increased with ET and CIHH (NS-100 vs. NE-150, HS-128, HE-151 katomsO/min/mg, p<0.05) and CyP D decreased with CIHH per se (NS-100 vs. HS-83, HE-95 katomsO/min/mg, p<0.05). No differences were observed in HSPT and OXPHOS subunits.

CONCLUSION: ET and CIHH modulate basal LM bioenergetics and may antagonize some adverse effects of salicylate. Supported by FCT grant PTDC/DES/115580/2009.
Board #321 MAY 30 9:30 AM - 11:00 AM
An Examination of Stretching Practices and Perceptions within US Collegiate Cross Country and Distance Programs
Lawrence Judge1, David Bellar2, Jeffrey Petersen1, Bruce Craig1, Kimberly Bodey3, Erin Gilreath1, Laura Simons1, Matt Benner1. 1Ball State University, Muncie, IN. 2University of Louisiana at Lafayette, Lafayette, LA. 3 Baylor University, Waco, TX. 4 Indiana State University, Terre Haute, IN. (No relationships reported)

Research pertaining to pre-activity and post-activity stretching continues to expand in varied sport settings along with related best practice recommendations.

PURPOSE: This study was designed to determine if the pre- and post-activity stretching practices and perceptions of college cross country and track and field distance programs are aligned with the current recommendations.

METHODS: A total of 770 questionnaires were distributed to NCAA Division I, Division II, and Division III coaches in the United States. The demographic characteristics for participants in the investigation were as follows: n = 111, 78.2% male, 21.8% female, and age 41.3±12.0 years. The questionnaire was designed to gather demographic, professional, and educational information, as well as specific pre- and post-activity stretching usage by the coaches. The responses were examined by computing frequency counts and means where applicable. Pearson’s χ-square tests were utilized to determine differences in stretching modality usage.

RESULTS: Chi square analyses revealed a significantly greater usage of static stretching alone as a pre-activity modality (χ² = 21.582, p = 0.0174) by non-certified coaches (18.9%, n = 9) versus their certified counterparts (1.8%, n = 1). In addition, certified coaches reported higher usage of dynamic flexibility only during the pre-activity period (47.4%, n = 27) versus non-certified peers (32.4%, n = 16). Coaches were also asked about static stretching between interval work and competitive efforts, and similarly a significant difference (χ² = 11.948, p = 0.0177) was noted with a higher percentage of non-certified coaches (45.5%, n = 23) allowing athletes to perform static stretches during these situations than certified peers (37.9%, n = 22).

CONCLUSION: When comparing coaching specific certification to pre-activity flexibility practices, it is clear not all coaches are in compliance with suggested pre-activity flexibility recommendations. These significant differences help demonstrate coaching certification could be an effective tool for communicating current information about effective stretching modalities. However, the results also revealed that there are still many certified coaches who are not implementing best practices into athlete stretching routines.
RESULTS: Athletes averaged 12.6±2.1 training sessions/wk for a total of 202±22 sessions over 16 wks. Average weekly training volumes were 173.6±32.5, 213.3±41.2 and 159.6±27.0 km/week for marathoner 1, 2 and 3, respectively. There was a weekly high TRIMP of 4437 AU (wk 9) and low of 1887 AU (wk 16), and an average of 3082±646 AU. Of the 606 total training sessions, on average ~74, 11 and 15% were completed at an intensity in zone 1 (very easy to somewhat hard), zone 2 (at lactate threshold) and zone 3 (very hard to maximal). There was 2.5±2.3 low energy training bouts per week. On race day athletes consumed 61±15g CHO in 604±156 ml per hour (10.1±0.3% CHO solution). Athletes improved their marathon race times from 2:16:53 to 2:11:23, a debut at 2:16:17 and 2:15:15 to 2:12:39, respectively.

CONCLUSIONS: These unique periodized training and nutrition approaches in preparation for competition allowed for enhanced individual marathon performance.

1544 Board #325  MAY 30  9:30 AM - 11:00 AM
Body Composition and Weight Changes Based on Sex During a 15-Week Marathon Training Program
Scott R. Brown, Stacy J. Ingraham, Jane R. Yank, Jordan M. Langen. University of Minnesota, Minneapolis, MN. (No relationships reported)

Exercise and nutritional interventions have been at the forefront to produce positive health changes and reduce obesity. The general public often views the effectiveness of an exercise program solely on changes in weight, especially females. This research demonstrates weight loss may not occur with months of an endurance training intervention and weight loss may be a poor assessment to quantify positive results. This study also gives evidence that the public needs a practical way to assess body composition changes through intervention programs designed to lower body weight. Finally, there appears to be a difference between males and females in regards to weight loss during the marathon training.

PURPOSE: To determine if a 15-week marathon training program is successful for lowering body weight and improving body composition without a subsequent diet intervention.

METHODS: Eighty-five students (30 males, 55 females) were recruited from a marathon-training course offered by the Physical Activity Program at the University of Minnesota. Testing included VO2max, body composition, and anthropometric measures. Testing was done prior to the marathon training and two weeks prior to the marathon. Percentage of fat was assessed using a BodPod. Independent t-tests were used to compare males and females on two dependent variables: (a) change of weight (kg), and (b) change in percentage of body fat after 15 weeks of marathon training. Differences between pre- and post-test measurements of weight and percentage of body fat were assessed using dependent t-tests for paired samples.

RESULTS: There was a not a weight change for females (0.21 +/- 0.22 kg, p=0.346), and men trended to lose weight (-0.74 +/- 0.39 kg, p=0.75). Percent body fat did decline for females (-1.04 +/- 0.35%, p=0.004) and males (-1.26 +/- 0.46%, p=0.10) trended toward a decline also. Men lost more weight (0.95 +/- 0.441 p=0.027) than females and men also trended towards lowering percent body fat (0.258 +/- 0.14, p=0.073) when compared to females.

CONCLUSIONS: There is a tendency for males to lose more weight and to have larger changes in body fat percentages than females following a 15-week marathon-training program and changes in percent body fat may be the best way to monitor body compositional changes during an endurance training protocol.

1545 Board #326  MAY 30  9:30 AM - 11:00 AM
Maintenance of Increased Step Frequency Training in Female Runners Following Period of No Training
Timothy J. Quinn, FACSM, Sara E. Hourihan, Shauna L. Dempsey. University of New Hampshire, Durham, NH. (No relationships reported)

Running economy (RE) is the steady-state VO2 for a given submaximal running velocity and accounts for up to 65% of the variability in performance time. Increased step frequency (SF) training has been previously shown to improve running economy (RE). Whether an increased SF can be maintained following this type of training is unknown.

PURPOSE: The purpose of the study was to determine if a runner could retain an increased step frequency and improved RE after 12 days of structured training followed by 14 days with no learning stimulus.

METHODS: Ten female runners were recruited from local races and track clubs that had 5K times between 17-22 mins within the past year and a SF <175 s/min. Day 1 involved subjects running 5 mins on the treadmill at 3.4 and 3.8 m/sec at their preferred SF (PSF) and at an optimal SF (OSF) of 180 s/min. VO2 was measured at the two speed and SF conditions. VO2max was measured after the submaximal runs. Days 2-11 involved treadmill runs for 15 mins each day at the OSF of 180 s/min. A metronome was used to help subjects maintain the increased SF and SF was monitored using a footswitch and a BIOCAP MP100 Data Acquisition System. Days 12 and 26 involved post-training treadmill VO2 testing with no step training between days. Subjects were encouraged to train at the recently learned, faster SF. A repeated-measures ANOVA was used to detect significant differences at the p<0.05 level.

RESULTS: Following the training and on average, submaximal VO2 decreased by 3.0% (p=NS), HR dropped 4.0% (p<0.05), and SF was 4.0% (p=0.05) higher across both speeds and conditions. Following two weeks of no structured SF training, the VO2 reduction was maintained (2.9%; p=NS) as were the decreased HR (4.0%; p<0.05) and increased SF (3.7%; p=0.05) compared to the pre-training measurements and these findings were not different from post-training measurements.

CONCLUSIONS: The results from this study suggest that an increased SF can be maintained following a short SF training program resulting in a lower VO2 and HR and therefore, an improved RE in well-trained female runners.

1546 Board #327  MAY 30  9:30 AM - 11:00 AM
The Effect of Stride Frequency on Running Economy
Robert M. Otto, FACSM, Michele Aquino, John W. Wygand, Raymond Peralta, Mariel Wenzel, Cory Whitmer, Shannon Isom. Adelphi University, Garden City, NY. (No relationships reported)

Run economy is closely allied with both stride frequency and stride length, which are inversely proportional at a fixed speed. It is believed that veteran runners gravitate to a specific stride frequency, which may coincide with optimal efficiency. Often acute fatigue during a race attenuates both run performance and efficiency through changes in stride frequency and length. If an optimal stride frequency can be identified, then the seasoned athlete can strive to retain the optimal stride frequency during all efforts.

PURPOSE: To determine the effects of three different stride frequencies on energy cost at a fixed speed.

METHODS: 12 intercollegiate athletes (9 male, 3 females, ht. 173.3 ± 9.9 cm, body mass 66.9 ± 10 kg) volunteered to run at a steady state level which corresponded to their 10K race pace. A baseline trial was conducted at 214.4 (m/s), 241.2 (m/s) or 268 (m/s) m/min and 1% grade at the participants self-selected stride frequency (SS), while metabolic energy cost (oxygen consumption) and stride frequency were obtained. Subjects practiced running at the initial fixed speed with a stride frequency of 5 steps/min above (A) and 5 steps/min below (B) their self-selected stride frequency. After a minimum of four practice sessions, subjects performed trials A and B with open circuit spirometry in a randomized design.

RESULTS: Mean SS stride frequency was 89 ± 6.7 with a range of 81-102. The mean energy cost at a fixed speed and a stride frequency of SS, A, and B were 51.5 ± 5.7, 51.2 ± 5.6 and 51.4 ± 5.0 mLO2/kg-min, and .204, .203, and .204 mLO2/kg-meter, respectively, with a mean range of less than 39 mLO2/min among all trials. Stride length and stride length/hg leg length ratio were 1.43, 1.35, and 1.51 meters/stride and 1.70, 1.62, and 1.81, for SS, A, and B trials, respectively. Statistical analysis by ANOVA at p<0.05 revealed no significant difference among the three trials, even though eight subjects displayed the lowest energy cost at a stride frequency greater than their SS frequency.

CONCLUSIONS: The lack of statistical significance among various stride frequencies does not preclude the possibility of an improved run efficiency and/or performance of specific individuals with an alteration in stride frequency.

1547 Board #328  MAY 30  9:30 AM - 11:00 AM
Running Economy Is Not Related To Jumping Performance
James M. Smoliga, Josh J. Fleming, Michael S. Hux, Andrea J. Fradkin. 1Marywood University, Scranton, PA. 2Bloomburg University, Bloomburg, PA. (No relationships reported)

Previous research has shown that plyometric training is an effective way of improving running economy (RE). Yet it is unknown whether certain jump types have larger running-specific components associated with them.

PURPOSE: To determine the relationship between eight different jump types and RE.

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METHODS: Ten recreationally active college students (six males, four females) participated in two days of testing separated by 48 hours. On Day 1, participants ran for five minutes on a treadmill at four submaximal speeds with three minutes between each speed. Metabolic data was collected continuously and RE for each speed was computed as VO2 required to run 1 km. On Day 2, participants performed a series of eight randomized jumps including a single-legged vertical jump (VJ), broad jump (BJ), and contralateral jump (CJ) on both right (R) and left (L) legs, as well as a double-legged (2L) VJ and BJ. Participants performed three repetitions of each jump, with 45 seconds rest between repetitions and a three minute rest between jump types. A repeated measures ANOVA was performed to compute differences in metabolic data and RE between speeds. Pearson’s product moment correlations were performed to determine the relationship between the best jump performance for each condition and RE.

RESULTS: There were significant differences in heart rate and VO2 between all speeds (p < 0.001), yet there were no significant differences in RE between all speeds (p = 0.938). Very poor, non-significant, negative relationships were found between mean RE (218.2 ± 27.2 mL O2 · kg · min⁻¹) and both double-legged jumps (VJL (0.52 ± 0.16 mL, r = -0.015, p = 0.967); BJL (2.22 ± 0.50 mL, r = -0.055, p = 0.880), as well as VJR (0.39 ± 0.14 mL, r = -0.028, p = 0.938). Very poor, non-significant, positive relationships were found between RE and all right-legged jumps (VJR (0.37 ± 0.13 mL, r = 0.059, p = 0.872); BR (1.77 ± 0.43 mL, r = 0.248, p = 0.489); CR (2.02 ± 0.33 mL, r = 0.159, p = 0.662)), as well as BJL (1.82 ± 0.35 mL, r = 0.218, p = 0.546) and CJR (2.01 ± 0.34 mL, r = 0.175, p = 0.629).

CONCLUSION: All jump types examined in this study had very poor relationships to RE, suggesting that there must be alternate explanations for the improved RE seen after plyometric training. Future research should explore other jump types, as well as other mechanisms that may account for this.

1548 Board #329 MAY 30 9:30 AM - 11:00 AM
Effects of Unweighting on Heart Rate Response and Speed/Incline Adjustments Necessary in Elite Runners

RESULTS: All jump types examined in this study had very poor relationships to RE, suggesting that there must be alternate explanations for the improved RE seen after plyometric training. Future research should explore other jump types, as well as other mechanisms that may account for this.

1549 Board #330 MAY 30 9:30 AM - 11:00 AM
Physiological Characteristics of a Co-ed Cross Country Running Team Living and Training at Altitude
Scott N. Drum, FACSM, Sarah Baysden, Meta Haley. Western State College of Colorado, Gunnison, CO.

CONCLUSION: Unweighting due to LBPP requires an increase in running speed and incline in order to maintain training intensity levels in elite male runners. Since the increases in speed and incline necessary to achieve target intensities do not appear to be linearly related to the level of unweighting, further research is necessary to identify the variables at which maximum intensity can be achieved while ground reaction forces are minimal.

1550 Board #331 MAY 30 9:30 AM - 11:00 AM
Age, Gender, and Mode Considerations In Elite Ultra-endurance Triathlete Performances
Vincent Nethery, Travis Hudon, Tim Burnham, Robert Pritchett. Central Washington University, Ellensburg, WA.

CONCLUSIONS: The threshold for age related diminished performances in high-level ultra-endurance triathlon performances are related to both gender and specific event sub-discipline. Such performance-based analyses of world-class age-group athletes, provides unique insight into the relationships between aging, functional ability, and task mode.
Blood flow restriction (BFR) can have similar effects.

**Purpose:**
To provide information about the training, nutrition and overall health of triathletes.

**Methods:**
- Male and female triathletes (N = 277) ranged in age from 18 - 66 yrs (38.7 ± 0.61 years). Average height was 175.9 ± 0.81 cm and weight was 74.3 ± 0.15 kg. Athletes had 4 years of previous race experience and typically finished in the upper 50% of their age group by gender. Training consisted of 3.2 ± 0.21 hours swimming, 6.2 ± 0.39 hours biking, 5.1 ± 0.41 hours running, 1.3 ± 0.10 hours weight lifting, and 97 ± 0.19 hours of cross training per week. Triathletes reported consuming 3.5 ± 0.09 servings of carbohydrates, 3.0 ± 0.06 servings of fruits, 3.1 ± 0.08 servings of vegetables, 2.3 ± 0.08 servings of dairy products, 2.3 ± 0.08 servings of fat rich foods and 3.1 ± 0.08 servings of protein rich foods on a daily basis. The most commonly used nutritional supplements were bars (92%) followed by liquids (91%). Triathletes (n = 71) reported average energy consumption 2322 ± 51.5 kcal, with 2473.9 ± 72.9 kcal and 2072 ± 57.6 kcal in men and women respectively. Knee (34%), foot (31%), back (24%) and shoulder (18%) injuries were the most common, but the majority of athletes reported that their health (89%) and quality of life (86%) was very good or excellent. Lastly, most triathletes (88%) reported no problems with work or other daily activities as a result of emotional problems.

**Conclusion:**
In conclusion, triathletes cycle more than run and spend the least time swimming. Triathletes reported eating more carbohydrates than other food groups and regularly use liquids and bars as supplements. While most triathletes experience a higher quality of life, a number of them tend to experience injuries to the lower extremity.

**Results:**
- Recovery heart rates at 1 and 2 minutes, respectively, for young (31±13, 78±11), middle age (36±17, 84±22), and masters (31±11, 71±19) were significantly different (p<0.05). Training mode did have an impact on recovery heart rate. Heart rate recovery in runners was significantly faster (p<0.05) with HRR1 (39±13) and HRR2 (87±16) than recovery in cyclists with HRR1 (25±10) and HRR2 (64±16).

**Conclusion:**
This study describes the effect of age and mode on heart rate recovery in trained recreational athletes. Runners exhibit faster heart rate recovery than cyclists regardless of age.

**Results:**
- Traditional high-intensity cycle training (HI) has been shown to improve muscle responses and aerobic capacity, however, recent research indicates that low-intensity cycle training with blood flow restriction training (BFR) at 160-180 mmHg), and BFR at 160-180 mmHg), and CON (n=10, no exercise).
- Subjects in HI and LI exercised 3 sessions (5 min warm-up & 20 min cycling)/week for 6 weeks. Body composition (fat %, total fat mass, and total lean mass by DXA), muscle hypertrophy (leg fat and lean mass by DXA, and muscle CSA by pQCT), muscle strength (1-RM leg extension and flexion), and aerobic capacity (VO2max) were measured pre and post training. A two-way repeated measure ANOVA was utilized to compare groups and times with statistical significance set at p<0.05.

**Results:**
- There were no significant differences between groups for any of the outcome variables but a number of trends were noted. Fat %, fat mass, and lean mass changed by -4.7%, -4.3%, and 2.1% in LI, -0.4%, -0.1%, and 0.7% in HI, and -1.1%, -1.1%, and 0.0%, respectively in CON. Additionally, leg fat mass decreased by 3.1% in LI, but only 1.3% in HI and 0.4% in CON.

**Discussion:**
Handcycling is an effective training mode for upper body exercise capacity. A training schedule based on ACSM guidelines (though designed for exercising the large muscle masses of the lower body) leads to exercise specific improvements in handcycling performance on peak VO2, peak PO and peak HR. In this way, it seems that ACSM guidelines can be used as a general basis to determine training frequency, intensity and duration for upper body exercise in healthy able-bodied subjects. Future research must focus on transferability of these results to different patient groups and persons with different impairments and physiological capacities. In particular those with a low physical capacity must receive special attention.

**References:**
- References are provided for further information.

**Conclusion:**
In conclusion, triathletes cycle more than run and spend the least time swimming. Triathletes reported eating more carbohydrates than other food groups and regularly use liquids and bars as supplements. While most triathletes experience a higher quality of life, a number of them tend to experience injuries to the lower extremity.
CON. Leg flexion strength was significantly different between HI and CON (P = 0.035), however, % changes for leg extension and flexion strength were 5.2% and 7.2% in HI, 5.7% and 6.3% in LI respectively. Finally, % change for VO\textsubscript{2max} was 5.7% in HI, 2.1% in LI, and -1.4% in CON. VO\textsubscript{2max} was significantly different between HI and CON (P = 0.029).

CONCLUSIONS: Even though low-intensity cycle training with blood flow restriction did not statistically improve body composition, muscle hypertrophy, muscle strength, and VO\textsubscript{2max}, decreases for fat in the LI group were greater than the HI, and the other changes for LI were similar to the changes for the HI group.

1555 Board #336 MAY 30 9:30 AM - 11:00 AM
The Effect Of Endurance Cycling Training On Cross-sectional Area And Strength Of Thigh Muscles In Human
Hidetoshi Hoshikawa, Saori Yoshida, Tsukasa Miyamura. Hamamatsu University, Shizuoka, Japan.

(No relationships reported)

Although endurance training has been shown to markedly affect the oxidative capacity of the skeletal muscle, there is limited information about the effect of on the skeletal muscle morphological property and strength.

PURPOSE: To investigate the effect of endurance cycling training on cross-sectional area of and isokinetic strength of thigh muscles.

METHODS: Four male (20.8 ± 0.5 yr, 171.9 ± 1.5 cm, 63.5 ± 2.2 kg) and four female (20.5 ± 0.5 yr, 164.5 ± 4.5 cm, 52.9 ± 7.6 kg) university students were participated in this study. They trained for 7 weeks on a bicycle ergometer for 30 min/day, three times a week at a work load requiring 60 % of oxygen uptake reserve (VO2R) at 90 rpm. Before and after training, isokinetic knee extension and flexion moment (60, 150, and 240 deg/s) were measured and cross-sectional areas (CSAs) of quadriceps femoris and hamstrings at 30, 50, and 70 % of the femur bone length, and psoas major muscle at the center of the L4-L5 transverse level were determined by magnetic resonance imaging.

RESULTS: VO\textsubscript{2max} was significantly increased by 10.1 ± 6.6 % after training (p<0.01). By the end of the training period, peak knee extension moment at 60, 150 and 240 deg/s (10.3 ± 7.2, 9.6 ± 8.8, and 18.2 ± 14 %, respectively, p<0.05) and flexion moment at 60deg/s (8.7 ± 8.1 %, p<0.05) were significantly increased. CSA of quadriceps femoris was significantly increased at 30, 50, and 70 % of the femur bone length after training (5 ± 4.0 %, p<0.05). Although CSA of psoas major was not statistically significant, the value tended to be higher after training (p<0.06).

CONCLUSIONS: These results suggest that moderate endurance cycling training induce muscle hypertrophy and increase muscle strength in the thigh.

1556 Board #337 MAY 30 9:30 AM - 11:00 AM
Comparison Of Different Exercise Tests For Predicting Endurance Performance In Moderately Trained Cyclists
Niklas Pailander\textsuperscript{1}, Mikael Flockhart\textsuperscript{2}, Kent Sahlin\textsuperscript{1}.\textsuperscript{1} Karolinska Institutet, Stockholm, Sweden.\textsuperscript{2}Swedish School of Sport and Health Sciences (GIH), Stockholm, Sweden.

(No relationships reported)

Laboratory exercise tests are important for evaluating training adaptations and to predict endurance performance. The most frequently used test parameters are VO\textsubscript{2max} and power output at the 4 mmol L\textsuperscript{-1} blood lactate threshold (W\textsubscript{L1}). However, alternative test parameters might provide improved precision and/or reduce the need of expensive laboratory equipment.

PURPOSE: To investigate how different test parameters correlates with endurance performance in moderately trained cyclists.

METHODS: Eighteen cyclists (VO\textsubscript{2max} (mean ± SEM) 56 ± 1 mL kg\textsuperscript{-1} min\textsuperscript{-1}) completed two tests on separate days; a 40 min time trial (TT40) on a SRM cycle ergometer for assessment of endurance performance and an incremental ergometer test for assessment of maximal oxygen consumption (VO\textsubscript{2peak} (mL kg\textsuperscript{-1} min\textsuperscript{-1}) and maximal power output at exhaustion (W\textsubscript{L4}, W kg\textsuperscript{-1}). Lactate was measured in capillary blood taken during and after the incremental test and used for calculation of the power output at the 4 mmol L\textsuperscript{-1} (W\textsubscript{L1}, W kg\textsuperscript{-1}) lactate threshold.

RESULTS: Endurance performance, calculated as the average power output during the TT40 (W kg\textsuperscript{-1}), was correlated with the conventionally used test parameters VO\textsubscript{2max} (r = 0.81, p < 0.01) and W\textsubscript{L1} (r = 0.78, p < 0.01). However, higher correlation coefficients were observed between TT40 and the alternative test parameters W\textsubscript{L4} (r = 0.90, p < 0.01) and VO\textsubscript{2peak} (r = 0.87, p < 0.01). Further, multiple regression analysis shows that W\textsubscript{L4} + W\textsubscript{L1} can explain 80 % (adjusted $r^2$-value) of the variance in endurance performance whereas VO\textsubscript{2max} + W\textsubscript{L4} can explain 73 %.

CONCLUSION: Compared to traditional test parameters, our results indicate that both W\textsubscript{L4} and W\textsubscript{L1} are suitable test parameters to predict endurance performance in moderately trained cyclists. However, W\textsubscript{L4} is to be preferred due to high precision in combination with relatively low laboratory costs.

This study was supported by The Swedish National Centre for Research in Sports.

1557 Board #338 MAY 30 9:30 AM - 11:00 AM
Gender Differences In Training Load Guided Cycling Training
Andreas Bruch, Björn Stapelfeldt. Albert-Ludwigs Universität Freiburg, Germany, Freiburg, Germany.

(No relationships reported)

A novel approach for guiding endurance training is the Training Load (TL) concept. TL aims to make different exercise sessions comparable in terms of adaptive or exhausting characteristics. Input information for TL include gender, weight, VO\textsubscript{2max}, HRmax, HRrest, lactate threshold (LT), anaerobic threshold (IAT), heart rate and training time. It has been shown that using TL results in significantly less intense training with equal performance improvements in cycling training (Bruch et al., ECSS 2011). The question remains whether gender has an impact on TL guided vs. non-guided training in cyclists.

PURPOSE: To document and analyze gender differences in TL guided and non-guided training in well-trained cyclists.

METHODS: 22 competitive level German cyclists and triathletes (11 males, 11 females) with 15 h/week cycling training and VO\textsubscript{2peak} values between 50-60 mL/min/kg trained for 8 weeks, study group guided by TL, control group without guiding. At the beginning of the end of the study a standardized incremental exercise test (IET) was completed starting with 100 W for males and 80 W for females with 20 W increase every 3rd minute. Lab-test measurements included weight related power at LT, IAT and maximum power. During study time the TL-values of all subjects were calculated before and after every training session. In addition the training starting and ending times, the minutes of training over 100 bpm and the average HR of each session were documented.

RESULTS: TL guided cycling training decreased intensity in training and led to equal performance increase in women and men. Women completed an average of 53.45 training session, men 50.36 training sessions (p=0.41). TL-values before training were on average 87.39 in women and 91.49 in men (p=0.83). TL-values after training range from 152.65 in women to 159.23 in men (p=0.83). Women and men achieved similar performance increase (no significant differences in any relevant marker).

CONCLUSION: TL guided in cycling training seems to be effective in both genders. It leads to a less intense training while achieving the same performance increase. Positive implications include optimizing training intensity and recovery times. These may prevent overtraining and reducing the risk of illness and injury in women and men.

Supported by Polar Electro Oy, Kempele, Finlad.

1558 Board #339 MAY 30 9:30 AM - 11:00 AM
VO\textsubscript{2} Kinetics in Uphill Cycling
Andrew Gai. University of Central Missouri, Warrensburg, MO.

(No relationships reported)

PURPOSE: The objective of this study was to test for differences in oxygen consumption during a cycling hill climb based on whether the subject was seated or standing while pedaling.

METHODS: Eight male trained cyclists began by having DEXA scan to determine body comp and a preliminary VO\textsubscript{2max} test on an electronic bike ergometer. The VO\textsubscript{2}data was used to set the ergometer wattage levels and determine cardio-respiratory fitness. Subjects returned on a separate day to do a simulated climb portion of the research. The exercise began with cycling at a light pace to warm up. After warm-up, the intensity was increased to a wattage equal to 60% of VO\textsubscript{2max} to simulate a moderate hill climb. The subject pedaled in a standing position for 3 minutes while VO\textsubscript{2} data and heart rate were monitored and collected. After the 3 minute climb, the wattage was lowered to allow the subject to recover. After 3 min recovery, a second climb using seated
pedaling method for 3 minutes at 60% was completed. The subject was then allowed to recover and a second more difficult simulated climb was performed at 85% of VO2 max for 3 minutes seated and standing. Data was collected for VO2 consumption, wattage and heart rate for all 3-minute sessions. The VO2 data used for comparison was an average of the last minute of each 3 minute “climb” session.

RESULTS: The hypothesis was that the seated hill climb would require more oxygen consumption compared to the standing climb. Results for the 60% intensity were 3.376 ± 0.58 L/min standing and 2.967 ± 0.31 L/min seated (p<0.05). The values for the 85% intensity were 3.993 ± 0.52 L/min standing and 3.904 ± 0.32 L/min seated (p>0.05).

CONCLUSION: Based on the current data at lower wattage levels seated cycling is more efficient, while higher wattage levels were equal seated or standing.

1559 Board #340 MAY 30 9:30 AM - 11:00 AM
Range of Motion is Not Related to Cycling Performance
Daryl L. Parker, Jamie L. Donkin, Rick T. Bradley, Raymond Martinez, Jr, Max Polin, Roberto Quintana. Irvin Faria Exercise Physiology Research Laboratory, CSU Sacramento, Sacramento, CA.

(No relationships reported)

Over the past several year a number of research studies have evolved indicating that pre-exercise static stretching can reduce muscular performance. This has lead to the recommendation that static stretching should be completed during the post-exercise period. However, it is unclear whether improving range of motion in a joint provides a benefit or detriment to performance.

PURPOSE: This investigation was conducted to examine the range of motion (ROM) in the major muscle groups of cycling exercise and determine if there is a relationship between ROM and performance.

METHODS: Nine competitive cyclists (female n=1) age: 23.8±4.37 yrs, mass: 69.8±9.72 kg, VO2 max: 61.3±7.28 ml/kg/min served as subjects for this investigation. All had been competing for over a year and ranged in ability from category 5 to 2 (USA cycling). Upon arrival to the lab each subject completed a graded exercise test (GXT) on a cycle ergometer (male=35 W min⁻¹, female=25 W min⁻¹) to determine Wmax and VO2 max. Following the GXT, range of motion (ROM) was assessed using a Leighton flexometer. Hip flexion (HF), hip extension (HE), knee flexion (KF), knee extension (KE), and plantar flexion (PF) were all measured in triplicate. Following the ROM assessment, each subject completed a Wingate test for the determination of peak power (PP). The rest period between the GXT and the Wingate test was 30 minutes minimum. Thirty minutes was the minimum amount of time required for the GXT to not interfere with the outcome of the Wingate test during our pilot testing. Relationships between ROM and PP as well as ROM and Wmax were assessed using Pearson’s r. An alpha level 0.05 was used to assess significance in this sample.

RESULTS: The average Wmax and PP for the sample was consistent with competitive cyclists (Wmax 5.4±1.58 W/kg, PP 13.6±1.31, respectively). None of the ROMs assessed had a significant relationship with Wmax (HF r=0.32 p=0.40, HE r=0.20 p=0.61, KF r=0.40 p=0.28, KE r=0.10 p=0.79, PF r=0.40 p=0.29) or PP (HF r=0.37 p=0.33, HE r=0.36 p=0.33, KF r=0.04 p=0.99, KE r=0.04 p=0.91, PF r=0.34 p=0.38).

CONCLUSIONS: The data from this investigation seem to suggest that poor ROM is not a detriment to the motion of cycling. The data also seem to suggest that good range of motion is not a benefit in the motion of cycling. A larger sample may elucidate a different relationship.

1560 Board #341 MAY 30 9:30 AM - 11:00 AM
Comparison Of Vo2 For Three Cycling Modes
Andrew I. Miller, Edward M. Heath, FACSM, Eadric Bressel, Gerald A. Smith, FACSM. Utah State University, Logan, UT. (Sponsor: Edward M. Heath, FACSM)

(No relationships reported)

Bicycling research in a laboratory has an advantage of being more tightly controlled compared to field studies; however, consideration must be given to ecological validity for the study’s results to be best applied to its target population and environment. A stationary cycle ergometer is often the default instrumentation for lab data collections, but results may not generalize well to target populations or environments for two key reasons: (1) a cycle ergometer is not what a cyclist is accustomed to riding and will usually have a geometry different from an individually-fitted cycle, and (2) there is no balance requirement on a cycle ergometer. Rollers or a stationary trainer can be used to partially address these concerns.

PURPOSE: To compare oxygen uptake (VO2) at a similar power level during cycling on an ergometer, a stationary trainer, and rollers.

METHODS: Highly-trained cyclists (n = 5, age = 34.0 ± 8.9 yr, VO2 peak = 63.7 ± 4.8 ml/kg/min) performed a ramped VO2 peak test with 50 W increase per min on a stationary trainer using their own bicycle. This test was followed by 4 min sub-max tests at a power corresponding to 70% of VO2 peak on each of three modes in randomized order (modified Monark ergometer, CycleOps Supermagneto trainer, CycleOps aluminum rollers with magnetic resistance). Testing was performed at an altitude of 1382 m. Power on the bicycle (rollers and trainer) was measured via a Power Tap SL+ hub, and by way of resistance on the ergometer. Because power could not be exactly matched across the 3 modes, a regression based on the VO2 peak test was used to adjust VO2 values to corresponding values at a constant mechanical power.

RESULTS: Mean VO2 values at constant power levels were: rollers = 48.2 ± 5.2, trainer = 46.9 ± 5.1, and ergometer = 46.9 ± 4.1 ml/kg/min.

CONCLUSION: Riding on rollers required a 2.8% increase in oxygen uptake (10.2 W) compared to riding a stationary trainer or ergometer at the same mechanical power level (p < 0.05). This increased cost was likely due to the metabolic cost of balance associated with cycling on rollers, and suggests that rollers may better simulate the metabolic cost of natural cycling.

1561 Board #342 MAY 30 9:30 AM - 11:00 AM
Effect Of An 11-week Strength Core-training Program On Lumbar Range Of Movement In Swimmers
Monica Solana-Tramunt1, Josep Cabedo1, Ana M. Bobillo-Rodenas2, Josep Morales1, 1FPCEE Blanquerna Ramon Llull University, Barcelona, Spain. 2GISEAFE INEFC Barcelona, Barcelona, Spain.

(No relationships reported)

Lumbar range of movement (ROM) is essential to develop effective movements during underwater undulatory swimming technique. Core exercises are used to improve the strength of the muscles that participate on that technique but they are not designed to improve lumbar ROM.

PURPOSE: To examine the effects of an 11-week core training program on lumbar ROM after lumbar flexion and extension exercises on underwater gliding body position.

METHODS: A sample of 37 professional swimmers, 21 males and 16 females (20.7±3.3yrs), participated in the study. They were randomly divided in 21 swimmers for the experimental group (EG) and 16 swimmers for the control group (CG). EG fulfilled 3 core exercises, 6 days a week during 11-weeks. All the subjects underwent the same training in parallel with the experimental group intervention and signed informed consent.

The exercises consisted of performing maximum lumbar extension and recover underwater gliding body position, repeated at slow pace of 10 breaths. ROM was measured by an electrogoniometer attached on the skin, its cranial arm over T12-L1 spinous process, line up to L3 level, and lower arm over S1-S3 surface. The evaluation consist of measuring lumbar ROM from maximal flexion to maximal extension degrees, in 3 consecutive trials separated by 20s, sitting over a Swiss ball keeping hips and knees between 80° and 90° of flexion, the back straight, the sight to the front and both hands over the knees on a relaxed position. The test position allowed easy lumbar movements on sagittal plane.

It has been measured the mean of each flexion and extension trial and calculated the total ROM from the maximal extension mean to maximum flexion mean degrees. ROM comparisons between pre-test and post-test were made using paired samples t-Test. The results are expressed by the mean, SD and significant differences (p<0.05) before and after the experimental period.

RESULTS: Lumbar ROM changed on EG from 34.4±12.9° to 44.7±14.3° (p<0.000) and on CG from 34.7±11.9° to 35.9±12.5° (p=0.22).

CONCLUSIONS: The results suggest that to repeat maximal lumbar extension positions at breathing pace without holding them, can increase lumbar range of movement in sagittal plane. It could be important to consider this on future ROM exercises programs.
Effects of Altitude Training on Heart Rate Variability in Orthostatic Test in Elite Swimmers

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(Please note: No relationships reported)

Different stressors, like athletic training, can change the autonomic modulation of the heart. This can be evaluated with heart rate variability (HRV) analysis. Acute hypoxia is also known to attenuate parasympathetic activity and accentuate the sympathetic activity. Whether these changes in autonomic modulation will disappear with altitude acclimatization remains unclear.

PURPOSE: This study was made to investigate the effects of 3-week moderate altitude training on HRV in elite swimmers.

METHODS: 9 elite swimmers (HI) of international level (5 women and 4 men, age 19.4 ± 1.6 years) lived and trained at sea level. RR-intervals were recorded every morning in supine and standing positions with beat-by-beat heart rate monitors. Breathing was paced to 12 breaths/min. Recordings were done during the 3-week intervention period and one week before and after. HRV was analyzed from the last 5-min period of both positions with FFT spectral power analysis. TRIMPs of every training session were calculated to estimate training load. HRV results are averaged over every week and presented as relative percentage changes.

RESULTS: The training load was similar in both groups during the 3-week intervention but was lower during the week after in HI-group when compared to Lo-group (P=0.003). An interaction of group, time and TRIMPs was found in change in spectral power of supine LF (-40% vs. +36%, P=0.02) and HF (+46% vs. +55%, P=0.01) during the intervention period showing increased HRV in Lo group and decreased HRV in HI-group. Also LF (+93% vs. +12%, P=0.01) and LF/HF ratio (+79% vs. -2%, P=0.01) during standing increased more in HI-group than in Lo-group in the end of the intervention.

CONCLUSION: The present findings will support the hypothesis that the physiological stress of training at moderate altitude leads to parasympathetic withdrawal and possibly increased sympathetic activity even after night rest. These changes in autonomic modulation seem to last longer than for the first week after altitude training camp. Supported by CSD (35/UPB10/10, 05/UPB32/10) and MICINN (DEP2009-09181) grants.

364
1565  Board #346  MAY 30  9:30 AM - 11:00 AM

Heat Acclimation In Skin Graft Patients
 Rebekah A. I. Lucas, Matthew S. Garino, James Pearson, Craig G. Crandall, FACSM. Institute for Exercise and Environmental Medicine, Dallas, TX. (No relationships reported)

PURPOSE: This project tested the hypothesis that skin graft patients have the capacity to heat acclimate.

METHODS: Twenty burn survivors (age range: 22-54 years) with well-healed split thickness grafts (16±14 years post-injury) were stratified into two groups: 20-40% body surface area (BSA) grafted (N=13) and 45-75% BSA grafted (N=7). Six similarly aged, non-injured subjects served as controls. Subjects exercised for 90 min (the first 45 min at 1 l/min oxygen uptake followed by 45 min at a workload equivalent to 45% maximal oxygen uptake) in an environmental chamber (40° C, 30% relative humidity) on the first and final day of a 7 day heat acclimation regimen. Local sweat rate (from non-grafted skin), whole body sweat rate (pre/post weight), and change in body core temperature (intestinal) and heart rate responses were measured.

RESULTS: See Table. Five grafted subjects (one 20-40%, four 45-75% BSA) were unable to complete the second 45 min bout of exercise on Day 1; therefore, Day 7 comparisons were time matched.

CONCLUSIONS: 7 days of heat acclimation attenuated the increase in body core temperature and heart rate in both the 20-40% and 45-75% BSA groups, indicating that these individuals are able to heat acclimate and thus improve heat tolerance. Local and whole body sweat rates were not improved by the heat acclimation regime; though this may be because the central drive for sweating (i.e., body core temperature) was reduced following the acclimation regime.

Grant: NIH GM088856.

1566  Board #347  MAY 30  9:30 AM - 11:00 AM

Heat Preconditioning Abolishes Eccentric Exercise-induced IL-6 Increase
 San-Tsui Wang¹, Houeh-Yi Lin², Li-Ching Chou¹, Sun-Chin Yang³, Ming Chuan University; Taipei Physical education college, Taipei, Taiwan. ¹National Ilan University; Taipei Physical education college. Ilan, Taiwan. ²Ming Chuan University, Taipei, Taiwan. ³Hsin Sheng University; Taipei Physical education college, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM) (No relationships reported)

It has been reported that exercise-trained animals have lower mortality rate against heat stress than sedentary animals, implicating a cross-adaptation in physiological components central to heat tolerance.

METHODS: Using a balanced crossover design with one month separation, 16 active young male subjects voluntarily participated in a heat preconditioning program before exercise challenge, which includes 4 sessions of 30-min hot water immersions at 41 °C every 72 h.

RESULTS: Three days after last immersion, circulating muscle creatine kinase (CK) and thiobarbituric acid-reactive substances (TBARS) were slightly elevated by 27% and 21%, respectively (P<0.05). This was concurrent with increased heart rate variability (HRV) (P<0.05). After an acute bout of eccentric exercise challenge with 6 squats at 85% maximal voluntary effort for 6 sets, interleukin-6 (IL-6) and CK levels increased significantly by 120% and 34% (P<0.05). However, this normal exercise response was completely eliminated following heat preconditioning. Post-exercise HRV and vagal power in the heat preconditioning trial were significantly greater than those in the control trial.

CONCLUSIONS: The results of the study suggest a hormetic effect of heat preconditioning, which can attenuate eccentric exercise-induced muscle damage and inflammatory response.

1567  Board #348  MAY 30  9:30 AM - 11:00 AM

Effects Of Heat Acclimatization On Work Tolerance And Thermoregulation In Trained Tropical Natives
 Jason K W Lee, Amanda Q X Nio, David C Y Fun, Ya Shi Teo, Ez Von Chia, Chin Leong Lim. Defence Medical and Environmental Research Institute, Singapore, Singapore. (No relationships reported)

PURPOSE: This study aimed to investigate the effects of standard heat acclimatization in trained individuals residing in the tropics.

METHODS: Eighteen male trained soldiers, who are native to a warm and humid climate, performed a total of four heat stress tests donning the Skeletal Battle Order (SBO, 20.5 kg) and Full Battle Order (FBO, 24.7 kg) before and after (POST) a 10-day heat acclimatization programme. Each heat stress test comprised three cycles of 60-min marches on a treadmill at 4 km/h, separated by 15-min seated rest. The trials were conducted in an environmental chamber (dry bulb temperature: 32°C, relative humidity: 70%, solar radiation: 400 W/m²). Work tolerance, body core (via ingestible temperature capsules) and skin (chest, triceps, thigh and calf) temperatures, heart rate, sweat rate and subjective responses were measured.

RESULTS: Excluding the data sets of which participants fully completed the heat stress tests (210 min) before and after heat acclimatization, work tolerance improved from 173±30 to 201±18 min (-21%, p<0.05, n=9) following heat acclimatization. Heat acclimatization had no effects on baseline body core temperature across trials (37.1±0.3°C, p=0.05). After heat acclimatization, chest skin temperature during exercise was lowered in SBO (PRE=36.7±0.3°C vs. POST=36.5±0.3°C, p<0.01) and FBO (PRE=36.8±0.4°C vs. POST=36.6±0.3°C, p<0.01). Mean heart rate was similar with SBO (115±17 beats/min, p=0.44) and FBO (PRE=120±16 beats/min, p=0.70) following heat acclimatization. Heat acclimatization did not affect sweat rate in SBO (0.6±0.2 l/h, p=0.91) and FBO (0.6±0.2 l/h, p=0.54). After heat acclimatization, ratings of perceived exertion were decreased (PRE=11±2 vs. POST=10±2, p<0.05). Thermal sensation was reduced after heat acclimatization with SBO (PRE=1.2±0.7 vs. POST=0.9±0.7, p<0.05), but was similar with FBO (PRE=1.2±0.6 vs. POST=1.0±0.5, p=0.06).

CONCLUSIONS: A standard heat acclimatization programme improves work tolerance with negligible effects on thermoregulation in trained tropical natives. These findings are important for recommending appropriate heat acclimatization guidelines to tropical native athletes and military personnel undergoing physical training and competition/operation in a warm and humid environment.

1568  Board #349  MAY 30  9:30 AM - 11:00 AM

Core Temperature During Training In The Heat: Comparison Between Athletes In Continuous And Intermittent Sports
 Jessica A. Frontanés, Raúl A. Rosario, Farah A. Ramírez-Marrero, FACSM, Osvaldo Hernández, Walter R. Frontera, FACSM, Anita M. Rivera-Brown, FACSM. Center for Sports Health and Exercise Sciences, University of Puerto Rico School of Medicine, San Juan, Puerto Rico. (No relationships reported)

Few field data are available on core temperature responses in elite athletes exercising in the heat in sports of intermittent nature in which the decreased exercise intensity is expected to facilitate heat dissipation.

PURPOSE: To compare the core body temperature responses between athletes in continuous (CON) and intermittent (INT) sports during a training session of prolonged duration in the heat.
METHODOLOGY: Sixty-two elite athletes (runners, cyclists, and triathletes [CON]=23, mean age: 26.6 ± 6.9 yr; judo, soccer, tennis, basketball and handball players [INT]= 39, mean age:20.8 ± 3.3 yr) were tested during a typical training session for their sport. Heat exposure time in the last month was higher in CON (3,000.9 ± 1,738.2 min) compared to INT (796.9 ± 903.1 min). P < 0.05. Core temperature (Tc) was measured pre, every 10 min and at the end of training using an ingestible temperature sensor. Acute changes in body weight were used to assess dehydration level (% of the pre-training BW). Exercise intensity was estimated using an accelerometer worn by the athletes during training. RESULTS: The duration of the training session was: CON= 75.8 ± 18.1 min; INT= 95.4 ± 16.9 min, P < 0.05. Average exercise intensity was three times higher in CON (7,748.8 ± 1,307.3 activity counts/min) compared to INT (2,506.3 ± 506.6 activity counts/min), P < 0.05. Sweat rate and dehydration were higher for CON (1.6 ± 0.4 L/h and 2.0 ± 0.8%) compared to INT (1.0 ± 0.4 L/h and 1.0 ± 0.4%), both P < 0.05. Pre-exercise Tc was higher in INT (37.4 ± 0.3 °C) compared to CON (37.2 ± 0.3 °C), P < 0.05. A steady increase in Tc was observed throughout the exercise session for both CON and INT. The highest Tc was similar for CON (38.8 ± 0.4 °C) compared to INT (38.7 ± 0.4 °C) and was not related to % dehydration in either group (P > 0.05). The change in Tc (highest-pre exercise) was higher in CON (1.6 ± 0.6 °C) compared to INT (1.3 ± 0.4 °C), (P < 0.05).

CONCLUSIONS: In comparison to athletes in continuous sports, athletes in intermittent sports do not show the expected thermoregulatory response during training in a high heat stress environment possibly due to their lower level of heat acclimatization.

**Board #350 MAY 30 9:30 AM - 11:00 AM Heat Tolerance Testing: Physiologic Responses of Men and Women**

**Josh B. Kazman**, **Francis O’Connor**, **Patricia Deuster**, **Stacey Zeno**, **Yuval Heled**, FACSM. **USUHS, Bethesda, MD.** **Heller Institute, Tel Aviv, Israel.**

No relationships reported.

PURPOSE: Heat tolerance testing (HTT) is used by the Israeli Defense Force for managing exertional heat stroke (EHS) and when heat intolerance (HI) is suspected. We compared physiologic responses to the HTT as a function of gender and aerobic capacity.

METHODS: Men (n=16) and women (n=7) underwent maximal aerobic power testing (VO2max) and a HTT (walking at 8kph on a 2% grade for 120 minutes in a chamber set at 40°C/40% relative humidity). Heart rate, blood pressure, core and skin temperatures (Tcore/Tskin) were measured and sweat rate was determined by pre and post weight. The physiological strain index (PSI) was determined from heart rate and temperature. HI was determined by heart rate (>145 bpm) and Tcore (>38.5°C).

RESULTS: Maximal Tcore (Men: 38.2±0.3 vs. Women: 38.4±0.3°C), Tskin (Men: 36.8±0.6 vs. Women: 37.2 ± 0.3°C), and PSI (Men: 5.0±1.3 vs. Women: 5.9±1.4) did not differ significantly by gender, whereas heat rate was lower (Men: 127±21 vs. Women: 146±18 bpm; p=0.055) and VO2max (Men: 51.9±7.5 vs. Women: 43.8±5.9 ml/kg/min; p=0.02) and sweat rate (Men: 1.09±0.29 vs. Women: 0.72±0.26 L/hr; p=0.02) higher in men than women. Four men and 3 women were HI (30.4%). Persons with VO2max <50 ml/kg/min were 2.2 times more likely to be HI compared to 50 ml/kg/min.

CONCLUSIONS: The HTT does not appear to be biased against women, unless one considers VO2max, which is typically lower in women. Although different criteria could be set, it would not alter responses in a warm environment. Improving VO2max may be of primary importance.

**Board #351 MAY 30 9:30 AM - 11:00 AM Perceptual Responses of Obese and Lean Girls during Cycling under Thermoneutral and Heat Conditions**

**Gabriela Tomedi Leites**, **Paulo Lague Sehl**, **Giovanni dos Santos Cunha**, **Adriano Detoni Filho**, **Flavia Meyer**. **Federal University of Rio Grande do Sul, Porto Alegre, Brazil.**

No relationships reported.

Obese girls appear to subjectively perceive a greater discomfort during exercise in the heat compared to lean girls, indicating that ambient conditions could affect their adherence to an exercise program.

PURPOSE: To compare the perceptual responses of obese and lean pre-pubertal girls during exercise under thermoneutral and heat conditions.

METHODS: Twenty-seven girls (9.3±1.2 yrs old), 14 of whom were lean and 13 obese according to their % fat (≤25 and >30%) measured by DXA, participated in the study. The girls completed two sessions (2-3 days apart) that, in a randomized order, differed only with respect to the thermal condition of the environmental chamber: neutral (23.9±0.9°C, 50.0±5.6% RH) and heat (35.2±0.9°C, 38.4±3.9% RH). Sessions consisted of 30-min of cycling at 50% of their individual pre-determined VO2peak. Perceptual measurements consisted of four scales: 1) rate of perceived exertion (RPE Borg scale) 2) thermal sensation (9-point scale, from very cold to very hot); 3) thermal comfort (6-point scale, from very comfortable to very uncomfortable); 4) irritability (5-point scale, from nothing noticeable to very strong). RPE was recorded every five minutes of exercise, while the other responses were recorded at 0, 10, 20, and 30 minutes.

RESULTS: The RPE and thermal sensation were similar between groups and did not demonstrate a group x time interaction. Mean RPEs under the heat condition ranged from 8.0±2.0 to 12.0±4.0 and from 8.0±1.0 to 14.0±6.0, and under the thermoneutral condition from 8.0±1.7 to 11.0±4.0 and 8.0±0.7 to 12.0±4.0 in the lean and obese girls, respectively. Mean thermal sensation under the heat condition ranged from 6.0±1.3 to 7.5±2.2 in the lean and 6.0±1.2 to 7.0±1.5 in the obese, and under the thermoneutral condition, from 3.9±0.9 to 5.0±0.9 and from 3.8±1.5 to 5.0±2.0, respectively. In the lean girls, the thermal comfort decreased from 2.1±0.5 to 3.1±1.2 (p=0.009) and irritation increased from 1.3±0.4 to 2.0±1.0 (p=0.02) during the exercise in heat condition, while no change was observed in the obese girls.

CONCLUSION: Obese girls did not seem to experience a greater discomfort or heat sensation during cycling based on these exercise and environmental conditions.

**Board #352 MAY 30 9:30 AM - 11:00 AM Sweating Of Obese And Lean Prepubescent Boys During Cycling In The Heat**

**Jocelito B. Martins**, **Paulo L. Sehl**, **Flavia Meyer**. **Universidade Federal do Rio Grande do Sul - ESEF/UFRGS, Porto Alegre, Brazil.**

No relationships reported.

Obese children are considered to be at a greater risk of exertional heat illness and therefore, they are specially vulnerable because exercise is believed to be different from that of lean children.

PURPOSE: To compare sweat volume (SV), water balance, and sweat electrolyte concentration and losses in obese and lean boys after cycling in the heat.

METHODS: Thirty physically active prepubescent boys (age 9.3±1.1 years) participated in the study. Fifteen were obese (OB) and 15 lean (LB) with respective body mass, height, IMC, %fat and VO2peak of: 48.1±8.3 and 30.3±4.7 kg, 141±62 and 135±67 cm, 24.9±3 and 16.1±1 kg.m-2, 2.46±4.14 and 15.7±3.6 %, and 34.5±8.5 and 43.1±2.6 ml.kg-1.min-1). In a preliminary session whereby a physical evaluation and a VO2peak assessment were conducted, the boys came to an experimental session which consisted of 30-min of cycling (50%-0% of their predetermined VO2peak) in the heat (35°C, 40.45% RH); SV was calculated from change in body mass plus the voluntary fluid intake of a commercially available sports drink. Sweat was collected using adhesives for [Na+], [Cl-] and [K+] analysis in duplicates (AVL 9180, Roche). Independent T-test were used to compare groups.

RESULTS: The SV after the 30-min of cycling was similar between OB and LB, with respective means±SD of 280 ± 50 and 255 ± 110 ml. When corrected for body mass, SV was lower in OB than LB (5.9 ± 0.9 vs 8.6 ± 4.3 ml.kg-1; p=0.035) but when corrected for body surface area SV remained similar between groups (208 ± 33.8 vs 244 ± 116 ml.m-2; p=0.046). Sweat [Na+] and [Cl+] were higher (p=0.005) in OB, whereas [K+] was similar between groups. OB and LB showed no difference both in water balance in ml (-131 ± 170 and -189 ± 132, p=0.234) or in the resultant electrolyte losses in mmol (Na+: 12.0 ± 6.31 and 10.6 ± 4.24, p= 0.463; Cl- = 14.59 ± 5.23 and 10.9 ± 3.73; p= 0.054, and K+ = 2.84 ± 2.27 and 2.44 ± 1.98, p=0.638).

CONCLUSION: Prepubescent OB had similar SV both in absolute amount or when corrected for body surface area; however, they presented a higher sweat [Na+] and [Cl-]. Both groups ended the 30-min cycling in similar body water deficits and sweat electrolyte losses.

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Greater core temperature elevations in linemen compared to backs during summer training camps may be due to the stationary nature of linemen-specific activities resulting in a lower self-generated air velocity and a lower attendant convective and evaporative heat transfer.

**PURPOSE:** To compare the influence of self-generated convection on heat balance status between American football linemen (L) and backs (B) during preseason summer training camp.

**METHODS:** Ten NCAA D1 American football players 5 linemen (mass: 228±21 kg; BSA: 2.53±0.22 m²) and 5 backs (mass: 228±21 kg; BSA: 2.21±0.12 m²) took part in on-field measurements at the start of summer training camp in southern Florida (Tb,max:31.2±1.6°C; Tair,mean:27.0±0.7°C; T,air:38.4±2.8°C). Mean skin temperature (Ts) and self-generated air velocities (v_self) were measured throughout practice. Self-generated convective (hc) and evaporative (he) heat transfer coefficients and resultant sensible heat losses (C+R) and maximum rate of evaporative heat loss (Emax) were calculated.

**RESULTS:** Values for Tb, mean were similar between L (35.4±0.8°C) and B (35.4±0.4°C) (p>0.05). However, v_self (L:0.23±0.06 m/s; B:0.37±0.10 m/s) and the resultant hc and he values were greater in B compared to L (p<0.05). Nonetheless, no significant differences in C+R (L:4.1±5 W/m²; B:4.9±5 W/m²) or Emax (L:7.0±8 W/m²; B:8.1±7 W/m²) were found between L and B over the course of practice (p>0.05). However, since L had a lower BSA-to-mass ratio (L:0.23±0.06 m/kg; B:0.24±0.12 m/kg) Mmax, per unit mass was lower in L (1.6±0.3 W/kg) compared to B (2.8±0.2 W/kg) (p<0.05).

**CONCLUSION:** The greater v_self, hc, and he in B did not result in different C+R or Emax values between positions. However, due to differences in body morphology a greater metabolic rate can be sustained in linemen before physiological compensability is reached in a summer training camp environment.
CONCLUSION: Despite similar reductions in MAP in response to simulated hemorrhage, the increase in Ve was not greater when individuals were hyperthermic. These data suggest that the central drive to increase Ve during simulated hemorrhage is not altered by hyperthermia.

NIH HL61388

1576  Board #357  MAY 30  9:30 AM - 11:00 AM  
**Extracellular Hsp72 Is Both Duration- And Intensity-dependent During Moderate And Intense Exercise-Heat Stress To Exhausation**

Julien D. Périard 1, Patricia Ruell 1, Corinne Caillaud 1, Martin W. Thompson 2. 1Aspetar - Qatar Orthopaedic and Sports Medicine Hospital, Doha, Qatar. 2University of Sydney, Lidcombe, Australia.  

(No relationships reported)  
The extracellular expression of heat shock protein 72 (eHsp72) during exercise-heat stress is suggested to increase as a function of the core temperature attained. However, whether this relationship is also influenced by exercise intensity remains unclear.  

PURPOSE: This study investigated the relationship between eHsp72 expression and exercise to exhaustion in the heat at moderate and high intensities to determine the role of exercise intensity in mediating eHsp72 release.  

METHODS: Sixteen male subjects cycled to exhaustion at 60% and 75% of maximal oxygen uptake in hot conditions (40°C, 50% relative humidity). eHsp72 expression was measured prior to exercise, on reaching exhaustion, and 24 h following exercise cessation. Heart rate, core temperature, oxidative stress (malondialdehyde; MDA), and blood lactate and glucose concentration were measured to determine the predictor variables associated with eHsp72 expression.  

RESULTS: The expression of eHsp72 increased similarly from pre-exercise baseline to exhaustion in the 60% and 75% trials (P < 0.001). During the following 24 h, eHsp72 expression decreased to levels below baseline in both trials (P < 0.05). Core temperature was significantly different at exhaustion, reaching 39.7°C in the 60% trial (58.9 min) and 39.0°C in the 75% trial (27.2 min) (P < 0.001). The rate of rise in core temperature (2.1°C·h⁻¹) was significantly greater in the 75% trial (P < 0.001). Heart rate exceeded 96% of maximum on reaching exhaustion in both trials. A significant decline in MDA was observed 24 h after exercise compared with pre-exercise baseline and exhaustion (P < 0.001). eHsp72 expression was highly correlated with the core temperature attained in the 60% trial and the rate of increase in core temperature in the 75% trial (P < 0.005).  

CONCLUSION: The similarity in expression of eHsp72 during moderate and high intensity exercise may relate to the duration (i.e. core temperature attained) and intensity (i.e. rate of increase in core temperature of exercise). Therefore, the immuno-inflammatory release of eHsp72 in response to exercise in the heat appears to be duration- and intensity-dependent.  

1577  Board #358  MAY 30  9:30 AM - 11:00 AM  
**Platelet Inhibition Attenuates Skin Blood Flow During Exercise in the Heat Without Impairing Thermoregulation**

Rebecca S. Bruning, Jessica D. Dahmus, W. Larry Kenney, FACSM, Lacy A. Holowatz. The Pennsylvania State University, University Park, PA.  

(No relationships reported)  
During passive heating (water-perfused suit), chronic low-dose aspirin and clopidogrel (Plavix®) treatment each result in a lower skin blood flow response and a greater rate of rise in core temperature in healthy, middle-aged individuals. If similar results occur during exercise in hot environments this would have widespread health implications, as these are the top anti-thrombotic agents used worldwide.  

PURPOSE: The present double-blind, placebo control, crossover study examined the effects of seven days of systemic low-dose aspirin (81 mg/day) and clopidogrel (75 mg/day) treatment on physiological responses of healthy, middle-aged (50-65 years old) men and women during exercise in a hot environment (30°C, 40% rh).  

METHODS: Four men and three women exercised at 60% VO₂max on a cycle ergometer for up to 60 minutes. Esophageal temperature and skin temperatures at six sites were measured. Cutaneous vascular conductance was calculated as skin blood flow (laser Doppler Flowmetry) divided by mean arterial pressure (MAP) and normalized as a percentage of maximum vasodilation (elicited via local heating to 43°C; %CVmax). Heart rate and blood pressure were also recorded.  

RESULTS: Control of skin blood flow was altered by both low-dose aspirin and clopidogrel treatments. Both treatments increased the threshold for reflex vasodilation (aspirin 37.29 ± 0.03°C and clopidogrel 37.45 ± 0.04 °C versus control 37.07 ± 0.02°C; P < 0.001). Aspirin treatment resulted in lower plateau skin blood flow versus control (45 ± 3% versus 56 ± 3% CVmax). Heart rate and blood pressure did not differ between the two trials.  

CONCLUSION: Platelet COX inhibition (low-dose aspirin) attenuates the plateau in skin blood flow during exercise, while both COX and platelet P2Y12 ADP receptor inhibition (clopidogrel) increase the threshold for reflex vasodilation without impairing thermoregulation.  

FUNDING: Supported by NIH grant R21 HL098645-01  

1578  Board #359  MAY 30  9:30 AM - 11:00 AM  
**Sex-differences In Whole-body Sudomotor Activity Are Only Evidenced At High Requirements For Heat Loss**

Daniel Gagnon, Glen P. Kenny. University of Ottawa, Ottawa, ON, Canada.  

(No relationships reported)  
A lower whole-body sudomotor activity has recently been observed in females, paralleled by a lower thermosensitivity of the response. Although evidence suggests that these differences only occur at higher exercise intensities, no study has examined potential sex-differences in sudomotor activity at increasing requirements for heat loss.  

PURPOSE: To examine sex-related differences in whole-body sudomotor activity during progressive increases in the requirement for heat loss.  

METHODS: Eight males (M) and eight females (F; follicular phase) performed three successive 30 min exercise bouts at fixed rates of metabolic heat production equal to 200, 250, and 300 W·m⁻². Air temperature and humidity were set at 40°C and 20%. Whole-body sudomotor activity (evaporative heat loss, EHL) was measured by direct calorimetry. Mean body temperature (Tb) was calculated from esophageal and mean skin temperatures.  

RESULTS: By design, metabolic heat production did not differ between groups during the exercise bouts (p>0.05). Nonetheless, changes over time in EHL significantly differed between sex (p=0.002). Although EHL did not differ between groups during the first (M: 228 ± 5 vs. F: 220 ± 7 W·m⁻²; p=0.418) and second (M: 284 ± 9 vs. F: 273 ± 7 W·m⁻²; p=0.394) exercise bouts, it became significantly greater in males during the third exercise bout (348 ± 13 vs. 305 ± 8 W·m⁻²; p=0.015). The greater EHL observed in males was paralleled by a greater thermosensitivity of the response compared to females (296 ± 27 vs. 195 ± 21 W·m⁻²·°C⁻¹; p=0.011). In contrast, no differences in the mean Tb offset threshold for EHL were observed (p=0.224).  

CONCLUSION: Sex-differences in whole-body sudomotor activity are only evidenced at high requirements for heat loss. These results suggest that the lower sudomotor thermosensitivity observed in females is due to sex-differences in the properties of the thermoregulatory organ (sweat gland). Supported by NSERC grant RGPIN-298159-2009.
1579  Board #360  MAY 30  9:30 AM - 11:00 AM

Aspirin Prevents Hyperthermic Platelet Activation in Firefighters During Exertion in Thermal Protective Clothing

David Hostler, Serina J. McEntire, Steven E. Reis, Diane Comey, Charity G. Moore, Riana R. Pryor, Jennifer Erin, Priya Khorana, Francis X. Guyette, Joe Suyama.  University of Pittsburgh, Pittsburgh, PA. (No relationships reported)

Platelet aggregation is enhanced in firefighters following relatively short bouts of work in thermal protective clothing (TPC). Additionally, platelets may be directly activated by heat resulting in faster clot formation. It is important to understand if heat mediated platelet activation can be blunted or prevented given the high proportion of line of duty heart attacks in the fire service.

PURPOSE: Determine if aspirin therapy before and/or immediately following exertion in TPC prevents platelet activation.

METHODS: In this double-blind, placebo controlled study, 102 firefighters were randomized to receive daily therapy (81 mg aspirin or placebo) for 14d before and a single dose (325 mg aspirin or placebo) immediately following 30 minutes of treadmill exercise in TPC. The design used random assignment of aspirin before and after exercise (AA), placebo before and after exercise (PP), daily aspirin before and placebo following exercise (AP), and placebo before and aspirin following exercise (PA) conditions. Heart rate and core temperature were monitored during and for 90 minutes following exercise. Plateletlet closure time (PCT) was measured with a plateletlet function analyzer with an upper limit of detection of 300 sec before initial drug treatment, before exercise, immediately post exercise and 30, and 90 minutes later. A random effects tobit model was used to test the effects of drug prior to exercise and during recovery controlling for the baseline plateletlet closure time.

RESULTS: Maximum heart rate and core temperature during exercise did not differ between groups with means exceeding 170 bpm and 38.6°C. Baseline median PCT did not differ between groups ranging from 112-124 sec and did not change after two weeks of placebo. PCT differed over time for the four groups (p<0.001) rising to a median of 300 sec [IQR 99, 300] in AA and 300 [92, 300] in AP prior to exercise. Following exercise, median PCT decreased to 275.5 [62, 300] (AA), 207 [55, 300] (AP), 95 [71, 182] (PA), and 90 [58, 201] (PP) sec. Median PCT returned to 300 sec 30 min after exercise in AA and AP and rose to 300 sec in PA 60 min after exercise.

CONCLUSIONS: Daily aspirin therapy blunts plateletlet activation during exertional heat stress. Furthermore, single dose aspirin therapy following exertional heat stress reverses plateletlet activation within 60 minutes.

1580  Board #361  MAY 30  9:30 AM - 11:00 AM

Interindividual Variability in Orthostatic Tolerance during Heat Stress: Role of Reductions in Cerebral Perfusion

R. Matthew Brothers, Joshua F. Lee, Michelle L. Harrison, Skylor Brown.  University of Texas at Austin, Austin, TX. (No relationships reported)

PURPOSE: Heat stress compromises orthostatic tolerance relative to normothermic conditions. However, the extent to which heat stress compromises orthostatic tolerance differs amongst individuals with some being more affected than others. While the exact mechanism(s) responsible for this interindividual variability in orthostatic tolerance during heat stress remain unknown, syncpe will always occur when cerebral perfusion is not adequately maintained. This study tested the hypothesis that the individuals with the greatest heat-stress induced reduction in orthostatic tolerance would have the largest reduction in cerebral perfusion in this thermal condition.

METHODS: 15 individuals performed a maximal simulated hemorrhage challenge (lower body negative pressure; LBNP) during normothermia and following a whole-body heat stress on separate days. Tolerance during each condition was quantified as cumulative stress index (CSI) and the difference in CSI between thermal conditions was used to categorize individuals as HighDif (most affected by heat) and LowDif (least affected by heat). The effect of heat stress (prior to LBNP) on internal temperature (telemetry pill), cerebral perfusion (MCAV indexed by middle cerebral artery blood velocity), cerebral vascular conductance (CVC; MCAV/mean arterial pressure), and end-tidal carbon dioxide tension (PETCO2) was assessed in each group.

RESULTS: The difference in CSI was larger in the HighDif group relative to the LowDif group (HighDif: 1243±135 mmHg × min; LowDif: 605±311 mmHg × min, P<0.01). The increase in internal temperature was similar between groups (HighDif: 1.47±0.15 °C; LowDif: 1.50±0.13 °C, P=0.70). Heat stress reduced PETCO2, MCAV, and CVC relative to normothermia in both groups (P<0.05 for each variable), however, the magnitude of the reduction in PETCO2 (HighDif: 7.2±5.7 Torr; LowDif: 5.3±2.7 Torr, P=0.56), MCAV (HighDif: 21.9±4.7 cm/s; LowDif: 20.7±4.9 cm/s, P=0.23), and CVC (HighDif: 31.3±2.9 cm/s·mmHg-1; LowDif: 11.4±2.9 cm/s·mmHg-1, P<0.01) was similar between groups.

CONCLUSION: These results indicate the large interindividual variability in heat-stress induced reductions in orthostatic tolerance is not related to the degree to which cerebral perfusion is reduced in this thermal condition.

1581  Board #362  MAY 30  9:30 AM - 11:00 AM

Reduced Cardiac Baroreceptor Responsiveness is Associated with Reductions in Orthostatic Tolerance in Hyperthermic Individuals

Joshua F. Lee, Michelle L. Harrison, Skylor Brown, R. Matthew Brothers.  University of Texas at Austin, Austin, TX. (No relationships reported)

Orthostatic tolerance is reduced in hyperthermic humans; however, there is a large degree of variability in this response with tolerance being reduced more in some individuals than others. The factors underlying the variability in orthostatic tolerance during hyperthermic conditions remain largely unknown.

PURPOSE: To test the hypothesis that individuals with the largest difference in orthostatic tolerance during heat stress relative to normothermia would have a reduced heart rate response to spontaneous reductions in systolic blood pressure (lower cardiac baroreflex sensitivity) during heat stress compared to individuals with the least difference in tolerance between the thermal conditions.

METHODS: On 2 different days, one during normothermia and another during heat stress, 15 individuals were exposed to a simulated hemorrhage via lower body negative pressure (LBNP) to pre-syncpe. Tolerance to LBNP was quantified using a cumulative stress index (CSI). The difference in CSI between thermal conditions was calculated for each subject. The 6 individuals with the largest CSI difference (LargeDif) and the 6 with the least CSI difference (SmallDif) between conditions were grouped together. The effect of heat stress on spontaneous cardiac baroreflex sensitivity during reductions in systolic blood pressure (prior to LBNP) was assessed using the sequence technique. Cardiac baroreflex sensitivity was assessed during reductions in systolic blood pressure since this is the relevant analysis for orthostatic tolerance.

RESULTS: The difference in CSI between thermal conditions was greater in the LargeDif group relative to the SmallDif group (1243±135 mmHg x min vs. 605±311 mmHg x min; P<0.01) despite a similar rise in core temperature (LargeDif: 1.47±0.15 °C vs. SmallDif: 1.50±0.13 °C, P=0.70). The increase in heart rate during spontaneous reductions in systolic blood pressure (i.e. cardiac baroreflex sensitivity) was lower in the LargeDif group relative to the SmallDif group during hyperthermia (LargeDif: -0.50±0.47 beats · min-1 · mmHg-1 vs. SmallDif: -1.81±1.13 beats · min-1 · mmHg-1, P<0.01).

CONCLUSION: These data support the hypothesis that individuals with lower spontaneous cardiac baroreflex sensitivity during heat stress are less able to tolerate orthostatic challenges in this thermal condition.

1582  Board #363  MAY 30  9:30 AM - 11:00 AM

Thermoregulatory Adaptations Following Sprint Interval Training

Charles P. Katica1, Andrew T. Del Pozzi2, Elisha Williams1, Svetlana Nepocatych2, Greg A. Ryan1, Jonathan E. Wingo1. 1University of Alabama, Tuscaloosa, AL. 2Elon University, Elon, NC. (No relationships reported)

Traditional endurance training (TET) typically involves weeks of long duration (60-90 min) exercise performed at a moderate to vigorous intensity. Recently, attention has focused on sprint interval training (SIT), a paradigm characterized by multiple bouts of short-duration, high-intensity exercise. Similar fitness benefits from TET and SIT have been demonstrated, but whether SIT improves thermoregulatory adaptations remains unclear.

PURPOSE: To test the hypothesis that SIT performed over 6 sessions results in measurable thermoregulatory and cardiovascular adaptations consistent with heat acclimation.

METHODS: Seven active men [mean ± SD, 12.9 ± 4.6% body fat, 22 ± 3 years, 3.1 ± 0.3 L/min peak oxygen uptake (VO2peak)] performed 6 SIT sessions over 12 days with 48-72 h betweenCopyright © 2012 by the American College of Sports Medicine. Unauthorized reproduction of this article is prohibited.
sessions. Each session consisted of 4-6 30-s Wingate Anaerobic Tests separated by ~4 min. Four individuals performed SIT in ~40 °C while 3 performed SIT in ~25 °C. Before and after the 2-week SIT protocol, participants cycled for 30 min at 65% VO2peak in 25 °C to assess the effects of SIT on heat acclimation.

RESULTS: Group outcomes were not different, so data were combined for simplification. There were no differences from pre- to post-training for any of the main outcome variables tested (onset of sweating, sweat sensitivity, heart rate at end of exercise, and rectal temperature change from pre- to post-exercise; all P > 0.05).

CONCLUSIONS: These results indicate that 2 weeks of SIT performed under the conditions specified does not result in heat acclimation.

1583 Board #364 MAY 30 9:30 AM - 11:00 AM
Variability in Simulated Hemorrhagic Challenge Tolerance is not Explained By Differences in Body Temperature
Matthew S. Ganio1, Kimberly Hubing2, James Pearson2, Rebekah A. Lucas1, Robert Matthew Brothers4, Craig G. Crandall, FACSM1.1 University of Arkansas, Fayetteville, AR. 2Texas Health Presbyterian Hospital, Dallas, TX. 3Texas Health Presbyterian Hospital, Dallas, TX. 4University of Texas Austin, Austin, TX.

(Please note relationships reported)

PURPOSE: To examine if body temperature variations in normothermic and heat stressed conditions explain the variability in tolerance to simulated hemorrhage within each thermal condition.

METHODS: Data were retrospectively examined in individuals who underwent a simulated hemorrhagic challenge to pre-syncpe (onset of syncopal symptoms) via lower body negative pressure (LBNP). The correlation between mean body temperature (Tbody, calculated from core and skin temperatures) and LBNP tolerance time while normothermic (n=45) and passively heat stressed (n=90) was examined. Second, LBNP time while normothermic and heat stressed in the 15 lowest Tbody was compared to the 15 highest Tbody within each thermal condition. Third, for subjects tested in both thermal conditions (n=33), the correlation between the increase in Tbody and the decrease in LBNP time was examined, as was LBNP times of the 10 smallest Tbody increases relative to the 10 largest Tbody increases.

RESULTS: LBNP time while normothermic (1237 ± 240 sec) and heat stressed (635 ± 275 sec) was not correlated to Tbody within each condition (normothermic range = 36.21-37.24°C, r=0.15, p=0.13; heat stress range = 37.69-39.46°C, r=0.12, p=0.28). Normothermic LBNP times of those with the lowest (36.35 ± 0.07°C) Tbody were not different (1241 ± 284 and 1233 ± 294 sec, respectively; p=0.94). Similarly, heat stressed LBNP times of those with the lowest (37.86 ± 0.09°C) and highest (38.82 ± 0.20°C) Tbody were not different (690 ± 266 and 559 ± 282 sec; p=0.20). For subjects tested in both thermal conditions, decreases in heat stressed LBNP time (606 ± 218 sec) were not correlated to the magnitude of Tbody elevation (1.64 ± 0.23°C; r=0.04; p=0.83); moreover LBNP time of those with the smallest Tbody increase (664 ± 231 sec, 1.38 ± 0.14°C) was not different than those with the largest Tbody increase (611 ± 212 sec, 1.91 ± 0.07°C; p=0.60).

CONCLUSIONS: Between subject variations in Tbody while normothermic and heat stressed do not explain the within-condition variability in tolerance to a simulated hemorrhagic challenge. Although heat stress compromises blood pressure control, differences (1.1-2.0°C) in the magnitude of body temperature increase during a heat stress do not explain the variability in tolerance.

Support NIH GM068865

1584 Board #365 MAY 30 9:30 AM - 11:00 AM
Caffeine’s Effect on Hydration and Body Temperature During Exercise in ≥26.6°C Environments: A Systematic Review
Kelly D. Pagnotta1, Douglas J. Casa, FACSM1, Kerri E. Gavin1, Lindsay M. McDowell1.1 Korey Stringer Institute, University of Connecticut, Storrs, CT. 2 Villanova University, Philadelphia, PA. "The Pomfret School, Pomfret, CT.

(Please note relationships reported)

Caffeine (CAF) has become the most widely used behaviorally active substances in the world today and has recently been removed from the list of banned substance by the International Olympic Committee. Previous studies related to CAF and performance indicate that CAF prior to exercising clearly enhances endurance performance. Recent studies have been completed to analyze how CAF directly effects hydration and core temperature (Tc) while exercising in a warm or hot environment.

METHODS: Two independent searches were completed in various databases for CAF, Tc and exercise and CAF hydration status and exercise, using a variety of search terms. Inclusion criteria included original research with human subjects, controlled, counter balanced hydration strategies, valid measurements of hydration status and Tc, CAF dosages of 3-9 mg.kg body mass administered less than 3 hours prior to exercise, exercise lasting greater than 30 minutes, environmental conditions greater than or equal to 26.6°C. Quality control was obtained by a PEDro score of greater than or equal to 6, and 2 independent reviews of each article. Studies were excluded if they included time to exhaustion as the exercise component, the effects of CAF could not be isolated, or they had no control group (CON). The initial search revealed 342 studies and 49 were further analyzed. 41 studies were excluded for not meeting the inclusionary criteria, leaving a total of 8 studies for inclusion. Studies with multiple trials examining various doses of caffeine were counted as separate studies, resulting in a total of 12 possible data sources.

RESULTS: Studies included in the analysis of change in Tc. (n=10) mean difference (CAF-CON) ±0.08°C. Independent of the mode used to assess, CAF had no effect on hydration status (CAF-CON) (%body mass Δ [n=7] = 0.033%, Uosmo [n=4] = 48.5, Usg [n=3]= 0.003).

CONCLUSIONS: Because CAF can have an ergogenic effect on performance, and, as our results suggest, little physiological effect on heat tolerance and hydration status, it seems to not have detrimental thermoregulatory effects when athletes who are exercising in the heat and utilizing doses between 3-9 mg.kg body mass.

A-46 Free Communication/Poster - Upper Extremity
MAY 30, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

1585 Board #366 MAY 30 9:30 AM - 11:00 AM
Biomechanical Simulation Of The Passive Mechanical Coupling In The Hand And Wrist
Benjamin I. Binder-Macleod, Jules P.A. Dewald, Wendy M. Murray, Northwestern University, Evanston, IL.

(Please note relationships reported)

The muscles that control the hand cross multiple joints, particularly the extrinsic finger muscles which cross the wrist and extend to the fingers. This complex musculoskeletal anatomy creates passive mechanical linkages between joints, coupling the movement of multiple joints. In healthy individuals the passive coupling between the wrist and hand facilitates opening and closing of the fingers. Impairments, due to stroke, OA, or other injuries, may disrupt this coupling and cause a loss of hand control.

PURPOSE: To use a multi-joint biomechanical model of the upper limb to evaluate how the musculoskeletal structures couple the motion of the index finger and wrist.

METHODS: A biomechanical model of the upper extremity was utilized to calculate the rest posture of the MCP joint at different wrist postures via static equilibrium analysis. Rest postures were calculated to be the MCP joint angle at which the sum of the total passive torques (ligaments, joint capsule, and intrinsic and extrinsic finger muscles) and the torque produced by the mass of the phalanges of the finger equal 0 Nm. Work done passively to resist motion of the MCP joint from the rest position by the musculoskeletal structures was calculated. A sensitivity analysis of the effects the muscle properties have on the rest posture and work was conducted at 0° wrist posture by varying the extrinsic flexor muscles’ optimal fiber lengths (Lfo) and tendon slack lengths (Lis).

RESULTS: The rest posture of the first MCP joint at wrist flexion angles of -60°, 0°, and 60° were 75°, 51°, and -20° respectively. At wrist angles -60° and 0° the extrinsic finger flexors contributed the largest percentage of work (91% and 59%) to resist MCP motion, and at 60° the extrinsic finger extensors primarily (74%) resisted MCP motion. The sensitive analysis of Lfo and Lis to 99%, 95% and 90% of nominal length showed changes in rest postures (Lfo: 51°, 51°, & -63°; Lis: 51°, 80°, & 90°) and increases in the passive resistive work (Lfo: 125%, 268%, & 579 %; Lis 187%, 1000% & 3779%).

370
CONCLUSIONS: When passive properties of the musculoskeletal structures of the hand are incorporated into a multiaxial biomechanical model of the upper limb, simulations of the mechanical coupling of the hand and wrist can be analyzed, along with how alterations to muscle properties, due to disorders, may affect this coupling.

1586  Board #367 MAY 30 9:30 AM - 11:00 AM
The Influence of Patient’s Body Size on Dental Hygienist Shoulder Kinematics
Tal Amasay, Andrew Karduna. Barry University, Miami Shores, FL. University of Oregon, Eugene, OR.

Dental Hygienists have been identified, as an occupational group that is at risk for musculoskeletal disorders of the upper extremities, and that the prevalence of these disorders increases with years of occupational exposure. Additionally, in the United States, the prevalence of overweight and obese people has increased sharply for both adults and children. This increase may introduce more exposure of dental hygienists to obese patients which may result in an increased prevalence of shoulder musculoskeletal disorders.

PURPOSE: The aim of this study was to evaluate the influence of patient girth on dental hygienists shoulder kinematics and exposure during teeth instrumentation in a simulated occupational environment.

METHODS: Sixteen female dental hygienists, mean age of 49.6 years (28 - 64 years) and current work experience ranging from 1.5 - 32 years participated in the study. Three dimensional kinematics of the scapula and humerus were collected at a sampling rate of 120 Hz using the Polhemus Liberty magnetic tracking system. During data collection, the participants instrumented three different teeth on two different manikin representing the 50th and 99th percentiles of body size. To quantify differences in humeral and scapular kinematics and humeral exposure parameters, two independent variables with two levels were chosen, Hand Dominance and Body Type size. Separate two-way ANOVAs with repeated measures were conducted.

RESULTS: Significant higher mean humeral elevation angles were observed while instrumenting the big manikin for the dominant (33 vs. 45 deg) and non-dominant (31 vs. 36 deg) hands. Significant higher mean scapular upward rotation angles were observed while instrumenting the big manikin for the dominant (2 vs. 6 deg) and non-dominant (-1 vs. 2 deg) hands. Furthermore, dental hygienist spent significantly more time above 30 deg (dominant 42% vs. 68%, non dominant 47% vs. 60%) and 60 deg (dominant 13% vs. 28%, non dominant 4% vs. 11%) of humeral elevation while instrumenting the big manikin.

CONCLUSION: This study provided evidence that dental hygienists alter their shoulder kinematics while instrumenting big girth patients. Consequently, patients of greater girth may increase dental hygienists’ risk of developing shoulder musculoskeletal disorders.

1587  Board #368 MAY 30 9:30 AM - 11:00 AM
Kinematics Of The Shoulder Complex During Ergonomic Hand Drive Wheelchair Propulsion: Shoulder Impingement Implications

The shoulder is the most mobile joint in the body and vitally important to the manual wheelchair user for propulsion and transfers. Shoulder impingement (SI) syndrome is the most frequently reported upper extremity pathology for wheelers. SI pain is exacerbated by various combinations of four particular movements of the shoulder complex: scapular protraction and arm flexion (FLX), abduction (ABD) and internal rotation (IR). Alternative drive mechanisms may provide relief.

PURPOSE: To test an ergonomic hand drive mechanism (EHDM) for a conventional manual wheelchair (CMW) that may lead to improved wheeling mechanics as related to SI.

METHODS: Thirteen adult full-time wheelchair users (43.0±15.0 yrs, 74.5±16.8 kg, 173.1±13.2 cm) completed five trials in a CMW and five trials in the same chair equipped with an EHDM. All participants were medically and functionally stable and at least six months post injury. Digital video data were captured by 11 cameras as each participant wheeled at their preferred pace across a flat, smooth 8m long surface. Angular kinematics of the shoulder (flexion/extension, abduction/adduction, internal and external rotation) and one measure of scapular motion (protraction/retraction) were computed for right and left sides. At least one push cycle was analyzed per trial with average values calculated for all five trials. Paired sample t-tests were used to compare maximum values between the two conditions (α=0.05).

RESULTS: The following changes were noted with EHDM use compared to CMW: FLX increased (p<.001), ABD decreased (p=.002), IR decreased (p=.001), and scapular protraction decreased (p=.025).

CONCLUSION: The kinematic alterations while using the EHDM may have clinical implications regarding SI. ABD was reduced by 14.6%, IR was reduced by 48.2%, and scapular protraction decreased by 57.5%. Additionally, FLX increased over three fold to 31.5°, but presumably not to a level of impingement. EHDM use may lessen SI risk by reducing three of the four injurious movements. The influence of these movements in combination was not considered and should be addressed in future research.

This work supported in part by NIH/NICR C RTSA award to the University of Florida UL1 RR028980. The hand drive mechanism used in this study is the intellectual property of Shands Healthcare.

1588  Board #369 MAY 30 9:30 AM - 11:00 AM
Quantitative Examination of Pelvic and Scapular Stabilizing Muscle Activation during Shoulder Rehabilitation
Michael Sola, Gretchen D. Oliver, Sean Huddleston. University of Arkansas, Fayetteville, AR. (Sponsor: Heidi Klaess, FACSM)

The kinematic approach to shoulder rehabilitation has become the standard. Incorporating proximal stability for distal mobility requires a stable base of not only the hips and pelvis but also the scapula. Thus shoulder rehabilitation should encompass the musculature about the shoulder as well as stabilizing musculature of the pelvis and hips.

PURPOSE: To quantify muscle activation of the gluteus maximus and upper trapezius muscle groups during shoulder rehabilitation exercises.

METHODS: Bipolar surface electrodes were applied to the 30 participants’ (23.5 ±1.34yr; 74.4±11.0 cm; 76.6 ± 16.9 kg) dominate upper trapezius and gluteus maximus muscle groups. sEMG data were collected and expressed as percent of maximum voluntary isometric contraction (% MVC).Data were interpreted as minimal activation 0-20% MVC, moderate activation 20-35% MVC, moderately strong activation 35-50% MVC, and significantly high activation >50% MVC. Participants performed shoulder dump, dynamic physioball (DB), standing dynamic abduction, and standing dynamic flexion exercises.

RESULTS: Moderate activation was seen in the shoulder dump and standing dynamic abduction exercise for the gluteus maximus. Standing dynamic abduction and DPB showed high upper trapezius activation, while standing dynamic flexion and the shoulder dump showed moderately strong activation (Figure 1).

CONCLUSION: The exercises performed allowed for moderate to moderately strong activation in both upper and lower extremity musculature. When trying to incorporate total kinetic chain during shoulder rehabilitation, it is important that the shoulder exercises are focused not only on the shoulder but also on the stabilizing base of the lower extremity.

1589  Board #370 MAY 30 9:30 AM - 11:00 AM
Wheelchair Propulsion Using an Ergonomic Hand Drive Mechanism Reduces Wrist Jerk Throughout Range of Motion
Lisa A. Zukowski, Jaimie A. Roper, Dana Otzel, Patty Hovis, Orit Shechtman, Mark D. Tillman, FACSM. University of Florida, Gainesville, FL.

Fifty-nine to 63% of conventional manual wheelchair (CMW) users suffer from carpal tunnel syndrome (CTS), which is likely induced by a combination of potentially large forces transmitted through the wrist and an extreme wrist range of motion (ROM). The ergonomic hand drive mechanism (EHDM) tested in this study utilizes a more neutral wrist orientation. Further, because the EHDM uses continuous contact between the lever and hand, more constant force application and therefore reduced jerk (Dα/Δt) should result.

PURPOSE: To evaluate wrist jerk in relation to angular orientation while using the EHDM.

METHODS: Thirteen adult full-time CMW users who were medically and functionally stable and at least six months post injury were recruited (43.0±15.0 yrs, 74.5±16.8 kg, 173.1±13.2 cm). Motion data were captured by 11 cameras as participants propelled across a length of 8m completing 5 trials in a CMW and 5 trials in the same CMW fitted with the EHDM. Angular
Results of the present study have evaluated changes in both shoulder range of motion (ROM) and humeral retrotorsion (HT) in high school baseball players over a year. Alterations in shoulder ROM without concomitant changes in HT indicates that the changes in shoulder ROM in high school baseball players are mainly attributed to changes in soft tissue property rather than osseous adaptation. This may be due to the fact that participants were approaching the end of skeletal maturity. Decreased internal rotation and total rotation ROM have been linked to upper extremity injuries in overhead athletes. Therefore, observations from this study supports the benefit of implementing stretching programs in high school baseball players to help maintain shoulder ROM and possibly prevent upper extremity injuries. Supported by NIH-NIAAMS R03AR055262.

### Table 1

<table>
<thead>
<tr>
<th>Description</th>
<th>Mean±SD</th>
<th>ROM difference Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Stretching</td>
<td>23.9±1.7</td>
<td>9.0±4.6</td>
</tr>
<tr>
<td>Cross Body Stretching</td>
<td>27.1±4.0</td>
<td>11.0±2.6</td>
</tr>
<tr>
<td>Sleeper’s Stretch</td>
<td>23.8±1.7</td>
<td>9.3±2.8</td>
</tr>
</tbody>
</table>

### RESULTS

- Stability: The increase in internal rotation ROM for the subjects in the manual stretching group (mean±SD: 19.0±4.6°) were significantly greater than the cross-body stretch group (11.0±2.6°, p<0.001) and sleeper stretch group (9.3±2.8°, p<0.001). The improvements in the sleeper stretch group were not different from the cross-body stretch (p=0.385).

### CONCLUSION

Based on our results, the manual stretching appears to be more effective when comparing to both cross-body stretch and sleeper stretch group to resolve the PST and GIRD. While the improvement in internal rotation from the cross-body stretch was greater than the sleeper stretch, this difference could not be statistically significant.

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**Board #371**

### 1590 9:30 AM - 11:00 AM

Reliability of Motion Capture Shoulder Kinematics in Wheelchair Propulsion Utilizing an Ergonomic Hand Drive

Patty W. Hovis, Lisa A. Zuzkowski, Jaimie A. Roper, Otzel M. Dana, Kaitlin Murphy, Ori Shechtman, Mark D. Tillman, FACSM, Univ. of Florida, Gainesville, FL. (No relationships reported)

Obtaining motion capture data from wheelchair users during propulsion requires multiple reliable trials. Data reliability (repeatability/consistency) implies precision of both measurements and the detection of differences between trials. Researchers commonly collect 5 trials; however, loss of trial data can occur due to intrinsic or extrinsic error leaving fewer trials for analysis. Reliability of results may be affected when only 3 to 4 successful trials are obtained. Thus, it is important to determine the minimum number of trials necessary to achieve data reliability.

**PURPOSE:** To determine the reliability of analyzing 3, 4, and 5 trials with a conventional manual wheelchair (CMW) and the same CMW with an attached ergonomic hand drive (EHD).

**METHODS:** Ten full-time wheelchair users (9.6 ± 9.8 yrs, 172.0 ± 13.3 cm, 72.5 ± 15.0 kg), at least six months post injury, completed 5 trials in a CMW and 5 trials in the same chair equipped with an EHD. Digital video data were captured as each participant wheeled at their preferred pace across a flat, smooth 8m long surface. Shoulder angular kinematics (max flexion [FL], max extension [EXT], and range of motion [ROM]) for the right side were computed for all 5 propulsion trials. Intra class correlation coefficients (ICC) were calculated and compared between the conditions.

**RESULTS:** The ICC for FL, EXT, and ROM for 3 trials (0.89, 0.88, 0.79 respectively), 4 trials (0.87, 0.89, 0.79 respectively), and 5 trials (0.89, 0.90, 0.84 respectively) varied. The ICC for FL angles obtained from 3, 4 and 5 trials with the EHD were greater than CMW trials (≥0.90 vs. 0.80-0.84, respectively). The ICC for EXT angles were greater for CMW trials than EHD trials (≥0.90 vs. 0.77-0.81, respectively). The ICC for ROM were greater for EHD than CMW trials (0.80-0.84 vs. 0.76-0.80, respectively).

**CONCLUSION:** High ICC values for the EHD FL and CMW EXT indicate high reliability for 3, 4, and 5 trials. However, higher variability was found between trials with ROM, EHD EXT, and CMW FL. Therefore, a minimum of 5 trials is recommended for manual wheeling motion capture with additional trials being performed based on participant capabilities.

This work supported in part by NIH/NIDRR CTSA award to the University of Florida UL1 RR029890. The hand drive mechanism used in this study is the intellectual property of Shands Healthcare.

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**Board #372**

### 1591 9:30 AM - 11:00 AM

Changes in Shoulder Range of Motion and Humeral Torsion in High School Baseball Players

Sakiko Oyama, Elizabeth E. Hibberd, Joseph B. Myers, University of North Carolina at Chapel Hill, Chapel Hill, NC. (No relationships reported)

Baseball participation involves repetitive throwing and/or pitching, and has been theorized to lead to musculoskeletal adaptations at the shoulder that are associated with injuries. However, no study has evaluated changes in both shoulder range of motion (ROM) and humeral retro-torsion (HT) in high school baseball players over a year.

**PURPOSE:** To describe changes in shoulder ROM and HT over a year in high school baseball players (16.1±0.8 years, range=14-17 years) using a longitudinal study design.

**METHODS:** In spring of 2010, shoulder internal/external rotation ROM (digital inclinometer) and HT (ultrasonographic method) was measured in 339 participants. Measurements were repeated on the 108 returners in spring of 2011. Dominant-limb shoulder internal/external rotation ROM, total rotation ROM, and HT were compared pre-post the follow-up period using paired t-tests.

**RESULTS:** Shoulder internal rotation (mean difference= -4.0°±9.5°, p<0.001), external rotation (mean difference= -5.1°±14.3°, p<0.001), and total rotation (mean difference= -9.4°±18.7°, p<0.001) ROM decreased over a year. HT (mean difference= 1.2°±5.7°, p<0.001) increased slightly, yet the change was clinically insignificant.

**CONCLUSIONS:** Alterations in shoulder ROM without concomitant changes in HT indicates that the changes in shoulder ROM in high school baseball players are mainly attributed to changes in soft tissue property rather than osseous adaptation. This may be due to the fact that participants were approaching the end of skeletal maturity. Decreased internal rotation and total rotation ROM have been linked to upper extremity injuries in overhead athletes. Therefore, observations from this study supports the benefit of implementing stretching programs in high school baseball players to help maintain shoulder ROM and possibly prevent upper extremity injuries. Supported by NIH-NIAAMS R03AR055262.

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**Board #373**

### 1592 9:30 AM - 11:00 AM

Comparison Of Sleeper'S, Cross Body And Manual Stretching For Posterior Shoulder Tightness: Randomized Controlled Trial

Hande Guney, Gul Baltci, Nihan O. Pekayyas, Gul Oznur Karabacak, Buke Teker, Pinar Balci, Ece Nohutlu Gunaydin, Hacettepe University Faculty of Health Sciences Physiotherapy and Rehabilitation, Ankara, Turkey. (No relationships reported)

**BACKGROUND:** Glenohumeral internal rotation deficit (GIRD) and posterior shoulder tightness (PST) have been linked to each other and associated with the shoulder pain. Lately, many researchers have focused on efficiency of different stretching method to PST and GIRD.

**PURPOSE:** To determine if the acute effects of manual stretching method is superior to cross-body stretching and sleeper stretch to resolve the PST and GIRD.

**METHODS:** Fifty-six asymptomatic female (mean age: 24.9±3.03 years/who have more than 20° of GIRD, randomly assigned to 1 of 3 intervention groups. Themain stretching group (n=20), the cross-body stretch group (n=18), the sleeper stretch group (n=18) (Table 1). Shoulder internal rotation ROM, with the arm abducted 90°was measured before and after 1-week intervention period. Subjects were asked to perform twice daily for 5 repetitions, holding each stretch for 30 seconds. One-way analysis of variance (ANOVA) was used for determination of equivalence among groups of variance and evaluation of subject characteristics.

**RESULTS:** The increase in internal rotation ROM for the subjects in the manual stretching group (mean±SD: 19.0°±4.6°) were significantly greater than the cross-body stretch group (11.0°±2.6°, p<0.001) and sleeper stretch group (9.3°±2.8°, p<0.001). The improvements in the sleeper stretch group were not different from the cross-body stretch (p=0.385).

**CONCLUSION:** Based on our results, the manual stretching appears to be more effective when comparing to both cross-body stretch and sleeper stretch group to gain internal rotation ROM. While the improvement in internal rotation from the cross-body stretch was greater than the sleeper stretch, this difference could not be statistically significant.

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### Table 1

<table>
<thead>
<tr>
<th>Description</th>
<th>Mean±SD</th>
<th>ROM difference Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age years Mean±SD</td>
<td>23.9±1.7</td>
<td>9.0±4.6</td>
</tr>
<tr>
<td>BMI kg/m2 Mean±SD</td>
<td>21.6±2.6</td>
<td>11.0±2.6</td>
</tr>
<tr>
<td>Manual Stretching</td>
<td>27.1±4.0</td>
<td>11.0±2.6</td>
</tr>
<tr>
<td>Cross Body Stretching</td>
<td>23.8±1.7</td>
<td>9.3±2.8</td>
</tr>
<tr>
<td>Sleeper’s Stretch</td>
<td>23.8±1.7</td>
<td>9.3±2.8</td>
</tr>
</tbody>
</table>
Chemotherapy induces a range of severe side effects in cancer patients including nausea, vomiting, and fatigue. Although chemotherapy-induced fatigue is reported in up to 99% of cancer patients, little has been done to elucidate the mechanisms and possible treatments; however we have preliminary evidence that MCP-1 induced inflammation may play a role in the development of fatigue and that the dietary flavonoid quercetin can blunt this effect.

**METHODS:** First, the effect of quercetin on voluntary wheel running was assessed using C57BL/6 mice assigned to one of four groups; normal diet-placebo (ND-PLA), normal diet-5-FU (ND-60), quercetin-placebo (Q-PLA), and quercetin-5-FU (Q-60). Mice were given a daily injection of either 60 mg/kg of 5-FU or phosphate buffered saline for five days and their activity was monitored 24 hours per day until 14 days post the initial injection. A second group of mice was used to assess blood following 5-FU. Mice were sacrificed at 5 or 14 d post initial injection.

**RESULTS:** Voluntary wheel running was reduced in both ND-60 and Q-60 as compared to the placebo groups (p < 0.05), however, this response was blunted in Q-60 (p < 0.05). Quercetin also blocked the 5-FU induced increase in plasma MCP-1 (146.5 ± 22.08 ng/mL for ND-14d vs. 59.7 ± 7.04 for Q-14d, p < 0.001). Both ND-60 and Q-60 had reduced hematocrit and hemoglobin at 5 and 14 days, but the reduction was less severe at 14 days in Q-60 (18.1±1.7 vs. 20.3±1.2 for Q-60, and 6.2±0.61 vs. 6.2±0.26 for Q-14d, p < 0.001).

**CONCLUSION:** These results suggest a beneficial role of quercetin not only in reducing MCP-1 and presumably inflammation, but in blunting the severity of common side effects of chemotherapy such as anemia and fatigue.

**PURPOSE:** To determine the efficacy of quercetin in reducing MCP-1 and subsequent fatigue after the administration of 5-fluorouracil (5-FU) chemotherapy.

**RESULTS:** To examine the relationships between physical activity (PA), social participation (SP) and health-related quality of life (HQOL) in older, long-term colorectal cancer survivors (CRCS).

**METHODS:** Surveys were mailed to 1,768 male and female CRCS, aged ≥ 65 years and at least 5 years post cancer diagnosis, as identified by the WI state cancer registry. Surveys provided information on PA, SP, HQOL, health history and relevant covariates. Analysis of covariance was used to evaluate the cross-sectional relationship between PA and SP with each of the SF-36 subscales, as well as both summary scores (physical component summary score (PCS) and mental component summary score (MCS)).

**RESULTS:** The final analytic sample consisted of 871 cases, the mean age was 81.5 ± 5.8 yrs (mean±SD) and mean time since diagnosis was 8.2 ±1.7 yrs. After adjustment for relevant covariates, PA, when classified as meeting or not meeting the current recommendation of 150 min/wk of moderate-vigorous activity, was associated with a 5-point higher PCS score (p=0.001), as well as higher physical function, role-physical, pain, general health, vitality, and social function subscale scores, but not MCS scores (p=0.30), SP, classified as “some” vs. “none,” was not associated with higher PCS scores (p=0.13), but was associated with a 3-point higher MCS score (p=0.003), as well as higher physical function, role-physical, general health, social function, role-emotional, and mental health subscale scores. Subjects reporting greater amounts of moderate-vigorous intensity PA had significantly higher scores on PCS (p<0.001) than those reporting lower amounts. Participation in greater amounts of light intensity was not significantly associated with higher PCS or MCS scores after adjustment for moderate-vigorous PA (p=0.21; p=0.43, respectively). Individuals participating in greater weekly hours of SP had higher PCS and MCS scores (p=0.01; p=0.001, respectively) than those participating less.

**CONCLUSIONS:** Results suggest that both PA and SP are associated with greater HQOL in older, long-term colorectal cancer survivors. While PA is related to the physical health of these survivors, SP is related to both physical and mental health.
Cancer-related fatigue (CRF) is hypothesized to impair quality of life by interfering with patients’ abilities to perform activities of daily living (ADL).

PURPOSE: The purpose of this study is to describe the interference of CRF with ADL in older cancer patients.

METHODS: 287 patients (all >65 yrs; M=72 yrs; N=171 female) with mixed cancer diagnoses were assessed on CRF and its interference with ADL 7 days after their first 2 chemotherapy infusions as part of a nationwide clinician trial conducted by the URCC CCOP Research Base. CRF and interference with ADL were assessed using questions from the Multidimensional Assessment of Fatigue instrument (10-point Likert Scale; 1=Not at all to 10=A great deal). Results are presented as means and standard errors (M±SE).

RESULTS: Nearly half (145 of 287) of patients reported CRF at cycle 1 (5.67±0.16) and cycle 2 (5.20±0.17). During cycle 1, 59% of patients reported that CRF interfered with socializing in 54% (5.32±0.18), household chores in 54% (5.44±0.18), and running errands in 53% (5.07±0.20). CRF interfered with walking in 56% (5.17±0.20), bathing in 46% (6.14±0.25), dressing in 45% (6.04±0.26), and engaging in sexual activity in 28% (5.35±0.32) of patients.

CONCLUSION: CRF interferes with older cancer patients’ abilities to perform ADL, such as walking, dressing, bathing, performing household chores, working, running errands, participating in recreational activities and leisure activities, socializing, and engaging in sexual activity while receiving chemotherapy.

Cancer-Related Fatigue Interferes with Walking and Recreational Activities among 287 Older Cancer Patients Receiving Chemotherapy

No relationships reported

Cancer is the most frequent type of cancer in women with rising numbers of patients and survivors. The benefits of physical activity (PA) for breast cancer patients are well known, including both physical and psychological effects. Thus, PA is increasingly discussed as concomitant therapy after breast cancer diagnosis and can add to the alleviation of therapy- and disease-related symptoms. However, little is known about PA behaviour in breast cancer patients during the course of the disease.

PURPOSE: To describe PA patterns including sports and active transportation in the course of breast cancer and to identify factors associated with these activities.

METHODS: The cohort study included 1,067 postmenopausal breast cancer patients from Southwest Germany. We collected quantitative information about walking and bicycling for transportation as well as sports before diagnosis, during therapy and one year after surgery and calculated MET-hours per week (MET=metabolic equivalent). Associations between these activities and clinical, behavioral and social characteristics were analyzed using logistic regression.

RESULTS: Median PA decreased significantly during therapy compared to PA before diagnosis from 36 to 14 MET-h/week and proportions decreased for walking (89.7% vs. 75.1%), bicycling (56.5% vs. 19.3%) and sports (64.6% vs. 14.8%, all p<0.001). The most frequent PA pattern during therapy was walking without any bicycling and sports (48.7%), followed by a pattern with none of the investigated activities (21.7%). Chemo-radiotherapy was negatively associated with sports (OR: 0.35 [0.17-0.73]), but positively associated with walking during therapy (OR: 2.08 [1.04-4.15]). Participation in rehabilitation increased the likelihood for bicycling (OR: 1.48 [1.06-2.09]) and sports one year after surgery (OR: 1.88 [1.38-2.51]).

CONCLUSION: The results highlight the need for interventions to increase PA after breast cancer diagnosis, in particular for moderate to vigorous activities. Increasing participation in rehabilitation might help to increase the proportion of patients who bicycle and engage in sports.

In observational studies of colon cancer survivors, physical activity has been associated with prolonged survival and lower rates of recurrence. Exercise interventions in cancer survivors are often supervised and require regular travel by participants. There is little data on the feasibility of interventions with stepped contact.

PURPOSE: To evaluate the feasibility of recruiting colon cancer survivors and effectively delivering an intervention to increase walking delivered through an existing evidence based physical activity intervention paradigm.

METHODS: Colon cancer survivors age 18 with resected new primary stage II or III colon cancer who were at least one month post-adjuvant therapy were recruited to a 12 week phase walking intervention. Participants met with a coach weekly for 4 weeks and walked on their own outside of meetings. In the second phase, lasting 8 weeks, survivors received brief weekly phone calls. Intervention messaging and content was based on an existing evidence-based walking intervention for diabetics. Participants self-reported physical activity and wore accelerometers at baseline and follow-up. The Freedson equation was used to calculate estimated energy expenditure.

RESULTS: Survivors referred 95 potentially eligible patients to the study. 23 were found ineligible, 62 declined and 11 enrolled. Between completion of the baseline assessment and their first intervention visit, three participants dropped-out of the study. Two of whom developed health problems that precluded their participation. Mean estimated energy expenditure at baseline was 1040 and at follow-up was 1552 kcal. 7 participants recorded valid step count data on their accelerometer. Mean step counts increased from 4365 at baseline to 6114 at follow-up. There were no statistically significant changes.

CONCLUSIONS: A stepped contact walking intervention can feasibly recruit colon cancer survivors after active treatment and engage them in significant behavior change.

In the United States, cancer-related symptoms such as depression, fatigue, and pain can last for years, negatively affecting the survivor’s quality of life. Exercise programs provide relief for some cancer-related symptoms. However, researchers have not examined the ability of exercise to “overlap” symptoms and provide simultaneous relief for the commonly occurring symptom cluster of depression, fatigue, and pain in breast cancer survivors.

PURPOSE: Women with early stage breast cancer, who were 6-months to 3 years post treatment, non-exercising, and self-reporting moderate symptoms for at least two symptoms of the cluster were enrolled in a pilot randomized controlled trial (RCT). Women were randomized to a standard exercise intervention, an intermittent exercise intervention, or a usual care control group. The exercise interventions consisted of 4-weeks of supervised exercise, followed by 8-weeks of unsupervised, home based exercise. Assessments were conducted at Baseline, 4, 8, and 12-weeks post intervention and included questionnaires, measurements of height, weight, cardiovascular fitness, and cancer-related symptoms.

RESULTS: Currently, 25 women have enrolled and most are Caucasian (63%) with Stage II disease (54%). At baseline, women were 52±9 years old, were overweight (Body Mass Index: M = 31.5, SD = 7.5), and had low fitness (VO2peak: M = 24.6, SD = 4.5). They also endorsed relatively high levels of depression (Center for Epidemiologic Studies Depression Scale: M = 23.4, SD = 8.9), fatigue (Functional Assessment of Cancer Therapy-Fatigue: M = 24.3, SD = 6.8), and pain (Brief Pain Inventory: M = 3.0, SD = 2.2). At the completion of the supervised exercise (4 week follow-up), effect sizes [ES] for depression were large in the exercise groups [Standard Exercise Intervention: ES = 1.7, Intermittent Exercise Intervention: ES = 1.4] and medium for the control group [ES = 0.5]. Similarly large ES were found among the exercise groups for fatigue, but not for pain.
CONCLUSION: Initial data from this pilot RCT suggest that exercise is effective in alleviating cancer-related depression and fatigue among breast cancer survivors experiencing a symptom cluster. However, results are less clear for the effect of exercise on cancer-related pain among these survivors.

**TABLE 1.** Mean difference between predicted HRpeak and achieved HRpeak.

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean HR difference (BPM)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbar (208-0.7*age)</td>
<td>29.4 ± 6.0</td>
<td>17.0-41.8</td>
</tr>
<tr>
<td>Tanaka (207-0.7*age)</td>
<td>27.6 ± 6.0</td>
<td>15.2-40.0</td>
</tr>
<tr>
<td>Gellish (207-0.7*age)</td>
<td>28.4 ± 6.1</td>
<td>16.2-40.6</td>
</tr>
<tr>
<td>Age Prediction (220-age)</td>
<td>32.9 ± 6.2</td>
<td>20.5-45.3</td>
</tr>
</tbody>
</table>

**METHODS:** Current guidelines for cancer survivors define exercise training intensity relative to age predicted peak heart rate (HRpeak). Because chemotherapy and radiation are cardiotoxic, we hypothesized that HRpeak predicted by published, age-based equations would not accurately reflect achieved HRpeak in cancer survivors. To test this hypothesis, achieved HRpeaks were compared to HRpeaks estimated by the prediction equations of Inbar (1994); Tanaka (2001), Gellish (2007) and 220-age.

**RESULTS:** Table 1 presents the mean differences between the HRpeak predicted by each equation and the achieved HRpeak. The Bland-Altman analysis indicates that the 95% confidence interval of agreement between observed and predicted HRpeak exceeded the acceptable level of bias (± 2 SD) for all tested prediction equations.

**CONCLUSIONS:** Because the tested equations overestimated achievable HRpeak, their use would underestimate exercise intensity defined relative to estimates of HRpeak.

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**1601 Board #9 MAY 30 2:00 PM - 3:30 PM**

**Fundamental Measurements Of Body Composition And Heart Rate To Advise Women On Healthy Lifestyle Choices.**

David H. Jones, Melissa Nestore, Sara Henoply, Helen Hu, Jean Boucher, FACSM, Alain S. Comtois, John Keyserlingk, Concordia University, Montreal, QC, Canada. Ville Marie Breast and Oncology Centre, Montreal, QC, Canada. Université du Québec à Montréal, Montréal, QC, Canada. Ville Marie Breast and Oncology Centre, Montreal, QC, Canada. (Sponsor: Jean Boucher, FACSM)

The Ville Marie Breast Centre has established a prevention and early detection program for women at risk of developing breast cancer. A component of this program is to encourage the women to work towards and continue to maintain their ideal body composition. This includes reducing the total amount of body fat and in particular, the total amount of visceral fat which accumulates on the body. Previous work has shown that as a woman’s BMI increases, her risk for developing breast cancer also increases. Women that have been diagnosed and had treatment for breast cancer also have a greater risk of recurrences, as their BMI increases. Previous work in this area shows that women who have undergone adjuvant therapy tend to have a significantly higher BMI than women who have not undergone treatment for breast cancer.

**PURPOSE:** The goal behind this study was to determine body composition and basic cardiovascular measurements of the women who utilize the wellness services at the Ville Marie women’s health centre.

**METHODS:** As part of the standard medical evaluation, a team of kinesiologists performed body line measurements on 4096 patient at the Ville Marie Breast Center. Measurements were obtained on 3400 non oncology female patients and 696 oncology female patients. The data obtained included age, height, weight, BMI, resting heart rate and blood pressure. Additional data was also obtained on lean muscle mass, body fat and waist-to-hip ratio on just over 1000 of the women.

**RESULTS:** The mean age of the oncology patients was 60.1 years (SD ± 9.2). The mean age of all subjects was 56.3 years (28-88 years). The mean blood diastolic pressure 75 mmHg (SD ± 9.8) and mean systolic pressure was 127 mmHg (SD ± 17.4). The mean resting heart rate was 73 beats/min (SD ± 11.95). The mean height and weight was 161 cm (SD 7.5) and 67 kg (SD ± 13.5) respectively. The mean Body mass index, BMI was 25.95(SD± 5.37).

**CONCLUSION:** The information obtained from these measurements is utilized by the medical team to help direct the women on healthy lifestyle choices which include diet and exercise, as part of the prevention program. The physicians and medical team are able to incorporate the morphological measurements and heart rate and blood pressure values into the patients chart to determine the patient’s level of risk.

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**B-24 Free Communication/Poster - Cardiovascular I**

**MAY 30, 2012 1:00 PM - 6:00 PM**

**ROOM: Exhibit Hall**

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**1602 Board #10 MAY 30 3:30 PM - 5:00 PM**

**Test-retest-reliability Of Metabolic And Cardiovascular Load During Isokinetic Strength Testing.**

Josefine Weber, Juliante Muller, Christoph Otto, Friederike Scharhag-Rosenberger, Anja Carlsohn, Frank Mayer. Outpatient Clinic University of Potsdam, Potsdam, Germany. University of Applied Science for Prevention and Health Management, Saarbrücken, Germany.

Isokinetic strength tests are evident to quantify strength deficits in healthy subjects or patients in physio- or sports therapy. However, the metabolic and cardiovascular load as well as the reliability of these measures during isokinetic strength testing is unknown.

**PURPOSE:** The aim of this study was to analyze the reproducibility of metabolic and cardiovascular measures during isokinetic strength testing of the lower limb.

**METHODS:** 15 healthy subjects (7 F; 8 M; 28 ± 5 yrs; 1.75 ± 0.08 m; 72 ± 9 kg; maximum oxygen uptake V0₂max = 49 ± 10 ml/min/kg) were included. Metabolic (V0₂ [ml/min/kg]) and cardiovascular variables (heart-rate [beats/min]) were measured at the end of an isokinetic test for local muscular endurance (LME; 60 sec., leg-extension concentric, 0.3 m/s alternate; Legpress). Reproducibility was evaluated in a test-retest study-design over a period of 14 days (M1, M2). Intraclass correlation coefficient (ICC), Bland and Altman analysis (Bias ± LoA) and Test-ReTest-Validity (TRV) were calculated. V0₂ and heart-rate was analyzed descriptively (mean ± SD).

**RESULTS:** The mean value of pretest for V0₂ was 37.4± 3.57 ml/min/kg and for retest 35.4± 3.43 ml/min/kg. Heart-rate was 172 ± 10 beats/min in M1 and 170± 9 beats/min in M2. ICC was
calculated .86 (p<.001) for VO₂ and .72 (p<.008) for heart-rate. Bias for VO₂ was -1.2 ml/min/kg (± 5.23 ml/min/kg) and for heart-rate -0.5 beats/ min (± 14.3 beats/min). TRV was 6.0 ± 4.55% for VO₂ and 3.29 ± 2.51% for heart rate.

CONCLUSIONS: It can be concluded that a one-minute strength test of the lower extremity elicits reasonable metabolic and cardiovascular reactions in healthy subjects. Both VO₂ and heart-rate can be measured reliably during isokinetic strength tests for local muscular endurance.

1603 Board #11 MAY 30 3:30 PM - 5:00 PM
Effects of a Single Resistance Training on Cardiovascular Health Indicators
Huan-Chieh Chen, Shui-Yu Liu, Yi-Ting Su, Sandy S. Hsieh, FACSM. National Taiwan Normal University, Taipei, Taiwan.

(No relationships reported)

PURPOSE: To investigate the effects of a single resistance training on cardiovascular health indicators.

METHODS: Twenty (24) males who have engaged in resistance exercise up to 6 months or more were recruited in this study. Subjects were divided into three groups with a circular-randomly order according to their maximum leg press strength: 1) high intensity with low repetition group (HL; 90%1RMx4) (age: 22.0 ± 2.7 yr, height: 179.0 ± 5.8 cm, weight: 73.6 ± 8.3 kg, BMI: 22.9 ± 1.9, maximum strength: 282.0 ± 97.2 kg); 2) middle intensity with middle repetition group (MM; 75%1RMx10) (age: 23.3 ± 2.5 yr, height: 175.4 ± 6.4 cm, weight: 69.7 ± 9.2 kg, BMI: 22.6 ± 2.2, maximum strength: 267.1 ± 109.0 kg); and 3) low intensity with high repetition group (LM; 60%1RMx15) (age: 22.6 ± 2.5 yr, height: 174.0 ± 2.6 cm, weight: 69.3 ± 6.4 kg, BMI: 22.9 ± 1.9, maximum strength: 252.2 ± 93.1 kg). The single resistance training protocol included 2 sets (400 RM) of 4-km up and 4 sets of the main exercise (kg graded with 2 minutes rest between sets. Blood samples were collected at rest, after warm up and immediately after each main exercise session (1st, 2nd, 3rd, and 4th). The values of C-reactive protein (CRP), triglycerides (TG), and high density lipoprotein (HDL) were analyzed with a mixed design two-way ANOVA.

RESULTS: There were no significantly differences among groups for CRP and HDL. However, for TG, the 2nd, 3rd and 4th values of LH exercise were significantly higher (p<.05) than that of HL exercise (137.5 ± 68.7 vs. 77.0 ± 18.4, 135.9 ± 64.6 vs. 75.8 ± 18.8, 134.1 ± 59.5 vs. 76.8 ± 21.5 mg/dL). The consistent trend for within group comparison is that the HDL levels were significantly higher (p<.05) for all 3 groups after the 4th set as compared to the baseline (HL: 56.3 ± 7.3 vs. 53.4 ± 8.4 mg/dL; MM: 55.9 ± 11.9 vs. 52.0 ± 10.2 mg/dL; LH: 56.9 ± 14.7 vs. 51.2 ± 13.1 mg/dL).

CONCLUSION: A single resistance training for those who have been accustomed with regular resistance exercise have acute benefits on cardiovascular health indicators. The rise in blood HDL values has a protective effect on cardiovascular system. Also, different intensities and repetitions of a single resistance training only affect TG in the LH group, but not the values of HDL and CRP.

1604 Board #12 MAY 30 3:30 PM - 5:00 PM
Influence of Temperature on Vascular Adaptation to Muscle Endurance Exercise
Leland Nielsen1, K. K. McCully, FACSM. 1Lander University, Greenwood, SC. 2University of Georgia, Athens, GA.

(No relationships reported)

PURPOSE: The aim of this study was to determine whether temperature is a factor that influences the magnitude of vascular adaptation to training.

METHODS: Using a pretest-posttest design, twenty-two healthy, able-bodied subjects performed endurance-type training of the forearm with one arm in a warm condition and one arm in a cool condition. Subjects trained 4 times for 5 weeks. Both arms were submerged in water for 5 minutes with one arm exposed to warm water (42-44°C) and the other exposed to cool water (18-20°C). Once the 5-minute bathing period was completed, the corresponding arm was wrapped with either a heating pad or a cold pack. Once wrapped, the 20-minute training session began consisting of full range wrist curls using free-weight dumbbells. The subject was instructed to perform 10 repetitions in one arm over the period of 15 seconds then repeat with the opposite arm. Following this pattern, the subject performed exercise with one arm at a time over the 20-minute session with each arm performing 20 repetitions per minute (400 repetitions per session). The resistance was set to equal 15% of their 1-RM for each arm and progressed as tolerated. The outcome variables measured in each arm included arterial range in the radial artery, peak blood flow, lean tissue mass of the forearm assessed via dual energy x-ray absorptometry (DXA), and forearm strength assessed by a test of one-repetition maximum (1RM).

RESULTS: 1-RM strength significantly increased in both the warm (13.3 ± 11.9%, mean ± SD) and cool (14.8 ± 12.2%) conditions arms (p < 0.0001), although no temperature effect was observed (p = 0.44). Despite a significant increase in forearm lean tissue mass (598 ± 218.1 vs. 609 ± 219.4 grams), no difference was seen between temperature conditions (p = 0.39). Arterial range in the radial artery did not change from pre to post in either arm (p = 0.68). Peak blood flow in the radial artery did not change in either arm with training (p = 0.09).

CONCLUSION: Increasing muscle temperature did not enhance arterial range or muscle adaptations following endurance training in able-bodied subjects. While people with SCI often have cool limb temperatures, our study suggests that temperature is not an important factor in determining muscle adaptations with training.

1605 Board #13 MAY 30 3:30 PM - 5:00 PM
Handgrip Exercise Training Following Transradial Catheterization Ameliorates Arterial Dysfunction
Nigel T. Cable1, Ellen Dawson1, Amr Alkarmi2, D. Jay Wright3, Daniel J. Green3, 1Liverpool John Moores University, Liverpool, United Kingdom. 2Liverpool Heart and Chest Hospital, Liverpool, United Kingdom. (Sponsor: Keith George, FACSM)

(No relationships reported)

PURPOSE: The aim of the present study was to assess radial artery vasodilator function prior to transradial catheterization and again following randomisation to 6 weeks of rehabilitative localized handgrip training or a similar inactive control period.

METHODS: Twenty-five subjects undergoing transradial catheterization were recruited and assessed before (Pre) and 6 weeks following (Post) catheterization. Subjects were randomized to either 6 weeks of handgrip exercise training (Exercise, n=14) or a similar non-exercise group (Control, n=11). Radial artery flow-mediated dilatation (FMD; endothelium- and NO-dependent) and dilation in response to a sublingual dose of glyceryl trinitrate (GTN; endothelium-independent and NO-mediated) were assessed using high-resolution ultrasonography. In a subgroup of subjects (n=12, 8 Exercise, 4 Control), radial artery blood flow responses to graded upstream brachial artery infusion of acetylcholine (ACH; an endothelial-dependent nitric oxide-dependent vasodilator) and sodium nitroprusside (SNP; an endothelium-independent, nitric oxide-dependent vasodilator) were assessed. Procedures were undertaken 4 weeks prior to, and 6 weeks following catheterization and blood flow assessed as above.

RESULTS: FMD was significantly impaired following catheterisation in the Control group (7.9±1.4 to 4.5±0.6%), but was maintained in the Exercise group (6.0±0.9 to 6.6±0.9%; pre versus post) (P<0.05). There were no significant differences between the groups or across time for either the ACH or the SNP protocols (P>0.05). Post-hoc t-tests in the Exercise group showed a significant increase from baseline blood flows with all SNP infusions (P<0.05).

CONCLUSIONS: Six weeks of localized handgrip exercise training preserved radial artery endothelium-dependent vasodilator function following transradial catheterization. We suggest that exercise training should be considered to enhance radial artery function, prevent possible clinical consequences of catheterization and preserve the viability of the artery for subsequent catheterization or use as a bypass graft.

1606 Board #14 MAY 30 3:30 PM - 5:00 PM
QT Interval Shortening in Long Term Androgenic Anabolic Steroid Users
Nicholas Sculthorpe1, Fergal Grace1, Lee Taylor2, Bruce Davies, FACSM, 1University of Bedfordshire, Bedford, United Kingdom. 2University of Western Scotland, Hamilton, United Kingdom. 3University of Glamorgan, Pontypridd, United Kingdom.

(No relationships reported)

Androgenic anabolic steroid (AAS) abuse is associated with a growing number of cardiac consequences and has been implicated in cardiac electrophysiological changes. However conflicting reports have been published regarding the effect of AAS on rate corrected QT interval (QTc) at rest.

PURPOSE: this study aimed to further investigate the effect of AAS on QTc in a cohort of long-term AAS users in whom the effects may be more pronounced.

376
Sensitivity of QTc in differentiating between AS and C in our sample is lower than that reported previously. This may be due to a number of factors e.g. increasing age countering the QTc shortening effects of long-term AAS abuse.

**CONCLUSION.**

RESULTS.

Groups. As previous research had reported both increases and decreases in response to AAS use, a 2-tailed analyses was performed. A secondary outcome was to calculate QTc interval that best differentiated between C and AAS users.

METHODS. Eight resistance-trained pre-hypertensive and hypertensive males (SBP = 133 ± 7 mmHg; DBP = 82 ± 6 mmHg; 29 ± 6 yrs) performed a randomized cross-over designed study which included 3 sets of a 6 exercise circuit (CIR), 12 minutes of continuous two-handed swings (THIS), and a resting control (CON). Resting blood pressure (BP) and heart rate (HR) measurements were recorded before each trial. Participants recovered for 120 minutes after exercise before post-exercise BP and HR were recorded. Measurements occurred every 30 minutes for 120 minutes. Statistical significance was determined by two-way ANOVA with repeated measures and Tukey post-hoc analysis. Post-exercise BP responses were classified as clinical significance based on SBP >130 mmHg or BP < 80 mm Hg.

RESULTS. Both CIR and THIS averaged statistically significant decreases in SBP-post-exercise compared to pre-exercise values (-7.2 ± 1.2 and -7.1 ± 1.5 mmHg respectively; p<0.05). All post-exercise SBP measurements were clinically significant for CIR and for THIS at minute 0, 10, 90, & 120. A clinically significant decrease in DBP post-exercise compared to rest occurred at minute 30 and 60 for CIR. Heart rate was significantly elevated above CON during minute 0 for CIR and THIS (23 ± 4.7 and 21 ± 4.7 bpm respectively, p<0.001).

CONCLUSIONS. The results indicate that kettlebell exercise is effective at producing an acute decrease in post-exercise BP in pre-hypertensive or hypertensive resistance trained males. The magnitude of the decrease in post-exercise blood pressure is clinically significant.

**CONCLUSIONS:**

**METHODS:**

The incidence of adverse cardiovascular events such as myocardial infarction and arrhythmias peaks during winter. Cold may exacerbate adverse cardiovascular events in susceptible individuals performing physical activity.

METHODS. Twenty healthy men (23 ± 3 y) were randomized to assume the supine position for 30 min in an environment chamber at cold (4ºC) or temperate (24ºC, temp) trials. Radial waveform errors and HRV were obtained by applanation tonometry and HR monitor respectively. After resting measurements (RES), subjects performed a 3 min IHG (30% MVC) followed by a 3 min recovery period (REC).

RESULTS. From rest to peak exercise, there was a significant increase in heart rate (69 ±6±3.43 to 148.3±21.99 b/min), systolic blood pressure (117.7±2.62 to 141.4±16.96 mmHg), mean arterial pressure (90.15±1.48 to 114.25±14.52 mmHg), and VO₂ (22±5.01 to 1.29±0.63 L/min). Rating of perceived exertion (RPE, 15 pt. scale) increased significantly during exercise to peak at 9.8±1.6. Total caloric expenditure during exercise was 93.6±35 kcal. EPOC was 3.7±2±16 L. Total caloric expenditure for exercise and recovery was 112.3±43.1 kcal.

CONCLUSIONS. The loading protocol from the present study, data suggest that kettlebell exercise produces significant cardiovascular stress with a low to moderate metabolic cost.

**METHODS:**

A cross sectional independent groups design was used with AAS using resistance athletes ((AS) n=15) compared with a group of non-AAS using, resistance trained, age matched controls ((C) n=15). AS had a significant history of AAS use (18±2 yrs) and both AS and C had >19 year history of resistance training. Participants underwent a resting 12 lead ECG, from which QT interval was calculated and corrected to QTc using the Bazett formula. The main outcome measure was determined as evidence for differences in mean corrected QTc between groups. As previous research had reported both increases and decreases in response to AAS use, a 2-tailed analyses was performed. A secondary outcome was to calculate QTc interval that best differentiated between C and AAS users.

RESULTS. QTc was shorter in AS than in C (382.0 ± 21.01 ms versus 409 ± 18.77 ms for AS and C respectively p<0.001). Chi squared analyses revealed a greater incidence of QTc<380 ms in AS versus C p<0.01, specificity 93% sensitivity 60%.

CONCLUSION. The results support previous findings that AAS use causes a reduction in QTc which may be due to the effect of AAS on cardiac ion channels. Additionally the specificity and sensitivity of QTc in differentiating between AS and C in our sample is lower than that reported previously. This may be due to a number of factors e.g. increasing age countering the QTc shortening effects of long term AAS abuse.

**PURPOSE:**

To determine if kettlebell exercise produces a PEH response that is statistically and clinically significant in a pre-hypertensive and hypertensive resistance trained male population.

**METHODS:**

All movements were timed such that each subject completed a standardized number of movements across the session with 1:1 exercise/rest intervals of 45s and 2 min rest between circuits for a complete presses) and to become familiarized with the kettlebell exercises. Subject completed a subsequent kettlebell session at least one week following the preliminary session, and consumed a liquid meal (Ensure®

**CONCLUSIONS:**

During IHG, AIx, aMAP, and nLF were increased (P<.01), while nHF was decreased (P<.01) in both trials; but aAIx was higher in the cold vs. temp. During REC, aMAP and aAIx remained elevated (P<0.05) in the cold vs. temp. The nLF was lower (~.08 ms) and nHF was higher (~.10 ms, vagal rebound) than REC in the temp trial compared to a full REC of nLF and nHF in the cold.

**METHODS:**

A cross sectional independent groups design was used with AAS using resistance athletes ((AS) n=15) compared with a group of non-AAS using, resistance trained, age matched controls ((C) n=15). AS had a significant history of AAS use (18±2 yrs) and both AS and C had >19 year history of resistance training. Participants underwent a resting 12 lead ECG, from which QT interval was calculated and corrected to QTc using the Bazett formula. The main outcome measure was determined as evidence for differences in mean corrected QTc between groups. As previous research had reported both increases and decreases in response to AAS use, a 2-tailed analyses was performed. A secondary outcome was to calculate QTc interval that best differentiated between C and AAS users.

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**CONCLUSIONS:**

Exercise provides a beneficial post exercise hypotensive response (PEH) for healthy and hypertensive adults. Currently, ACSM recommends exercise that uses “large muscle groups, can be maintained continuously, and is rhythmic and aerobic in nature” to obtain the benefits of PEH (Pescatello, 2004). Kettlebell exercise meets these recommendations. A kettlebell is a cannonball shaped weight with a handle that is lifted using ballistic, Olympic lifting style, full-body movements.

**PURPOSE:**

To determine if kettlebell exercise produces a PEH response that is statistically and clinically significant in a pre-hypertensive and hypertensive resistance trained male population.

**METHODS:**

All movements were timed such that each subject completed a standardized number of movements across the session with 1:1 exercise/rest intervals of 45s and 2 min rest between circuits for a complete presses) and to become familiarized with the kettlebell exercises. Subject completed a subsequent kettlebell session at least one week following the preliminary session, and consumed a liquid meal (Ensure®

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Influence of Alternate Nostril and Paced Breathing on Cardiac Autonomic Balance

Dante Andres, Shreya Ghiya, Matthew Lee, FACSM, M. Dot Fullwood. San Francisco State University, San Francisco, CA. (Sponsor: Marialice Kern, FACSM) (No relationships reported)

Alternate nostril breathing (ANB) has been shown to enhance autonomic control of the heart by increasing vagal modulation, but there is little information on autonomic control during ANB at slow breathing rates.

PURPOSE: To examine cardiac autonomic modulation during ANB at a slow rate and to compare the effects of ANB to that of paced breathing (PB) at the same respiratory rate.

METHODS: Twenty healthy individuals (22.3 ± 2.9 yr) with no prior experience with ANB engaged in 30 min of both ANB and PB at a breathing rate of 5 breaths/min which were preceded by 5 minutes of normal breathing (PRE). Mean arterial pressure (MAP) and an electrocardiogram (EKG) were collected during all conditions and the EKG was evaluated for mean RR interval and heart rate variability (HRV) indices. HRV was reported as spectral power in the total (TP), low- (LF), and high-frequency (HF) ranges and were natural log (ln) transformed. Analysis of covariance (ANCOVA) using sex as a covariate was used to examine differences in the variables between conditions.

RESULTS: ANCOVA revealed differences in all HRV indices between the conditions (Table 1). Post-hoc analysis found that lnTP, lnLF/lnHF, and normalized LF (LFNU) were greater during PB and ANB compared to PRE. Conversely, normalized HF (HFNU) was lower during PB and ANB compared to PRE. There were no differences in MAP or mean RR interval between conditions.

CONCLUSION: Both ANB and PB at 5 breaths/min resulted in decreased parasympathetic and/or increased sympathetic control of the heart.

Table 1. Data are mean ± SEM.

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>PB</th>
<th>ANB</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnTP (ms2)</td>
<td>6.51 ± 0.12</td>
<td>6.32 ± 0.15 *</td>
<td>6.10 ± 0.13 *</td>
<td>0.026</td>
</tr>
<tr>
<td>lnLF (ms2)</td>
<td>7.51 ± 0.13</td>
<td>6.10 ± 0.16 *</td>
<td>6.78 ± 0.16 †</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>lnHF (ms2)</td>
<td>6.78 ± 0.17</td>
<td>6.32 ± 0.21</td>
<td>6.39 ± 0.15</td>
<td>0.015</td>
</tr>
<tr>
<td>lnLF/lnHF</td>
<td>1.12 ± 0.02</td>
<td>1.46 ± 0.04 *</td>
<td>1.39 ± 0.03 *</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HFNU (%)</td>
<td>66.5 ± 2.8</td>
<td>93.0 ± 1.0 *</td>
<td>89.3 ± 2.2 *</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LFNU (%)</td>
<td>33.5 ± 2.8</td>
<td>7.0 ± 1.0 *</td>
<td>20.7 ± 2.2 *</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean RR (ms)</td>
<td>519.3 ± 17.5</td>
<td>580.1 ± 20.5</td>
<td>615.4 ± 18.7</td>
<td>1.064</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>65.8 ± 1.7</td>
<td>55.6 ± 1.7</td>
<td>58.5 ± 2.0</td>
<td>1.127</td>
</tr>
</tbody>
</table>

* p<0.05 vs. PRE; † p<0.05 vs. PB

1610 Board #18 MAY 30 3:30 PM - 5:00 PM
The Effect of Bikram Yoga on Vascular Function
Stacy D. Hunter, Pure Action, Inc., Austin, TX.
(No relationships reported)

Bikram yoga is a trademarked form of hatha yoga in which a series of 26 yoga postures are performed in a heated, humidified environment over a 90-minute period. The 90-minute session consists of pranayama (breathing), and standing, balancing, strengthening, and stretching asanas (postures) all performed in a sauna-like environment. Although this highly controlled style of Bikram yoga provides an optimal choice for interventional research studies, few studies have attempted to elucidate the health benefits associated with Bikram yoga.

PURPOSE: To determine the effects of Bikram yoga on key vascular functions and metabolic risk factors.

METHODS: 25 obese (42±12 yrs) and 27 lean (34±12 yrs) sedentary adults were studied before and after an 8-week Bikram yoga intervention. Subjects attended 3 90-minute Bikram yoga classes per week (24 sessions). During each class, a series of 26 postures were performed to scripted instruction in a room heated to 105° F with 60% relative humidity.

RESULTS: Body mass, body fat (via DEXA), systolic blood pressure, and total cholesterol were greater (p<0.05) in obese than in lean subjects. After the intervention period, there were no changes in body mass, body fat, or blood pressure, but trunk flexibility (via sit-and-reach test) increased in both groups (p<0.05). Serum concentrations of glucose, insulin, lipids, and lipoprotein did not change. Quality of life as assessed by SF-36 questionnaire improved after 8 weeks (p<0.05). No changes in measures of central arterial stiffness (aortic pulse wave velocity and carotid artery compliance) were observed after the yoga intervention. An index of endothelium-dependent vasodilation (brachial artery flow-mediated dilation) and glucose area under the curve (in oral glucose tolerance test) tended to decrease (p=0.08 and 0.07, respectively) in obese but not in lean adults.

CONCLUSIONS: Even though Bikram yoga was efficacious in improving quality of life and flexibility, it does not appear to improve arterial stiffness, endothelial function, or glucose tolerance in either lean or obese subjects.
RESULTS: Data are presented in Table 1. ANOVA revealed that lnLF, lnLF/lnHF, and normalized LF (LFNU) were lower during ANB and PB compared to PRE. Additionally, normalized HF (HFNU) was greater during ANB and PB compared to PRE. Lastly, lnLF and mean RR interval were lowest during PB.

CONCLUSION: Both ANB and PB at 12 breaths/min resulted in increased vagal modulation of the heart compared to normal breathing. These data suggest that PB has a similar effect on cardiac autonomic balance as ANB when breathing rate is the same.

Table 1. Data are mean ± SEM.

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>ANB</th>
<th>PB</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnLF (ms²)</td>
<td>7.58±0.48</td>
<td>6.49±0.27*</td>
<td>5.84±0.26*</td>
<td>0.016</td>
</tr>
<tr>
<td>lnHF (ms²)</td>
<td>7.10±0.33</td>
<td>6.77±0.37</td>
<td>6.40</td>
<td></td>
</tr>
<tr>
<td>lnLF/lnHF</td>
<td>1.12±0.07</td>
<td>0.92±0.03*</td>
<td>0.91±0.05*</td>
<td>0.006</td>
</tr>
<tr>
<td>LFNU (%)</td>
<td>66.6±7.3</td>
<td>76.7±5.4*</td>
<td>75.1±7.2*</td>
<td>0.004</td>
</tr>
<tr>
<td>HFNU (%)</td>
<td>37.5±7.3</td>
<td>33.3±5.4</td>
<td>35.0±7.2</td>
<td>0.004</td>
</tr>
<tr>
<td>Mean RR (ms)</td>
<td>772.6±75.3</td>
<td>835.4±55.6</td>
<td>761.3±49.6*</td>
<td>0.043</td>
</tr>
</tbody>
</table>

* p<0.05 vs. PRE; † p<0.05 vs. PB

1613 Board #21 MAY 30 3:30 PM - 5:00 PM
Influence of Alternate Nostril Breathing on Heart Rate Variability in Non-Practitioners of Yogic Breathing
Clarence M. Lee, Shreya Ghiya. San Francisco State University, San Francisco, CA. (Sponsor: Marialice Kern, FACSM)
(No relationships reported)

Although chronic alternate nostril breathing (ANB) has been shown to increase vagal modulation, there is no information on the immediate effects of ANB on autonomic control compared to paced breathing (PB) at the same rate.

PURPOSE: To evaluate the effect of intermittent mild dorsi-plantar flexion exercise on circulatory responses during protracted sitting in a simulated aircraft cabin environment.

METHODS: Six healthy male subjects participated in this study (age: 21.2±2.9 yr) with no prior exercise with ANB engaged in 30 min of both ANB and PB in a randomly assigned order. ANB and PB were preceded and followed by 5 min of normal breathing (PRE, Post-ANB, and Post-PB, respectively). An electrocardiogram was recorded during all conditions for HRV analysis, along with mean arterial pressure (MAP). HRV was reported as spectral power in the total (TP), low- (LF), and high-frequency (HF) ranges and were natural log (ln) transformed. Analysis of variance (ANOVA) was used to examine differences in the variables between conditions and a significance level of 0.05 was used for all tests.

RESULTS: Data are presented in Table 1. ANOVA revealed that lnLF, lnLF/lnHF, and normalized LF (LFNU) were lower during ANB and PB compared to PRE. Additionally, normalized HF (HFNU) and MAP were greater during ANB and PB compared to PRE. Lastly, lnLF and mean RR interval were lowest during PB.

CONCLUSION: These data suggest that there was an increase in cardiac autonomic modulation following ANB and PB without a shift in autonomic balance. To our knowledge, this is the first study to investigate the autonomic effects of ANB in this population and to compare the effects of ANB and PB at the same breathing rate.

Table 1. Data are mean ± SEM.

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>ANB</th>
<th>PB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean RR (ms)</td>
<td>821.6±22.2</td>
<td>743.6±28.3</td>
<td>852.9±38.4</td>
</tr>
<tr>
<td>lnTP (ms²)</td>
<td>8.51±0.14</td>
<td>6.95±0.20*</td>
<td>6.75±0.22*</td>
</tr>
<tr>
<td>lnLF (ms²)</td>
<td>7.57±0.18</td>
<td>6.46±0.14*</td>
<td>6.69±0.22*</td>
</tr>
<tr>
<td>lnHF (ms²)</td>
<td>6.62±0.21</td>
<td>7.96±0.28*</td>
<td>8.38±0.30*</td>
</tr>
<tr>
<td>lnLF/lnHF</td>
<td>1.15±0.03</td>
<td>1.07±0.03</td>
<td>1.05±0.03</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>85.8±1.7</td>
<td>87.5±1.8</td>
<td>85.3±2.3</td>
</tr>
</tbody>
</table>

* p<0.05 vs. PRE

1614 Board #22 MAY 30 3:30 PM - 5:00 PM
The Effect Of Mild Exercise On Circulatory Responses During Simulated Aircraft Cabin Hypoxia And Dehydration
Steve P. Hunter1, Gary Kitchen1, David P. Sumners2, 1London South Bank University, London, United Kingdom. 2Kings College London, London, United Kingdom. (No relationships reported)

INTRODUCTION: The incidence of a deep vein thrombosis or pulmonary embolism is increased with flight time over 6 hours (Lapostolle et al 2001). Immobilization PiO2 and lower ambient humidity encountered in the aircraft cabin are associated with hypohydration, hypovolaemia, increased blood viscosity, and reduced venous blood flow in the legs. (Greenleaf et al 2004). Schiffer et al (2005) stated mild exercise performed for 3 mins every 15 mins did not protect against DVT.

PURPOSE: To evaluate the effect of intermittent mild dorsi-plantar flexion exercise on circulatory responses during protracted sitting in a simulated aircraft cabin environment.

METHODS: Six healthy male subjects participated in this study (age: 21.2±2.9 yr). Trials were allocated by systematic rotation. Prior to each trial subjects were hypohydrated until they lost 0.3-0.5kg of body mass. Each trial required the subjects to breath 15% inspired oxygen whilst sitting and for 40 minutes. Blood velocity was measured at the femoral artery for a 1-minute period every 5 minutes. In the exercise trial 1-minute of ankle plantar flexion was carried out every 10 minutes.

RESULTS: Normalised peak femoral artery blood velocity (BV) was significantly higher immediately post ankle plantar flexion in the exercise trial (1.9±0.60 vs 0.83±0.13 p=0.04). This tendency was maintained across the 4 exercise bouts but had disappeared 5 minutes post exercise. Evidence of a cumulative effect of exercise on blood velocity was not seen. Heart rate (HR, bpm) was significantly elevated following exercise compared to rest trial (84.3±8.2 vs 74.3±7.4 bpm, p=0.002) and this difference was maintained 5 minutes post exercise (75.6±9.5 vs 71.9±8.0 bpm, p=0.043). Systolic blood pressure showed no significant differences immediately following exercise (137.9±14.5 vs 117.6±13.5 p=0.07).

CONCLUSION: Intermittent plantar flexion exercise elevated HR, SBP and peak BV significantly immediately post exercise. Elevation in HR but not in BV 5-minutes post exercise was seen. BV measured at the femoral artery may not be sensitive enough to determine peripheral short-term BV responses. Future studies should include measures of microcirculation and tissue swelling to determine the potential protective circulatory benefits of this form of exercise, or use more intense/frequent exercise.

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Impact of Air Travel and Marathon Running on Markers of Thrombotic and Vascular Risk in Endurance Athletes

Beth A. Parker¹, Amanda L. Auger², Jeffrey A. Capizzi³, Kevin D. Ballard³, Brian R. Kupchak², Peter Kriz⁴, Christopher Troynanos⁵, Pierre A. D’Hemecourt, FACSM⁶, Paul D. Thompson, FACSM⁷, Hartford Hospital, Hartford, CT. ²University of Connecticut, Storrs, CT. ³Center for Sports Medicine, East Providence, RI. ⁴Children’s Hospital, Boston, MA.

(Purpose: D-dimer and p-selectin are markers of venous thrombotic risk and elevated p-selectin has been associated with increased cardiovascular events. We examined the effects of exercise and air travel on markers of vascular risk in marathon runners.

Methods: Forty-one adults participating in the 114th Boston Marathon (April 19, 2010) were divided into travel (n=23) and non-travel “control” (n=18) groups based on whether they lived > 4 hr plane flight or < 2 hr car trip from Boston. Subjects provided venous blood samples the day before (PRE), immediately after (FINISH), and after returning home the day after the marathon (POST). Blood was analyzed for soluble D-dimer and p-selectin.

Results: D-dimer increased more PRE to FINISH (142±83 to 387±196 ng/mL) in travel than in control subjects (85±26 to 233±95 ng/mL; p=0.02 for comparison). Moreover, 6 travel vs. 0 control subjects had d-dimer values >500 ng/mL, the clinical threshold for excluding venous thrombosis (p = 0.03 for Fisher’s exact test). P-selectin increased with exercise (p < 0.01) regardless of travel (p = 0.09), but age was related to p-selectin (p = 0.01) such that older subjects exhibited higher p-selectin values PRE (r = 0.14; p = 0.02), and FINISH (r = 0.16, p=0.01).

Conclusions: These results demonstrate that the combination of exercise and travel increases venous and arterial thrombotic risk. Moreover, resting and post-exercise p-selectin levels are higher with age. These results may explain reports of venous thrombosis with air travel after athletic events as well as reports of cardiac events in older individuals running marathons.

Research supported by ACSM Foundation Research Endowment Grant (Parker).

One Week of Swimming Training Influences Resting Heart Rate Variability in Young Swimmers

José Morgado, Francisco Alves, Cristina Paula Monteiro, Maria José Laires. Faculty of Human Kinetics, Lisboa, Portugal.

(Purpose: To investigate the effect of 1-wk of swim training on young swimmers HRV parameters at rest.

Methods: 12 swimmers (7 female: 13±3 yrs, 47±6.1 kg; 5 male: 14±6 yrs, 48±6.4 kg) swam an incremental maximal step test (2x200 m front crawl) and undertook HRV recordings at the 1st (M1) and 6th (M3) days of a training week and at the 3rd day (M2) for HRV also. A 5-min R-R interval (RR) data was collected, in supine position under controlled breathing, using Polar RS800CX and processed by HRV Analysis software. Time and frequency domain analysis gave: heart rate, std. deviation (sd.) of normal RR intervals (SDRR), square root of the mean of the sum of the squares of differences between adjacent NN interval (RMSSD), number of interval differences of successive NN intervals greater than 50 ms (NN50), percent of NN50 (pNN50), sd. dev. of the instantaneous beat-to-beat variability of data (SD1), and std. dev. of the continuous long-term variability (SD2). Very low (VLF, 0.003 - 0.04 Hz), low (LF, 0.04 - 0.15 Hz), and high (HF, 0.15 - 0.4 Hz) frequency bands, were analyzed in absolute (ms²), percentage (%) and normalized units (nu) power. LF/HF ratio was calculated. T test and Wilcoxon tests were used (p<0.05).

Results: In females, RR rose from M1 to M3 (8.8±1.9 Hz) and from M2 (8.8±1.9) to M3. pNN50 augmented from M1 to M2 (22±16 ± 38±17). HF% increased from M1 to M2 (33±13 / 25±12) and LF/HF ratio (1.7±1 / 7.8±3) declined from M1 to M3. The lower time performed on the 2nd 200 m rep from M1 to M3 (171±18 / 167±16 s) came with elevated swimming speed (1.18±.1 / 1.2±.1 m.s⁻¹), and percent of 200 m race swimming speed (94±2 / 96±3 %). In males, pNN50 declined from M1 to M3 (25±12 / 1615±167 s) and HFnu from M1 to M3 (42±15 / 59±11). LFnu (59±15 / 41±11) and LF/HF ratio (1.7±1 / .7±.3) declined from M1 to M3. The lower time performed on the 2nd 200 m rep from M1 (161±16) to M3 (154±16) was associated with increased swimming speed (1.2±.1 / 1.2±.1 m.s⁻¹) and percent of 200 m race swimming speed (93±2 / 96±3 %).

Conclusions: Training seems to be the main determinant of increases on HRV time domain indexes. Frequency domain variations, suggesting an increased parasympathetic and suppressed sympathetic modulations, occurred only in females. The predominance of vagal influence may be associated with the higher performance observed after 1-wk of swim training. Further studies are needed to determine how can these disturbances be useful in training methodology.

The Link Between Physical Activity, Heart Rate Variability and Bone Mineral Content in Women


Studies have demonstrated that cardiovascular disease (CVD) and mortality are associated with reduced bone mineral content (BMC) and bone fractures. Heart rate variability (HRV) has been considered a strong predictor of increased cardiac mortality. However, little is known about the link between HRV and BMC in woman.

Methods: HRV parameters were investigated in the supine and standing positions in 48 healthy females (20±6 years ± 1.25). Several anthropometric measurements were taken, including; height (158.98 cm ± 8.52), body mass (59.6 ± 8.5 kg), and BMI (23.68 kg/m² ± 3.1). HRV was analysed using the time domain, frequency domain and Poincaré plot analysis. Dual-energy x-ray absorptiometry (DEXA) was used to obtain the participants body bone mineral content (BMC). Statistical analysis included the determination of the Pearson correlation coefficient for the normal distributed data and Spearman correlation coefficient for non-normal distributed data sets. The strength of the correlations coefficients were defined as weak (0.1 to 0.2), moderate (0.3 to 0.4) and strong (0.5). A p-value of <0.05 was considered statistically significant.

Results: Associations were found between BMC and HRV. A statistically significant moderate positive correlation was found between standing heart rate (HR) and leg BMC (p=0.025) as well as standing HR and total BMC (p=0.033). Significant moderate negative correlations were found between: (a) Mean RR (standing) and BMC of the leg (p=0.019), trunk (p=0.028) and total BMC (p=0.018); (b) HFnu (standing) and leg BMC (p=0.021). A weak negative correlation was observed between HFnu (standing) and trunk BMC (p=0.045).

Conclusions: Several associations were found between BMC and the standing HRV measurements. Supine heart rate is regulated primarily by the parasympathetic branch of the ANS, while the response to standing is regulated by the withdrawal of the parasympathetic and increase of the sympathetic tone. These results suggest the role of increased BMC and responsiveness to an orthostatic challenge may be found in the more active and fit individuals. However, further studies are necessary to define the relationship between CVD risk factors, bone mineral content and osteoporosis, more specifically and to understand the complex interaction between these risk factors.

Sex Differences in Blood Pressure Variability and Baroreflex Sensitivity Following 8 Weeks of Endurance Training

Rebecca M. Kappus, Sushant M. Ranadive, Huimin Yan, Abbi D. Lane, Marc D. Cook, Ken Wilund, Jeffrey A. Woods, FACSM, Bo Fernhall, FACSM. The University of Connecticut, Storrs, CT. 2Children’s Hospital, Hartford, CT.

(Purpose: To determine if there are sex specific responses in BPV and BRS before and after a maximal exercise bout and the effect of an 8 week endurance exercise intervention on these responses.

Methods: Baseline and post training measurements were obtained in 58 previously sedentary subjects (30 females and 28 males). BPV measurements were assessed using finger plethysmography, during paced breathing in a supine position. The 8 week endurance training program consisted of 30-60 min of endurance exercise at 60-90% of HRmax 3 times per week. Pre-
and post-intervention values were compared between sexes using a repeated measures (2x2) ANOVA. If data were not normally distributed, they were log transformed before statistical analyses.

RESULTS: Acute exercise increased LF-BPV significantly both pre and post training (p=0.025 and 0.039, respectively) in women (5.31±0.71 to 8.23±1.34 pre training and from 4.83±0.75 to 7.73±3.91 post training) but not in men. Men had significantly higher baseline values of LF-BPV compared to women (p=0.013 and 0.020, pre and post training, respectively) but LF-BPV did not significantly change with an acute bout of exercise either pre (10.16±1.90 to 8.02±1.40) or post (8.96±1.64 to 9.11±1.36) training in men. Exercise training also did not significantly change resting or post exercise levels of LF-BPV.

However, exercise training increased (p=0.038) the reduction in BRS in response to the acute exercise bout in men (+9.40±3.30 to -12.60±1.69) but not in women.

CONCLUSION: Acute maximal exercise increases sympathetic modulation in females to values closer to those of males, but this effect is not changed with training. With training, men, but not women, increased vagal withdrawal in response to acute exercise. The impact of these sex differences in autonomic control on cardiovascular risk needs further investigation.

1619 Board #27 MAY 30 3:30 PM - 5:00 PM
Effects Of Sprint Interval And Traditional Endurance Training On Heart Rate Recovery In Obese Children
Ana Carolina C. Araujo, Ana Lúcia S. Pinto, Hamilton Roschel, Danilo L. Prado, Maria Beatriz Perondi, Sandra M. Villares, Bruno Gualano. University of São Paulo, São Paulo, Brazil.
(No relationships reported)

Heart-rate recovery after maximal graded exercise test (HRR) has been identified as a strong predictor of cardiovascular mortality in adults. Previous studies have found a positive association between adiposity and reduced HRR, which suggests cardiovascular autonomic dysfunction. However, the differential effects of sprint interval training (ST) and endurance training (ET) on HRR have been overlooked in obese children.

PURPOSE: The main aim of this study was to compare the effects of ST and ET on HRR in obese children.

METHODS: Thirty obese children aged 10 ± 0.8 years were randomly assigned into either ST or ET group. The training program was comprised of two exercise sessions per week for 12 weeks. The ST group performed 3-6 sets of 1-minute running exercise at the VO2 peak velocity (vVO2) interspersed by 3-minute rest intervals. The ET group performed 30 to 60-minute running sessions at 80% of the VO2 peak. At baseline and after the intervention, a maximal graded exercise test was performed to determine VO2 peak. Furthermore, HRR at the first minute (ΔHRR1) and second minute (ΔHRR2) were assessed following the exercise test.

RESULTS: Both groups equally and significantly improved HRR (Table 1). Additionally, VO2 peak and time-to-exhaustion were improved in both ST (delta changes: 4.8 ± 1.7%, 1.8 ± 0.5%, respectively; p<0.05) and ET groups (delta changes: 4.6 ± 0.9%, 1.8 ± 0.2%, respectively; p<0.05).

CONCLUSIONS: ET and ST equally improved HRR after exercise in obese children, suggesting that the both types of exercise training are able to improve autonomic function in obese children. Furthermore, classical cardiovascular adaption to training were improved at a similar extent following ST and ET training programs.

Table 1. Effect of a 12-week sprint (ST) vs endurance training (ET) program on HRR in obese children

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<tr>
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<th>ST</th>
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<td>16.8±9.5</td>
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1620 Board #28 MAY 30 3:30 PM - 5:00 PM
Acute Exercise Training Enhances Resting Microvascular Nutritive Exchange; Nitric Oxide and α-Adrenergic Mediated Mechanisms
Justin D. La Favor, Raymond M. Kraus, Timothy P. Gavin, FACSM, Robert C. Hickner, FACSM. East Carolina University, Greenville, NC.
(No relationships reported)

Acute exercise training has been shown to improve vascular function and nitric oxide (NO) bioavailability.

PURPOSE: To determine if muscular nutritive exchange is enhanced by seven days of exercise training, and if changes are mediated by a NO mechanism.

METHODS: 16 men and 16 women performed seven consecutive days of exercise on a cycle ergometer for one hour at 70% VO2peak. One day prior to and one day following training, a muscle biopsy was taken and six microdialysis probes were inserted into the vastus lateralis and perfused with a control solution (0.9% saline containing 5 mM ethanol) at 2 µl/min and the outflowing dialysate was collected under resting, non-stimulated conditions. Perfusion media was changed on five probes to contain the control solution and one of the following: 1) 10 mg/ml L-NMMA (NOS inhibitor), 2) 30 mg/ml sodium nitroprusside (SNP), 3) 30 mg/ml acetylcholine (ACH), 4) 1 µM phenolamine (Phen), an α-adrenergic blocker, 5) 1 µM norepinephrine (NE), an α-adrenoceptor agonist. Nutritive exchange was assessed via the ethanol outflow/inflow ratio and converted to units of blood flow. NOS activity was determined from muscle homogenate using a classic assay kit.

RESULTS: Nutritive blood flow increased in response to training [10.1 ± 7.2 ml/(100g * min) pre vs. 13.9 ± 12.8 ml/(100g * min) post, p = 0.03]. Treatment nutritive blood flows (ml/100g * min) pre- and post-training, respectively, were: ACH (15.9 ± 26.6 pre, p = 0.07 vs control(22.0 ± 25.3 post, p = 0.03 vs control), SNP (30.2 ± 19.0, p < 0.01/45.9 ± 39.9, p < 0.01), NE (7.9 ± 8.1, p = 0.07/9.4 ± 12.0, p = 0.11), Phen (16.7 ± 13.3, p = 0.02/14.9 ± 13.5, p = 0.68), L-NMMA (11.5 ± 10.3, p = 0.99/11.4 ± 10.7, p = 0.22). Statistics compared treatments to respective controls. NOS activity (3786 ± 1040 to 4478 ± 2091 dpm/µg protein, p = 0.100) did not increase with training.

CONCLUSIONS: Exercise training increased resting nutritive exchange. Training did not increase total NOS activity or the response to ACH, SNP, or L-NMMA. Thus, it is unlikely that the increased nutritive exchange is due to increased NO production or action. However, α-receptor blockade blunted vasocomstriction pre-training but not post-training indicating a decrease in α-adrenergic vasocconstrictor activity. Therefore, enhanced nutritive exchange may be due to a reduced sympathetic tone.

1621 Board #29 MAY 30 3:30 PM - 5:00 PM
The Red Blood Cell NOS System after Blood Donation and Re-infusion in Moderately Trained Subjects
Lena Willkom1, Eric Polzer2, Thierry Konou1, Galina Balakirski1, Wilhelm Bloch1, Julia Franke1, Eike Marek2, Dennis Marek2, Timo Hinrichs2, Klara Brixius1, Petra Platen2. 1German Sport University, Cologne, Germany. 2Ruhr University, Bochum, Germany.
(No relationships reported)

Transfusing Red Blood Cells (RBC) is the oldest form of blood doping and recent media reports suggest it is still widely used among different groups of athletes. Our research group has demonstrated that the procedure of blood-sampling, storage, and re-infusion in patients with hip-surgery induce an increase in nitric oxide synthase (NOS) activity in the RBC concentrate as well as in the patients’ blood after re-infusion. These findings implicate that the RBC NOS system could potentially be used for the detection of autologous blood doping.

PURPOSE: The aim of the study was to demonstrate that blood donation and re-infusion causes a shift in NOS activity that can be used as an indicator of autologous blood doping.

METHODS: 12 moderately trained subjects received a medical examination including iron status and basal blood parameters. Subjects then donated 500 ml of blood according to standard blood donation procedure. After 2 weeks, the blood concentrate was re-infused. Blood samples were drawn off the subjects before, during and after the donation and re-infusion process. The withdrawn blood was analysed for routine blood parameters and NOS activation at pSer116 and pSer117. Furthermore, erythropoietin (Epo) levels were measured.

RESULTS: Routine blood parameters showed the expected changes over the time course of the study. pSer116 and pSer117 increased slightly after blood donation from basal values of 10.8 ± 4.0 to 12.0 ± 4.0 and from 15.6 ± 2.4 to 17.0 ± 2.2, respectively, but values did not change significantly with the blood re-infusion. Furthermore, Epo levels rose from 5.1 ± 2.7 mIU/mL to 14.4 ± 3.9 mIU/mL after the blood donation and fell back to initial values (6.6 ± 2.6 mIU/mL) after the blood-re-infusion.
CONCLUSIONS: Blood withdrawal but not blood re-infusion activates the RBC NOS system. Possibly, this induction was caused by the increase in Epo, but other mechanisms seem also to be responsible for this observation. However, RBC NOS is no valuable parameter for the detection of blood doping.

**1622 Board #30**
**MAY 30 3:30 PM - 5:00 PM**
**Forearm Ischemia-reperfusion Injury Reduces FMD but Augments L-FMC Irrespective of Menstrual Cycle Phase**
Mark Rakobowchuk, Emily R. Parsloe, Sarah E. Gibbins, Emma Harris, Karen M. Birch. 1University of Leeds, Leeds, United Kingdom. 2University of Cambridge, Cambridge, United Kingdom. (Sponsor: Keith F George, FACSM)

No relationships reported.

Twenty minutes of forearm ischemia followed by reperfusion is used as a model to induce endothelial injury. Exercise training does not protect from this effect however the impact of oestrogen availability has not been assessed, nor has the complete vascular response to this stimulus been quantified.

**PURPOSE:** To determine the impact of menstrual cycle phase on recovery from induced endothelial injury.

**METHODS:** 9 women (33 ± 10y) attended the lab during the follicular, ovulation, and mid-luteal phases of the menstrual cycle. After 30 minutes of supine rest, brachial arterial vascular function was assessed using ultrasound and 5 minutes forearm ischemia. Subsequently, a 20-minute forearm ischemia-reperfusion period was completed. Following this period vascular function assessments were made 15, 30 and 45 minutes into recovery. FMD and low-flow mediated constriction (L-FMC) were determined at all time points.

**RESULTS:** FMD was reduced following ischemia-reperfusion but recovered at 30 and 45 minutes (PRE: 7.1 ± 1.0%, POST15: 4.5 ± 0.6%, POST30: 5.5 ± 0.7%, POST45: 5.9 ± 0.4%, p < 0.01), L-FMC exhibited an inverse pattern when compared to FMD with more constriction apparent after vascular injury (PRE: -1.3 ± 0.4 %, POST15: -3.3 ± 0.6%, POST30: -2.5 ± 0.5%, POST45: -1.5 ± 0.12%, p < 0.01). Endothelial sensitivity (sum of absolute values of FMD and L-FMC) was unaltered (PRE: 8.8 ± 0.9% POST15: 7.8 ± 0.5%, POST30: 8.1 ± 0.7% POST45: 7.4 ± 0.5%, p = 0.11). Data were unaffected by menstrual phase.

**CONCLUSIONS:** The forearm ischemia-reperfusion model elicits an alteration of vascular function that may be related as much to enhanced vasocostriction as it is to impaired vasodilation. This suggests that throughout recovery from vascular injury the haemodynamic and/or circulating vasoactive milieu alter vasodilatory and vasoconstrictive responses. Fluctuations in oestriol however, have no effect upon these responses.

Supported by the British Heart Foundation (PG/08/080/25340) and the Wellcome Trust.

**1623 Board #31**
**MAY 30 3:30 PM - 5:00 PM**
**The Interval Between Pre-conditioning and Regional Ischemia is Critical to Cardioprotection in Perfused Rat Hearts**
Cathryn E. Krier, Patricia Colloton, Cassandra R. Nelson, Robert H. Fitts, FACSM. Marquette University, Milwaukee, WI.

(No relationships reported)

Ischemic heart disease leading to cardiac cell death (infarct) is one of the leading contributors to heart failure. Pre-conditioning (PC) the heart with a brief period of global ischemia prior to regional ischemia (RI) has been shown to be cardioprotective.

**PURPOSE:** To determine the optimal time interval between PC and RI that produces maximal cardioprotection and assess gender differences.

**METHODS:** Female (31) and male (35) rats were anesthetized with Nembutal (50mg/kg body wt.) and hearts excised, weighed, and cannulated on a Langendorff apparatus. A balloon inserted into the left ventricle measured ventricular pressures and heart rate (HR). Following 30 min of baseline recordings, hearts were subjected to one of three conditions: 1) 30 min of RI by occluding the left anterior descending coronary artery, regional only (RO); 2) 5 min of global ischemia followed by 5 min of reperfusion, then 30 min of RI (PC5); 3) 5 min of global ischemia followed by 10 min of reperfusion, then 30 min of RI (PC10). Post RI hearts were reperfused for 3 hrs before RI was reestablished and the heart perfused with Trypan Blue dye. The left ventricle was cut into 1 mm pieces and the non-stained occluded area stained with triphenyl tetrazolium chloride. Infarct size was determined from the ratio of dye absorbing living cells to the pale dead cells using color detection software.

**RESULTS:** Pre-RI the systolic - diastolic (i.e. delta pressures) for males and females were 144 ± 4 mmHg and 144 ± 3 mmHg, respectively. PC10 significantly (p<0.01) decreased infarct size in males (PC10: 29 ± 2% vs. RO: 46 ± 4%) and females (PC10:35 ± 6% vs. RO: 55% ± 4), however % recovery of delta pressure after 3 hrs of reperfusion was not significantly different between groups in males (RO: 59 ±5%, PC5: 48 ± 3%, PC10: 49 ± 2%, p= 0.113) or females between PC10 and RO (40 ± 3% vs. 45 ± 4%, p=0.376). In contrast, PC5 significantly decreased the functionality of the heart in females (26 ± 2% vs. RO: 45 ± 4%).

**CONCLUSIONS:** The results indicate that the time between PC and the onset of RI is critical to cardioprotection with 10 min reperfusion providing greater protection than 5 min in both genders. While limiting cell death, PC did not prevent loss of function, and it can decrease function in females if reperfusion time is too short.

**1624 Board #32**
**MAY 30 3:30 PM - 5:00 PM**
**Post Exercise Blood Pressure Response To Exercise With Blood Flow Restriction**
Alexander T. Sougiannis, Juliane F. Wallace, FACSM. Southern Illinois University Carbondale, Carbondale, IL.

(No relationships reported)

The restriction of muscle blood flow with short term low-intensity exercise has been shown to enhance muscle size and strength. Post exercise hypotension is consistently elicited following 30-60min bouts of moderate intensity (50-60% peak aerobic capacity) exercise. Following an acute bout of exercise, systemic resistance does not completely recover, resulting in post exercise hypotension.

**PURPOSE:** To determine if exercise with blood flow restriction in healthy individuals is as effective as traditional exercise in eliciting post exercise hypotension.

**METHODS:** Ten healthy (age =23±2y; VO2max=38±4ml/min/kg;18±1min; bodyfat =18±5%) college-aged individuals volunteered to participate in this within subject’s design. Participants were randomly assigned to one of two exercise trials: one with blood flow restriction and one without. The normal exercise (NE) trial consisted of level walking at 60% of heart rate max for a total of 60 minutes. Exercise with blood flow restriction (EBR) consisted of level walking at 53.6m/min (2.0mph) for 20 minutes (two bouts of 10 min). In order to create blood flow restriction, large blood pressure cuffs were placed around the most proximal portion of both legs. Prior to exercise, the pressure in each cuff was increased in stages of 120mmHg, 140mmHg, and 160mmHg while decreasing to 80mmHg and 100mmHg intervals between the first and second and second and third stages respectively. In both exercise trials, heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were assessed every 5 minutes. Post exercise HR, SBP, and DBP were assessed every 5 minutes for a total of 60 minutes.

**RESULTS:** SBP was significantly lower post NE at minutes 30 (111±4 vs. 115±5 mmHg), 35 (109±3 vs. 114±5 mmHg), 40 (110±2 vs. 115±4 mmHg), and 50 (111±4 vs. 113±4 mmHg) compared to EBR. DBP was significantly lower in the first 5 minutes post exercise (76±7 vs.83±4 mmHg) in the NE vs. the EBR trial. No differences in post exercise heart rate were noted.

**CONCLUSION:** Exercise with blood flow restriction utilizing a lower duration and intensity of exercise does not yield the same post exercise hypotension as traditional moderate intensity exercise.

**1625 Board #33**
**MAY 30 3:30 PM - 5:00 PM**
**Participation in a 10K Running Race Significantly Decreases Post Exercise Blood Pressure**
Mark A. Schafer, James W. Navalta, Scott W. Amet, Scott Lyons, Gina L. Sobredo, Steven Bean, Shannon Sims, Demetrie Kirkwood, Fredric L. Goss, FACSM. 1Western Kentucky University, Bowling Green, KY. 2University of Pittsburgh, Pittsburgh, PA.

(No relationships reported)

Previous investigations have indicated that following aerobic exercise of various durations and intensities, blood pressure may drop significantly for a period of time (i.e. 1 to 24 hours). These investigations have mainly employed laboratory-based protocols administered at a particular prescribed exercise intensity.

**PURPOSE:** The primary purpose of this investigation was to determine if exercise, trained, normotensive male and female runners (18 to 39 years old) would show evidence of post exercise hypotension (PEH) following a competitive 10K running race.

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METHODS: Nineteen male (n = 13) and female (n = 6) runners from the Medical Center 10K Classic road race participated in the study. Subjects reported to the Exercise Physiology lab the morning of the race to have their resting blood pressure taken and receive study instructions. Immediately following the 10K race, participants returned to the lab where they remained seated and their blood pressure was taken in 30-minute intervals for 1.5 hours (30 min, 60 min, & 90 min). All post exercise systolic (SBP, mm Hg) and diastolic (DBP, mmHg) blood pressures were then compared to the baseline prerace resting values using a repeated measures ANOVA.

RESULTS: The SBP was significantly lower (p < 0.05) at all time intervals (30, 60 & 90 min) following the 10K running race compared to the prerace measurements (Pre SBP = 116 ± 11.6 mmHg, Post 30 min SBP = 101.5 ± 10.4 mmHg, Post 60 min SBP = 98.5 ± 15 mmHg, and Post 90 min = 99.7 ± 15.1 mmHg). There was no significant difference in the prerace DBP and any of the post race time intervals (Pre DBP = 71.7 ± 11.0 mmHg, Post 30 min DBP = 66.3 ± 9.4 mmHg, Post 60 min DBP = 66.3 ± 9.0 mmHg, Post 90 min DBP = 69.7 ± 11.3 mmHg).

CONCLUSIONS: The findings of the present investigation indicated that healthy normotensive runners demonstrate PEH as indicated by the drop in SBP for up to 90 minutes following a 10K running race. The PEH noted presently may have health-fitness benefits in healthy, trained normotensive runners. Future studies should track the blood pressure responses following a 10K running race for a longer period of time (3 to 24 hrs) and attempt to determine the potential mechanism(s) that lead to PEH in normotensive competitive runners.

1626 Board #34 MAY 30 3:30 PM - 5:00 PM
Exercise Timing Affects the Direction (Positive/Negative) of Relationships Between Blood Pressure and Sleep Architecture
Dwight Joseph The1, Ben W. Cartner2, Kimberly Fairbairn2, Chelsea D. Curry2, Scott R. Collier, FACSM2, 1Montana Tech, Butte, MT; 2Appalachian State University, Boone, NC.
(No relationships reported)

Previously, our laboratory has shown that exercise at 7pm produced a greater dip in nocturnal blood pressure (BP) and more time in REM sleep than exercise at 1pm, yet exercise at 7pm was similar in benefits to morning exercise. The purpose of this study was to determine the differences between exercise at 7am vs. 7pm in an older prehypertensive cohort.

METHODS: Thirty-four 60-69 year old pre-hypertensive subjects (height = 67.84 ± 2.71 in; weight = 163.88 ± 27.46 lbs; VO2peak = 38.31 ± 7.89 ml/kg/min) performed 30 minute bouts of moderate intensity aerobic exercise (65% of VO2peak) on three separate, counterbalanced laboratory visits at 7am, 1pm, & 7pm. Ambulatory BP was monitored every 20 minutes for 24 hours after exercise. Sleep architecture was assessed using a Zeo3® ambulatory sleep EEG monitor.

RESULTS: Statistically significant (p ≤ 0.05; ρ ≤ 0.01) values for two different non-parametric, bivariate correlations are tabulated below. The correlations for exercise at 7pm are in the opposite direction (positive or negative) of those for exercise at 7am and 1pm.

CONCLUSIONS: These data confirm REM sleep is only correlated with BP variables (Mean SBP & Mean DBP) for the 7pm exercise bout. Exercising at 7pm seems to produce a beneficial relationship between blood pressure and sleep architecture that is not observed following exercise at 7am/1pm.

<table>
<thead>
<tr>
<th>Exercise @ 7am</th>
<th>Mean DBP &amp; Wake</th>
<th>Mean DBP &amp; Sleep</th>
<th>Mean DBP &amp; Sleep Time</th>
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<td>Spearman’s Rank (p)</td>
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<td>0.485*</td>
<td>0.687**</td>
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1627 Board #35 MAY 30 3:30 PM - 5:00 PM
The Effects Of Constant-Load Exercise At Percentages Of The Ventilation Thresholds On The Magnitude Of Heart Rate Drift
Raymond Martinez Jr, Rick T. Bradley, Max M. Polin, Roberto Quintana, Daryl L. Parker. Irvin Faria Exercise Physiology Research Laboratory CSU Sacramento, Sacramento, CA.
(No relationships reported)

Traditionally cardiovascular drift (CVdrift), the changes in cardiovascular responses over time, despite no change in exercise intensity, has been examined at intensities set relative to a percentage of VO2max. Previously little consideration has been given to the HR response relative to ventilation threshold (TH1) and respiratory compensation point (TH2).

PURPOSE: The purpose of this study was to investigate the effects of exercising at percentages of TH1 and TH2, on the magnitude of heart rate drift (HRdrift), a component of CVdrift.

METHODS: Four male cyclists age 29 ± 6yrs, weight 82.9 ± 28.3kg, height 176.1 ± 8.3cm, VO2max 56.3 ± 14.7ml/kg-1 min-1 volunteered for this study. Visit 1 consisted of a graded exercise test (GXT) to determine TH1 and TH2, and two power detection rides used to determine the workloads that would be used for the constant-load exercise (CLE) rides to fatigue. Visit 2 consisted of a randomized CLE ride to fatigue at a power output that elicited a VO2 that was either 5% below TH1 (-5%TH) or a VO2 that was midpoint of TH1 and TH2 (midTH) in a thermal neutral GXT to determine TH1 and TH2, and two power detection rides used to determine the workloads that would be used for the constant-load exercise (CLE) rides to fatigue. Visit 3 consisted of the remaining CLE ride to fatigue. Heart rate was recorded every minute; expired air, blood pressure, and RPE were recorded for the last 2 minutes of every 90 seconds until 15-point of RPE was reached. The heart sound was collected in a personal computer via an A/D converter throughout the exercise test. For determining the HSBP of each subject, AHS1 of each stage was plotted on a graph versus workload. The point of the abrupt increase in AHS1 was determined from visual inspection. Blood pressure was determined from three separate, counterbalanced laboratory visits at 7am, 1pm, and 7pm. Ambulatory BP was monitored every 20 minutes for 24 hours after exercise. Sleep architecture was assessed using a Zeo3® ambulatory sleep EEG monitor.

RESULTS: Subjects had a 21.7% ± 9.3 and 17.8% ± 4.6 increase in HR and VO2 respectively for the -5%TH ride (220 ± 47W) and a 15.2% ± 6.2 and 12.0% ± 2.3 increase in HR and VO2 respectively for the midTH ride (244 ± 51W). There was a statistically significant difference (p < 0.02) in the magnitude of HRdrift for both trials. The terminal HR drifting to TH2 for both trials in each subject suggests there was a statistically significant difference (p ≤ 0.01) values for two different non-parametric, bivariate correlations are tabulated below. The correlations for exercise at 7pm are in the opposite direction (positive or negative) of those for exercise at 7am and 1pm.

CONCLUSIONS: The findings of the present investigation indicated that healthy normotensive runners demonstrate PEH as indicated by the drop in SBP for up to 90 minutes following a 10K running race. The PEH noted presently may have health-fitness benefits in healthy, trained normotensive runners. Future studies should track the blood pressure responses following a 10K running race for a longer period of time (3 to 24 hrs) and attempt to determine the potential mechanism(s) that lead to PEH in normotensive competitive runners.

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1628 Board #36 MAY 30 3:30 PM - 5:00 PM
Relationships between Blood Pressures at Resting State and Anaerobic Threshold Point
Shigeru Ohara1, Takuro Matsuda2, Hiroaki Tanaka2, 1The University of Tokushima, Tokushima, Japan; 2Fukuoka University, Fukuoka, Japan.
(No relationships reported)

PURPOSE: It is a well-known fact that mild intensity exercise is safe and effective exercise for persons with lifestyle-related diseases. The mild intensity indicates the anaerobic threshold (AT) point in exercise. The AT point has been determined as a lactate threshold (LT), a double product breaking point (DPBP) or a ventilation threshold (VT). Recently, the heart sounds breaking point (HSBP), which was determined from change in amplitude of the first heart sound (AHS1) during graded exercise, is used as an AT point. The purpose of this study is to examine the relationship between systolic pressures (SBP) at test and at AT point determined by HSBP, and also between both diastolic pressures (DBP). These results may be useful for the exercise prescription.

METHODS: Thirty subjects aged 19 - 79 years with a BMI of 21.8 ± 2.3 kg/m2, underwent a graded cycle ergometer test. The work rate started at 20 watts and then increased by 10 watts every 90sec until 15-point of RPE was reached. The heart sound was collected in a personal computer via an A/D converter throughout the exercise test. For determining the HSBP of each subject, AHS1 of each stage was plotted on a graph versus workload. The point of the abrupt increase in AHS1 was determined from visual inspection. Blood pressure was determined from

383

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measured by carotid-femoral pulse wave velocity. These variables were measured at baseline, 3 and 5 hours after a high fat meal.

**METHODS:** Obtained the informed consent, we included 24 healthy professional soccer players (age 22±5; weight 70±7 Kg). Anthropometric data, blood pressure and heart rate have been evaluated early morning, when all players have not eaten since 10 hours. Cardiac Echo-Doppler (GE Vivid 7) and the anterior descending artery flow (LAD) values were performed. All measurements have been repeated three times (T0, T1 and T2). In 2-tailed tests, a value of P<0.05 was considered statistically significant and calculated with a standard statistical package (SPSS for Windows version 12.0).

**RESULTS:** Obviously we observed a little but significant reduction of the blood pressure and heart rate in T2. Echocardiographic measurements showed a statistically significant increase of the indexed left ventricular mass just in T1 (interventricular septum T0=0.93±0.11 cm; T1=1.09±0.09 cm; P<0.0001), without important differences in volumes (T0=5.40±3.30 cm; T1=5.25±3.30 cm; P=0.053). This increase was associate to a reduction of the ejection fraction (T0=53.6±5.26%; T1=49.7±4.05%; P=0.082) and an increase of the shortening fraction (T0=34.8±4.04%; T1=35.2±5.44%; P=0.005), without significant changes of the stroke volume. These findings may be due to a reduction of the longitudinal shortening velocity of the myocardial fibers (S' T0=0.12±0.02 cm/sec; T1=0.10±0.01 cm/sec). In T2 we noted an increase of the shortening velocity of the myocardial fibers (0.13±0.02 cm/sec; P=0.002) for an adequate functional adaptation. Moreover in the anaerobic training phase we observed a reduction of the LAD flow (T0=0.19±0.05 m/sec; T1=0.17±0.03 m/sec) with a successive significant increase in T2 (P<0.0001).

**CONCLUSION:** This first longitudinal study, regarding professional soccer players, demonstrates that the cardiac adaptation improves significantly only during the aerobic/anaerobic training phase. Our results may be contribute to modify the workout of the professional athletes.

**1629**  **Board #37**  **MAY 30**  **3:30 PM - 5:00 PM**  **Cardiovascular Changes During Championship In Professional Soccer Players**  
Antonio Amnendolia, Sofia Miscel, Marzia Lamundo, Ilaria Carè, Andrea Ferragina, Raffaile Maio. University of Catanzano, Catanzano, Italy.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to evaluate the cardiovascular changes in a professional soccer team along one agonistic season, from the pre-championship training phase (T0), during the championship (T1) and in the detraining phase (T2).

**METHODS:** The study aims to describe the morphological and functional modification in a group of professional adolescent soccer players matched with a group of non-professional one in order to evaluate any possible differences and also realtionship with the atropometric parameters.

**RESULTS:** 40 professional male soccer players (PSP) and 47 non professional NPSP), were evaluated since the age of 12 up to 17 years. Once a year every athlete underwent to a 2D Echocardiographic exam, the evaluation of the main morphological and functional left ventricle parameters including the wall thickness and systo-diastolic chamber sizes.

**CONCLUSION:** Our results may be contribute to modify the workout of the professional athletes.

**1630**  **Board #38**  **MAY 30**  **3:30 PM - 5:00 PM**  **Morphologic And Functional Cardiac Modifications In Adolescent Soccer Players**  
Giorlamo Matteo Milici1, Laura Stefani2, Valentina Di Tante2, Giorgio Galanti2. 1Sport Medicine, Florence, Italy. 2Sports Medicine, Florence, Italy.  
(No relationships reported)

**PURPOSE:** Almost all the study on athlete’s heart have been carried out on adult players, while few data are now available on the cardiac adaptations to regular sport activity in adolescents. The study aims to describe the morphological and functional modification in a group of professional adolescent soccer players matched with a group of non-professional one in order to evaluate any possible differences and also realtionship with the atropometric parameters.

**METHODS:** 40 professional male soccer players (PSP) and 47 non professional (NPSP), were evaluated since the age of 12 up to 17 years. Once a year every athlete underwent to a 2D Echocardiographic exam, the evaluation of the main morphological and functional left ventricle parameters including the wall thickness and systo-diastolic chamber sizes.

**RESULTS:** At T0, 4 subjects (10%) showed a significant shortening velocity of (S' T0=0.10±0.01 cm/sec) with a successive significant increase in T1 (P=0.005) and a significant decrease of the stroke volume (T0=40.1±3.40 m; T1=35.8±3.17 m; P=0.002) and of the ejection fraction (T0=53.4±3.6%; T1=49.6±3.07%; P=0.005) with significant changes of the stroke volume. These findings may be due to a reduction of the longitudinal shortening velocity of the myocardial fibers (S' T0=0.12±0.02 cm/sec; T1=0.10±0.01 cm/sec).

**CONCLUSION:** The data are indicative for an early cardiac remodeling especially in highly trained athletes. However there are no evident correlations between LVM and BSA values. Intensive training does not seem to have any influence on BSA growth while a positive factor on LVM has been verified.

**1631**  **Board #39**  **MAY 30**  **3:30 PM - 5:00 PM**  **Effect Of Acute Active Video Game On Pulse Wave Velocity In Young Health Adults**  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the acute effect of active video game on pulse wave velocity in young healthy subjects.

**METHODS:** Twenty-three young healthy subjects (age 21±3 years and body mass index 22.6±1.9 kg/m2) were randomly assigned to acute bout of active video game (n=11, 50-minute, Nintendo Wii sports(boxing, tennis) and a walking exercise (n=12, 30-minute, 60-70% of heart rate reserve) as a control exercise. Carotid-femoral pulse wave velocity as an index of aortic stifness was measured using applanation tonometry(SphygmosCor, AtCor Medical, Australia). All variables were measured at baseline and 40 minutes after each exercise.

**RESULTS:** In T0, we noted an increase of the shortening velocity of the myocardial fibers (0.13±0.02 cm/sec; P=0.002) for an adequate functional adaptation. Moreover in the anaerobic training phase we observed a reduction of the LAD flow (T0=0.19±0.05 m/sec; T1=0.17±0.03 m/sec) with a successive significant increase in T2 (P<0.0001).

**CONCLUSIONS:** These findings suggest that an active video game dose not decrease pulse wave velocity in young healthy adults. Further studies are needed to clarify the effects of long term active video game on arterial stifness.

**1632**  **Board #40**  **MAY 30**  **3:30 PM - 5:00 PM**  **Active Video Game Does Not Attenuate A High Fat Meal Induced Vascular Dysfunction In Young Healthy Adults**  
(No relationships reported)

**PURPOSE:** A high fat meal transiently decreases vascular function, while acute aerobic exercise improves vascular function. Active video games are now highly popular and play a role in promoting physical activity. Although studies suggest that acute aerobic exercise attenuates high fat meal induced vascular dysfunction, but it is not clear whether an active video game could attenuate vascular dysfunction after a high fat meal. We tested the hypothesis that an active video game would partially prevent the unfavorable effect of vascular function by high fat meal in young adults.

**METHODS:** Using a randomized cross over design, sixteen healthy young subjects (male 9, female 7; age 24±4 yrs, BMI 22.4±2.1kg/m2) were assigned to both an active video game (60 minutes, Nintendo Wii sports(boxing, tennis) and a seated rest after a high fat meal. Endothelial function was measured by brachial artery flow mediated dilatation and arterial stiffness was measured by carotid-femoral pulse wave velocity. These variables were measured at baseline, 3 and 5 hours after a high fat meal.
RESULTS: Blood triglyceride levels were similarly increased in two treatment conditions after a high fat meal and did not significantly different between two groups (active video game: 0.34±0.1, 6.05±0.94, 6.3±1.07 mmol/l; control group: 6.3±0.85, 6.19±0.89, 6.28±1.01 mmol/l, p<0.483).

CONCLUSIONS: These findings show that a high fat meal caused a temporary decrease in endothelial function, but these decreases were not significantly attenuated in the group with active video game compared to the group with seated rest. Therefore, active video game may not have a cardioprotective effect in young healthy adults exposed to acute high fat meal.

Board #41
MAY 30
3:00 PM - 5:00 PM
Cardiovascular Fitness is Associated with Venous Compliance in Healthy Subjects
Ingeborg M. Leinari1, Øystein Grønnevik2, Asbjørn Støylen1, Trine Karlsen1, 1Norwegian University of Science and Technology, Trondheim, Norway. 2Norwegian University of Science and Technology and St. Olavs University Hospital, Trondheim, Norway.

Reduced venous outflow (VOF) is negatively associated with 6 minutes walk test performance in heart failure patients when compared to healthy age matched subjects, indicating that exercise intolerance may be linked to an insufficiency in venous circulation.

PURPOSE: Compare the relationship between venous compliance (VC) and cardiovascular fitness measured as maximal oxygen uptake (VO2max) in healthy subjects.

METHODS: Twenty-eight healthy subjects 20-70 years of age (46.4±16.2 years, 72.8±13.7 kg, 174±8.4 cm, men n=16, women n=12) who participated in a cross sectional study. VO2max was measured using an instrument ramp treadmill protocol. Resting venous and arterial flow and diameters were measured with ultrasound during a 10-minute occlusion protocol aiming to alter arterial and venous in- and outflow in the brachial vein and artery. Occlusion of VOF was achieved by occluding the upper arm to 7mmHg below diastolic blood pressure, and alternation in arterial inflow by occluding the wrist at 240mmHg. Vascular measures were normalized for dimensional scaling due to differences in subjects body composition. Measured diameters were scaled with fat free mass (FFM)2/3, and measured VOF with FFM-1/3. Compliance of VOF was defined as the difference between resting and maximal occlusion compliance. Total blood, plasma volume and red cell mass were measured after the vascular examination with the improved CO-rebreathing method.

RESULTS: Mean VO2max was 3.38 ± 0.8 L·min-1, delta VC 16.57 ± 7.6 mm2·mmHg-1·kg · FFM-1/3 and blood volume 5.05 ± 1.3 L. VO2max (L·min-1) was positively correlated with delta VC (mm2·mmHg-1·kg · FFM-1/3) (r = 0.542 and p = 0.004) and VOF (cm·s·FMM-1/3) (r=0.554 and p=0.006). Additionally a significant correlation was found between delta VC (mm2·mmHg-1·kg · FFM-1/3) and total plasma (r = 0.598 and p = 0.002) and total blood volume (r = 0.638 and p = 0.001).

CONCLUSION: VO2max is positively correlated with delta VC in the investigated population of healthy subjects. Additionally there is a positive correlation between VO2max and VOF and total plasma volume. As VO2max and arterial flow mediated dilatation previously have been positively correlated, the present result may indicate that exercise intolerance may also be linked to venous circulation.

Board #42
MAY 30
3:00 PM - 5:00 PM
Effects Of The Combined Treatment Of Aerobic Exercise Training And Curcumin Intake On Arterial Function
Nobuhiko Akazawa1, Youngju Choi2, Asako Miyaki3, Jun Sagawa2, Ryuichi Ajsaka4, Seiji Maeda1. 1University of Tsukuba, Tsukuba, Japan. 2National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan.

The purpose of this study was to test the effects of curcumin ingestion alone and in combination with aerobic exercise training on arterial function in postmenopausal women.

METHODS: A total of 38 postmenopausal women were assigned randomly to four group: placebo (PLA), curcumin (CUR), exercise + placebo (EX+PLA), and exercise + curcumin (EX+CUR). Curcumin or placebo was ingested orally for 8 weeks. The exercise groups underwent 8 weeks moderate aerobic exercise training. PLA and CUR groups did not change their physical activity level. Before and after each intervention, carotid arterial compliance and flow-mediated dilation (FMD) were measured.

RESULTS: There were no differences in baseline carotid arterial compliance, FMD, and most other key dependent variables among the groups. Aerobic capacity in the EX+PLA and EX+CUR groups increased significantly after each intervention. Carotid arterial compliance increased significantly in CUR (0.087 ± 0.005 vs. 0.097 ± 0.006 mm/minHg, P < 0.05), EX+PLA (0.081 ± 0.004 vs. 0.092 ± 0.006 mm/minHg, P < 0.05), and EX+CUR (0.089 ± 0.005 vs. 0.103 ± 0.006 mm/minHg, P < 0.05) after each intervention. The change in carotid arterial compliance, EX+CUR was the greatest among the groups. VOF also increased significantly in CUR (2.7 ± 0.5 vs. 4.4 ± 0.7 %, P < 0.05), EX+PLA (2.7 ± 0.6 vs. 4.6 ± 0.7 %, P < 0.05), and EX+CUR (3.3 ± 0.6 vs. 4.5 ± 0.8 %, P < 0.05) after each intervention. There was no significant difference in the magnitude of increases in FMD among the groups.

CONCLUSIONS: The present study demonstrated that curcumin ingestion improved arterial function and that the combined aerobic exercise training and curcumin ingestion was more efficacious in increasing central arterial compliance than either treatment alone in postmenopausal women.

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Board #43
MAY 30
3:30 PM - 5:00 PM
Sex Differences in Cardiovascular Function at Rest and During Submaximal Exercise in Healthy Humans
Courtney M. Wheatley1, Eric M. Snyder1, Bruce D. Johnson1, Thomas P. Olson1. 1University of Arizona, Tucson, AZ. 2Mayo Clinic and Foundation, Rochester, MN.

BACKGROUND: Differences in cardiovascular response between sexes has been documented at rest and maximal exercise; however, these differences during submaximal steady-state exercise are less clear. This study investigated the cardiovascular response to submaximal steady-state exercise between sexes.

METHODS: We recruited 31 male and 33 female (age=30±1 vs. 28±1 yrs, ht=1.81±1.3 vs. 1.71±1.3m, wt=82±1.8 vs. 64±1.8kg, BSA=2.0±0.4 vs. 1.7±0.4m2, respectively, p<0.01 for ht, wt, and BSA). Study visit 1 included a maximal exercise test. Study visit 2 included 9 minutes of low and 9 minutes of moderate intensity submaximal exercise (40 and 75% of peak watts). Measurements included: intra-arterial blood pressure (SBP and DBP), cardiac index (Qc), heart rate (HR), oxygen consumption (VO2) and arterial catecholamines (epinephrine=EPI and norepinephrine=NE), and blood gases. Mean arterial pressure (MAP), stroke volume index (SVI), and systemic vascular resistance index (SVRI), arterial oxygen content (CaO2) and systemic oxygen transport (SOT) were calculated. We indexed Q, SV, and SVR for BSA.

RESULTS: At rest, Qc, SVc, SBP, MAP, NE, CaO2, and SOT were lower in females compared to males (p<0.05 for all). In females at low intensity, these differences were retained, especially EPI and DBP were lower (p<0.05 for all) despite a higher HR (p<0.05). At moderate intensity, VO2, Qc, SVc, SBP, MAP, EPI, NE, CaO2, and SOT were lower and SVR was higher in females (p<0.05 for all). The slope of the relationship between HR and Qc was greater in females compared to males from rest to moderate exercise (14.7±1 vs 21.4±1, p<0.001).

CONCLUSION: This study demonstrates differences in the cardiovascular response to submaximal steady-state exercise between sexes. Men had higher Q and SV at both low and moderate intensities. Females demonstrated a higher HR at low intensity with an increased slope of HR throughout exercise. These data demonstrate differential regulation of cardiac output, with a greater reliance on HR in females, during steady-state submaximal exercise.
vWF:Ag was significantly correlated with the WBV-induced change in TBI (r=-0.635, p=0.036) with improved peripheral blood flow. Recent vibration treatment to reduce the potential acute effect of vibration therapy sessions per week for four weeks. Each session included four three-minute treatments at a frequency of 25 Hz. Blood samples were analyzed in duplicate for vWF:Ag via ELISA test. Toe-brachial index, the rate of systolic pressure at the brachial artery compared to the great toe, was used to assess peripheral blood flow. Final testing was performed at least 24 hours after the most recent vibration treatment to reduce the potential acute effect of vibration therapy.

RESULTS: Subjects mean age at baseline was 24.7 ± 4 yr, average BSA was 1.73 ± 0.07 and mean VO2 peak was 34.8 ± 9.8 ml/kg/min. Compared to men, women had higher EaI (women: 0.80 ± 0.09 before and 0.87 ± 0.09 mmHg/ml/m2 after training; p<0.05) and higher Ea/ElvI before and after training, p<0.05. Women decreased Ea/ElvI from 0.41 ± 0.37 mmHg/ml/m2, p<0.05. EaI was not altered by training in either group, but training increased ElvI (from 1.25 ± 1.43 mmHg/ml/m2) in women only (p<0.05).

CONCLUSION: Women and men exhibit different VVC responses to endurance exercise training. EaI was not altered by training in either sex, while women augmented ElvI following training. As a result, women decreased Ea/ElvI suggesting training induced improvement in ventricular performance and energetics in women but not in men. Study Funding: NHLBI 1R01HL093249-01A1 (Fernhall)

Sex Affects the Ventricular-Vascular Coupling Ratio Following 8 Weeks of Endurance Training
Abbi D. Lane1, Huimin Yan1, Sushant M. Ranadive1, Rebecca M. Kappus2, Peng Sun3, Kenneth Wilund1, Jeffrey Woods, FACSM1, Bo Fernhall, FACSM2. 1University of Illinois, Urbana, IL, 2University of Illinois-Chicago, Chicago, IL.

BACKGROUND: The ventricular-vascular coupling ratio (VVC) is determined by the ratio of arterial elastance (Ea) to ventricular elastance (Elv). Previous work has shown that endurance exercise training can attenuate Ea, and, thus, reduce the coupling ratio. The role of sex in the VVC response to endurance training has not yet been elucidated.

PURPOSE: To determine the role of sex in changes in VVC after an 8-week endurance exercise intervention.

METHODS: Baseline and post training measurements were obtained in 53 previously sedentary subjects (25 women and 28 men), including: brachial blood pressures and end-systolic pressure (BP and ESP) using a standard cuff and applanation tonometry, and ultrasound images of the heart. Simpson’s rule was used to calculate heart volumes. Elastances were determined from the formula Ea=ESP/SV and Elv=ESP/ESV. These values were then indexed to body surface area (EaI and ElvI). A VO2 peak test was also performed. Subjects completed an 8-wk endurance training program which consisted of 30-60 min of endurance exercise at 60-90% of max HR 3 times per week. Pre- and post-intervention values were compared between sexes using a repeated measures (2x2) ANOVA.

RESULTS: Subjects mean age at baseline was 24.7±4 yr, average BSA was 1.73±0.07 and mean VO2 peak was 34.8±9.8 ml/kg/min. Compared to men, women had higher EaI (women:0.80±0.09 before and 0.87±0.09 mmHg/ml/m2 after training; p<0.05) and higher Ea/ElvI before and after training, p<0.05. Women decreased Ea/ElvI (from 0.41±0.37 mmHg/ml/m2, p<0.05). EaI was not altered by training in either group, but training increased ElvI (from 1.25±1.43 mmHg/ml/m2) in women only (p<0.05).

CONCLUSION: Women and men exhibit different VVC responses to endurance exercise training. EaI was not altered by training in either sex, while women augmented ElvI following training. As a result, women decreased Ea/ElvI suggesting training induced improvement in ventricular performance and energetics in women but not in men. Study Funding: NHLBI 1R01HL093249-01A1 (Fernhall)

Acute Arterial Compliance Responses to Whole-Body Vibration and Resistance Exercise in Postmenopausal Women
Carmen Chrisman, Vanessa Shenk, Christopher A. Fahs, Kaelin Young, Harshvardhan Singh, Jessica Smith, Michael Bemben, FACSM, Debra Bemben, FACSM. University of Oklahoma, Norman, OK.

No studies to date have investigated the acute arterial compliance responses to resistance and whole-body vibration exercise in postmenopausal women.

PURPOSE: To investigate the acute arterial compliance responses to high-intensity resistance exercise and with and without whole-body vibration exercise in postmenopausal women.

METHODS: Seven women (58 ± 2 years) participated in this randomized crossover study. 1-RM testing on the leg press, seated row, shoulder press, hip abduction, and hip adduction exercise machines. The exercise and control protocols, random in order and separated by 2-week washout periods, were comprised of whole-body vibration + resistance exercise (WBV), resistance exercise only (RES), or no exercise (CON). For the whole-body vibration, subjects stood barefoot on a tenneterboard whole-body vibration plate for 5, 1-minute intervals at 20 Hz and 1.25 mm (amplitude), followed by the resistance exercise. For the resistance exercise, subjects completed 3 sets of 10 repetitions 80% 1RM. Arterial compliance measurements were obtained by radial applanation tonometry before (Pre) and immediately after (Post) each protocol.

RESULTS: There were significant (p<0.05) time effects for heart rate (HR) and augmentation index (AI); and significant (p<0.01) protocol × time interactions for HR, ejection duration (ED) and the Buckberg sub-endocardial viability ratio (SEVR). HR increased pre to post exercise for WBV (Pre -67.4 bpm ± 2.6 vs. Post -73.9 ± 4.1 bpm) and RES (Pre -67.0 ± 3.7 bpm vs. 78.6 ± 6.1 bpm). AI significantly (p<0.05) decreased post exercise for each condition (WBV Pre 35.4 ± 2.7% vs. Post 32.3 ± 3.7%; RES Pre 35.1 ± 4.1% vs. Post 30.1 ± 3.9%; CON Pre 38.9 ± 2.8% vs. Post 37.4 ± 2.0%). ED significantly (p<0.05) increased and SEVR significantly (p<0.05) decreased post exercise for WBV and RES, however, there were no differences in Post ED or SEVR between WBV and RES protocols.

CONCLUSIONS: Arterial compliance responses, as measured by the augmentation index, were not altered by the addition of whole-body vibration to acute resistance exercise. Our findings suggest that whole-body vibration exercise may be added to resistance exercise without inducing greater cardiovascular stress.

von Willebrand Factor and Blood Flow Response to Whole Body Vibration in Diabetic Peripheral Neuropathy
Michael M. Lockard, Nathan J. Kessler, Jungji J. Hong, Rachel A. Siebuhr. Willamette University, Salem, OR. (Sponsor: Peter Harner, FACSM)

Elevated plasma levels of von Willebrand factor antigen (vWF:Ag), indicative of endothelial damage, have been associated with diabetes mellitus and impaired vascular health. Whole body vibration (WBV) is an emerging treatment modality for diabetics with potential to enhance endothelial maintenance and peripheral blood flow; however, the chronic effects of WBV are unknown.

PURPOSE: To determine the chronic effects of four weeks of WBV treatment on vascular endothelium in diabetics with peripheral neuropathy, and to determine whether these WBV-induced changes are correlated with changes in peripheral blood flow.

METHODS: Subjects were 11 diagnosed diabetics with peripheral neuropathy (6 male, 5 female), mean age 58.5 ± 11.4 years, and BMI 32.4 ± 5.5 kg/m2. Subjects underwent three WBV sessions per week for four weeks. Each session included four three-minute treatments at a frequency of 25 Hz. Blood samples were analyzed in duplicate for vWF:Ag via ELISA test. Toe-brachial index, the rate of systolic pressure at the brachial artery compared to the great toe, was used to assess peripheral blood flow. Final testing was performed at least 24 hours after the most recent vibration treatment to reduce the potential acute effect of vibration therapy.

RESULTS: Plasma vWF:Ag decreased significantly with WBV from 117.8±35.7% to 96.3±25.1% (p<0.032). No gender difference in plasma vWF:Ag was observed. The change in plasma vWF:Ag was significantly correlated with the WBV-induced change in TBI (r=0.635, p=0.036).

CONCLUSION: These data suggest that regular treatment with WBV decreases chronic endothelial damage associated with diabetic peripheral neuropathy, and that this change is associated with improved peripheral blood flow.

Mechanoreceptors in Skeletal Muscles Lead to Augmented Pressor Response in Obese Children
Hosung Nho, Hyun-Min Choi, Joon-Sang Park, Kwang-II Kim, Hyun-Tae Seo, Kyung-Ae Kim, Jong-Kyung Kim, Hye-Lim Yoo. Kyung Hee University, Yong In, Korea, Republic of.

Previous studies strongly indicate that the muscle mechanoreflex evokes altered cardiovascular responses to exercise in obese children. However, the effect of the mechanoreflex, another component of exercise pressor reflex (EPR), on the hemodynamic responses is not well understood.

PURPOSE: To investigate the effects of the mechanoreflex on the cardiovascular responses in obese children.
METHODS: Thirty subjects (8 obese and 13 lean groups, body mass index: 28.4 ± 1.0 vs. 18.8 ± 2.3 kg/m², respectively) participated. The testing protocol involved 5 min of baseline and 1 min brief passive dorsiflexion of the foot.

RESULTS: Mean arterial blood pressure (MAP) increased with the mechanoreflex activation in both groups, however, the peak MAP was significantly higher in obese groups. Inasmuch as cardiac output (CO) tended to be lower, the increase in MAP in lean groups was mainly due to lower levels of total vascular conductances (TVC) (see Table). On the other hand, the higher MAP in obese groups was due to both increase in CO and decrease in TVC. There was no difference between two groups during cold pressor test.

PURPOSE: To verify the role of rotation and twist parameters for better characterize the heart performance in trained elite young athletes from different kind of sports.

METHODS: Six healthy volunteers participated in three cycling trials consisting of double-leg cycling, single-leg cycling without the use of a counterweight and single-leg cycling with the use of 9 kg counterweight attached to the crank on the opposite side of the active leg. Each trial consisted of 5 minutes at three workloads: 40, 80 and 120 watts. Pedaling rate was kept constant at 80 rpm. During each workload VO2, RER, HR and RPE were obtained. VO2 and RER were used to calculate cycling efficiency.

RESULTS: Statistical analysis revealed a significant main effect of intensity and condition on VO2, HR, RER and efficiency. Paired T-test analysis indicated, on average, across all three workloads the use of a counterweight reduced VO2 (23.7±6.8 to 18.1±5.3 ml/kg/min), RER (0.96±0.04 to 0.91±0.02), HR (143±18 to 120±19 bpm) and RPE (14.8±2.2 to 12.2±2.2) and increased efficiency (13.3±0.03 to 17.8±0.04) compared to the non-counterweight condition. VO2, HR and efficiency were not, however, different between the single-counterweight and double-leg cycling conditions while RPE and RER were higher with the counterweight(12.2±2.2 and 0.91±0.02) compared to the double leg condition (10.7±1.6 and 0.84±0.04).

CONCLUSION: On the basis of these data, counterweighted single leg cycling provides an exercise modality that allows for greater exercise intensity at the peripheral level, without increasing central cardiovascular and pulmonary demand and therefore may be beneficial to those with cardiovascular or pulmonary limitations.
Cold-water immersion is a commonly employed treatment to facilitate recovery from exercise-induced muscle damage. Benefits may partly arise from reduction in limb blood flow, however no study has comprehensively investigated the influence of different degrees of cooling on femoral blood flow responses following exercise.

PURPOSE: To determine the influence of cold (8°C) and cool (22°C) water immersion on lower limb and cutaneous blood flow following exercise.

METHODS: Twelve males (25±1.3 years) completed a continuous cycle exercise protocol at 70% peak power output until a core temperature of 38°C was attained. In a randomized order, subjects were then placed in a semi-reclined position and hoisted into either 8°C or 22°C water to the iliac crest for 10 min or rested (Control). Rectal and thigh skin temperature, deep and superficial muscle temperature (Tm), thigh and calf skin blood flow (laser Doppler flowmetry) and superficial femoral artery blood flow (duplex ultrasound) were measured prior to and after 30 min immersion. Vascular conductance was calculated for cutaneous and femoral flow and mean arterial pressure. Data were analyzed using repeated measures ANOVA. Cutaneous data is presented as % of pre-immersion.

RESULTS: Compared with Control, femoral artery conductance was reduced to a similar extent in both immersion conditions (Cold, 1.58±0.13; Cool, 1.76±0.20; Control, 2.38±0.22 ml·min⁻¹·mmHg⁻¹; p <0.01). When compared to control, thigh (72.07±4.33%; Cool, -61.05±7.35%; Control, -21.85±4.04%; p=0.01) and calf skin conductance (Cold, -65.41±7.99%; Cool, -53.62±4.59%; Control, -28.48±7.39%; p=0.01) were significantly different between immersion conditions. The greatest reduction in Tm occurred at a depth of 1cm and was dependent on the condition (Cold, 31.10±0.48°C; Cool, 33.96±0.38°C; Control, 36.22±0.31°C; p <0.01). Deep Tm decreased over the recovery period, with the magnitude of Tm decrease dependent on the condition (Cold, 35.52±0.2°C; Cool, 36.00±0.15°C; Control, 36.91±0.09°C; p=0.01).

CONCLUSION: A core temperature load of similar magnitude induces similar reductions in femoral and skin blood flows, irrespective of the lower body being immersed in cold or cool water. Cold-water may be more effective in the treatment of exercise-induced muscle damage by virtue of a greater reduction in Tm.
Exercise is Medicine/Poster - Cardiovascular System, Cardiovascular Disease Management, and the Elderly

May 30, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

1646 Board #54 May 30 2:00 PM - 3:30 PM
Endurance Exercise Training and Curcumin Supplementation Inverses Lead-Induced Cardiotoxicity
Mahdi Hossein Zadeh, Valiollah Dubidi Roshan, Javad Ashrafi, Jonathan Myers, FACSMD, Aalborg University, Center for Sensory-Motor Interaction (SMI), Aalborg, Denmark. 2College of Physical Education and Sport Sciences, University of Mazandaran, Babolsar, Iran, Babolsar, Iran, Islamic Republic of. 3Cardiology Division, VA Palo Alto Health Care System, Stanford University, Palo Alto, CA, USA, Palo Alto, CA.

BACKGROUND: According to the American Heart Association, air pollution can develop cardiovascular disease. Lead is an environmental pollutant that can induce to long-lasting health problems including cardiovascular toxicity. Apelin is a novel endogenous peptide, and heat shock protein (HSP72) is detected in a variety of tissues and organs; both apelin and HSP72 play important protective role in the cardiovascular system.

PURPOSE: To investigate the cardioprotective effects of aerobic exercise training and/or curcumin supplementation, an antioxidant, alone or combined on left ventricular apelin, HSP72, total antioxidant capacity (TAC), and malondialdehyde (MDA) in rats chronically exposed to lead.

METHODS: Forty male Wistar rats were randomly divided to 5 groups: (1) lead acetate; (2) curcumin; (3) treadmill running; (4) treadmill + curcumin; and (5) sham-treated. The rats in groups 1 to 4 received lead acetate (20 mg/kg). Groups 3 and 4 underwent treadmill running, 15 to 22 m/min for 25 to 64 minutes, 5 times a week for 8 weeks, while groups 2 and 4 received curcumin solution (30 mg/kg) intraperitoneally. The sham group received curcumin solvent (ethyl oleate), only.

RESULTS: Lead administration resulted in a significant decrease in apelin (38%, P < 0.001), and TAC levels (27%, P < 0.001), and significantly increased HSP72 (15%, P < 0.01) and MDA (71%, P < 0.01) in the left ventricle in comparison to the sham group. However, both treadmill running and curcumin supplementation resulted in a significant increase in heart mass (12%, P < 0.01), as well as apelin (89%, P < 0.001), and TAC (27%, P < 0.001) levels, and significantly decreased HSP72 (57%, P < 0.01) and MDA levels (84%, P < 0.01) in comparison to the lead only group.

CONCLUSIONS: These results suggest a cardioprotective effect of concomitant antioxidants and regular endurance training in ameliorating lead-induced cardiotoxicity.

1647 Board #55 May 30 2:00 PM - 3:30 PM
Three Decades Of Participation In Cardiac Rehab
Allison Poremba, BS, Kirk Hendrickson. Beaumont Health System, Royal Oak, MI. (Sponsor: Barry A. Franklin, FACSMD)

BACKGROUND: An 84-year-old male has a history of coronary disease, including 2 four-vessel coronary artery bypass graft (CABG) surgeries; 1980 and 2003, and an angioplasty in 2003 to an occluded graft. In 2010, he underwent a cardiac catheterization as a follow-up to an abnormal graded exercise stress test (GXT).

PHYSICAL EXAMINATION: The patient was asymptomatic after initial CABG (1980) and began a progressive walking program. Prior to surgery he had anginal symptoms.

DIFFERENTIAL DIAGNOSIS: Myocardial ischemia

TEST AND RESULTS: Status post initial CABG (04/1980): Exercise capacity = 7.4 metabolic equivalents (METs); unremarkable exercise ECG; body mass index (BMI) = 25.5 kg/m²;

Status post secondary CABG (03/2003): Exercise capacity = 6.0 METs; unremarkable exercise ECG; BMI = 26.5 kg/m²; Lipid values (10/2003): Total cholesterol (TC), HDL-C, LDL-C, triglycerides (TG) and glucose (G) were 144, 33, 76, 174, and 99 mg/dL, respectively; HbA1c = 5.9.


Recent GXT (02/2010): Exercise capacity = 6.2 METs; horizontal/downsloping ST depression; BMI = 25.0 kg/m²; Lipid values (02/2010): TC, LDL-C, TG, and G were 110, 55, 34, 104 and 104 mg/dL, respectively; HbA1c = 5.7.

Cardiac catheterization (04/2010): Left heart catheterization revealed native left anterior descending coronary artery occlusion; medical management was recommended.

Lower extremity Doppler (06/2011): > 75% stenosis in right and left femoral arteries, signifying peripheral vascular disease (PVD).

FINAL WORKING DIAGNOSIS: Coronary artery disease/PVD

TREATMENT AND OUTCOMES: He began cardiac rehabilitation in 1980 and has been a participant for the past 31.5 years. His current lifestyle includes regular aerobic exercise and a heart healthy diet. He exercises 3 days/week for ~ 60 minutes/session using stationary cycle ergometry, arm-leg ergometry, and walking. He is physically active at home and regularly performs domestic chores and yard work. He denies cardiac complaints but was limited by leg fatigue on his most recent GXT; PVD was diagnosed in 2011. Most notably, the patient’s BMI and functional capacity have remained largely unchanged over the past 3 decades, and he has experienced no acute cardiac events.

1648 Board #56 May 30 2:00 PM - 3:30 PM
The Associations Of Plasma Fibrinogen With Self-reported Leisure-time Physical Activity And Sitting Time In Australian Adults
Bethany J. Howard, Alicia A. Thorp, Balkau Beverley, Neville Owen, David W. Dunstan. 1Baker IDI Heart & Diabetes Institute, Melbourne, Australia. 2INSERM CESP U1184 Villejuif, France. (Sponsor: Charles Matthews, FACSMD)

Plasma fibrinogen, an inflammatory marker is positively associated with all-cause and cardiovascular mortality. Leisure-time physical activity (LTPA) has been shown to be inversely associated with fibrinogen, indicating a protective role. Recent studies have shown that sedentary behaviour (sitting), independent of LTPA is associated with an increased risk of all-cause and cardiovascular mortality, however, the association of plasma fibrinogen with daily sitting time has not been studied.

PURPOSE: To examine the associations of daily LTPA and sitting time with plasma fibrinogen in Australian adults.

METHODS: Plasma fibrinogen was measured in 2,346 men and 3,052 women aged ≥ 30 years (mean age 54 years) without cardiovascular disease from the 2004-2005 Australian Diabetes, Obesity and Lifestyle (AusDiab) study. Multivariate linear regression analyses examined associations of self-reported daily LTPA (hr/day) and sitting time (hr/day) with plasma fibrinogen (as a continuous measure), adjusting for potential confounding variables including, age, smoking, education and energy intake.

RESULTS: Each 1 hour increment per day in LTPA was associated with a 0.06g/l-1 (95% CI: -0.09, -0.03), P ≤ 0.001 and a 0.07g/l-1 (95% CI: -0.14, -0.01), P < 0.05 reduction in plasma fibrinogen for men and women respectively. For daily sitting time, each 1 hour increment per day was associated with a 0.02g/l-1 increase in plasma fibrinogen in men (95% CI: 0.01, 0.03), P ≤ 0.001) and in women (95% CI: 0.02, 0.04), P < 0.05). These associations remained significant for men and women following further adjustment for sitting time and LTPA in the respective models, but remained significant in men only with further adjustment for BMI.

CONCLUSIONS: This is the first study to describe a deleterious association between daily sitting time and plasma fibrinogen, independent of LTPA. While the findings from this study will need to be examined in prospective settings, the results suggest that in addition to the promotion of regular physical activity during leisure time, preventative efforts could be directed at reducing sitting time to attenuate the deleterious effects known to be associated with fibrinogen.
1649  
Board #57  
May 30  
2:00 PM - 3:30 PM  
Cardiorespiratory Fitness And The Risk Of Cardiovascular Disease Mortality In Men With Hypercholesterolemia  
Xueoni Siu1, Duck-chul Lee2, Enrique G. Artero3, Timothy S. Church, FACSM2, Gregory A. Hand, FACSM3, Steven N. Blair, FACSM4. 1University of South Carolina, Columbia, SC. 2Pennington Biomedical Research Center, Baton Rouge, LA.  

PURPOSE: Elevated blood cholesterol is associated with increased risk of cardiovascular disease (CVD). Whether higher cardiorespiratory fitness (CRF) confers protection against CVD in individuals with manifest hypercholesterolemia is poorly understood. This longitudinal study sought to examine the association between CRF and risk of death from CVD in men with hypercholesterolemia in the Aerobics Center Longitudinal Study.  

METHODS: Participants were 8,920 men (mean ± SD age 45.9 ± 8.7 years, range from 20 to 82) with no history of CVD and cancer, and received a preventive examination at the Cooper Clinic in Dallas, TX during 1974 - 2001. At baseline, all men had hypercholesterolemia on the basis of measured fasting blood cholesterol ≥ 6.20 mmol/L. CRF was quantified as maximal treadmill exercise test duration and was grouped for analysis as low (lowest 20% of exercise duration), moderate (middle 40%), and high (upper 40%) using Cox regression analyses, we computed hazard ratios and 95% confidence intervals.  

RESULTS: During an average of 17 years of follow-up, 329 CVD deaths occurred. Age-adjusted CVD mortality rates per 10,000 person-yrs according to low, moderate, and high CRF groups were 34.9, 19.4, and 16.8 (trend P < 0.0001). After further control for baseline year of examination, body mass index, smoking, alcohol intake, physical activity, hypertension, diabetes, fasting blood cholesterol, and family history of CVD, hazard ratios (95% confidence interval) for CVD deaths across moderate and high categories of CRF (with low as referent =1.00) were: 0.65 (0.49-0.86), 0.54 (0.38-0.78). There was an inverse association between CRF and CVD death within both normal weight men (trend P < 0.0001) and overweight/obese men (trend P = 0.01). After stratifying data by baseline physical activity level, an inverse association between CRF and CVD death was observed in sedentary men (trend P = 0.0004); and a borderline significance was found in active men (trend P = 0.08).  

CONCLUSIONS: Among men with hypercholesterolemia, higher CRF is associated with lower risk of dying from CVD, independent of other clinical risk factors. Our findings underscore the importance of promoting CRF in the primary prevention of CVD in patients with hypercholesterolemia. Supported by NIH grant DK088195.

1650  
Board #58  
May 30  
2:00 PM - 3:30 PM  
Feasibility Of Aerobic Interval Training In Cardiac Rehabilitation  
Inger-Lise Aamot1, Siv Hege Forbord2, Vibeke Lockza2, Kjersti Gustad3, Andreas Stensen3, Astrid T. Berg2, Håvad Dalen1, Trine Karlsen1, Ashbjørn Suøylen1, 1NTNU, Trondheim, Norway. 2St.Olav’s Hospital, Trondheim, Norway. 3Levanger Hospital, Levanger, Norway.  

There is growing evidence that high-intensity aerobic interval training (AIT) is more efficient than continuous moderate exercise training in improving aerobic capacity, both in healthy and in cardiac patients. It is therefore important to provide efficient exercise training in the health care system. However, how easy AIT is performed in a clinical outpatient setting is not clear, in regard to both achieving exercise intensity and exercise adherence.  

PURPOSE: The aim of the study was to assess feasibility of AIT in cardiac rehabilitation (CR) in two Norwegian hospitals.  

METHODS: 90 patients (80 men/10 women, mean age 57±8) referred to CR, diagnosed Myocardial Infarction (MI n=61), Acute Coronary Syndrome treated with PCI ( n=7) or Coronary Artery Bypass graft (CABG, n=22), were invited to participate. Cardiopulmonary exercise test was performed before and after intervention to determine exercise tolerance, peak oxygen consumption (VO2peak) and peak heart rate (HRpeak). The intervention consisted of 12 weeks of AIT, twice a week with 4x4 intervals with 3 minutes of active break between. Target heart rate (THR) was set to 85-95% of HRpeak, and all patients exercised with a heart rate (HR) monitor. HR monitor data were downloaded regularly to assess exercise intensity and to give feedback to the participants. Main outcome measure was VO2peak, secondary outcome was exercise adherence. Paired Students T-test was used to analyse change within group.  

RESULTS: There were 7 drop-outs (6 men) during the intervention period, due to orthopaedic problems (3), withdraw (3), and gastro intestinal problems (1). 83 patients completed the training programme (92%), and 80 of them logged 17 training sessions or more (median 24, range 7-24). THR was achieved by all except one. No adverse events were noticed during the training period. VO2peak changed from 3.4±6.3 to 3.7±6.7 ml/kg/min (p=0.001), weight from 88.1±14.1 to 87.3±13.7 kg (p=0.005), resting HR from 59±9 to 57±8 beats/min (p=0.001). Systolic blood pressure from 139±20 to 135±14 mmHg (p=0.056), and diastolic blood pressure from 85±11 to 83±8 mmHg (p=0.047).  

CONCLUSIONS: AIT increased VO2peak significantly, was conducted without adverse events at THR, with an excellent exercise adherence and low drop-out rate. AIT should be considered as an option in cardiac rehabilitation.

1651  
Board #59  
May 30  
2:00 PM - 3:00 PM  
Women Doing Tai Chi During Phase III Cardiac Rehabilitation Have Better Physical Functioning Than Men  
Ruth E. Taylor-Fliaia, University of Arizona, Tucson, AZ.  

Exercise is well-recognized and effective for secondary prevention in patients with coronary heart disease (CHD). Traditional cardiac rehabilitation (TCR) efforts are targeted towards optimal physical functioning following a CHD event. Tai Chi exercise appeals to women following a CHD event. Tai Chi offers additional options for women to improve physical functioning, whether as an adjunct to a TCR program, as part of a maintenance program for persons with CHD, or as an exercise alternative at any point along this continuum.
Arterial stiffness (AS) is a subclinical measure of cardiovascular disease that predicts future cardiovascular events. Physical activity (PA) has been shown to reduce AS; however, the specific mechanisms are unknown.

**PURPOSE:** To determine the impact of PA on arterial stiffness in overweight, sedentary adults (20-45yrs) participating in a lifestyle intervention.

**METHODS:** The Slow Adverse Vascular Effects of excess weight (SAVE) trial is a study evaluating the relationships between weight loss, dietary sodium, and vascular health. Subjects were randomly assigned to a regular or reduced sodium diet, with all receiving one-year nutrition and PA intervention. Data was collected at baseline and 12 months follow-up. PA Intensity was assessed with the ActiGraph accelerometer. AS was assessed by brachial-ankle PWV (baPWV) using an automated device. Mixed models examined the associations between changes over 12 months in time spent in light intensity PA (LPA), moderate to vigorous PA (MVPA), sustained bouts of MVPA (>8 minutes), sedentary activity, total accelerometer counts (counts/day) on change in baPWV. Models were adjusted for time since baseline visit, age, sex, race, and smoking status, homeostatis model of assessment of insulin resistance (HOMA score), body mass index (BMI) and accelerometer weartime.

**RESULTS:** MVPA significantly increased from baseline to 12 months while time spent in LPA significantly decreased. BMI decreased from baseline to 12 months. Mean baPWV was similar at each time point. Change in baPWV was inversely related to change in total counts per day in the fully adjusted models (p=0.02). BaPWV and MVPA bouts were inversely related (p=0.07) when adjusting for age, race, gender, smoking status, and accelerometer wear time but was further attenuated when BMI was added to the model (p=0.12). Change in sedentary time was positively related to change in arterial stiffness in women (p=0.02) but not men.

**CONCLUSIONS:** Total accelerometer counts appeared to be more important for reducing arterial stiffness than time spent in any intensity of activity.
CONCLUSIONS: These findings suggest therapeutic-yoga improved flexibility, arm strength, and endurance for individuals post-stroke. Therapeutic-yoga requires repetitive, slow and sustained muscle activation which may contribute to these findings. Further testing, however, is warranted as these findings are preliminary.

The Antihypertensive Effects of Aerobic Exercise Training: A Meta-Analysis


PURPOSE: To investigate the effectiveness of AE training as compared to other forms of exercise on blood pressure (BP) in adults (≥19yr).

METHODS: A systematic search was conducted to locate relevant randomized controlled trials. Studies were included if they had adults (≥19 yr); a non-exercise, non-diet control, or comparison group or session; and reported pre and post-BP for AE and control groups and the FITT of the AE intervention. Studies were excluded if they involved any dietary or medication interventions, and/or special population with diseases unrelated to cardiovascular disease. Analyses followed random-effects assumptions.

RESULTS: 32 studies were included yielding 45 interventions with 1906 participants (exercise n=998, control n=908). Participants were white (93%), middle-aged (49.6±12.7yr) women (48%) and men (52%) who were overweight [body mass index (BMI) 27.4±2.4kg·m-2] and had pre-hypertension [systolic BP (SBP) 125±4±22.9/120±14.8mmHg] with 12.8% taking antihypertensive medication (n=244). AE interventions were performed at moderate to vigorous intensity (6.3±1.7 MET) for 37.6±12.4 min•session-1, 3.5±1.1 d•wk-1 for 8 weeks of activity (pre 0.488±0.04 to post 0.470±0.062) and increases for 8 weeks control (pre 0.052±0.075 to post 0.644±0.072).

CONCLUSIONS: Our results confirm AE training reduces BP, but our overall result of 1-2 mmHg is 30-80% less than past meta-analyses, likely due to our use of relatively rigorous effect size calculation methods. More importantly, our results demonstrate that the antihypertensive effects of AE are more pronounced in those who were older, had higher BP, greater BMI, or taking antihypertensive medications.

The Effect of Supervised vs. Unsupervised Summer Break on Cardiac Autonomic Modulation in Adolescents.

Marco Meucci1, Hannah Crawford2, Chelsea Curry1, Hannah Wheeler2, Carol Cook2, Kris Hartley2, Scott R. Collier, FACSM. 1University of Rome, Rome, Italy. 2Appalachian State University, Boone, NC.

PURPOSE: To investigate whether supervised vs. unsupervised summer breaks affect HRV in adolescents.

METHODS: 22 adolescents (8 to 12 years-old) were divided into three groups blinded to the investigators: The 4 (n=6) and 8 (n=6) week activity groups performed supervised, play-based physical activity 6 hours/day, 5 times/wk vs. a control group (n=10) which has been instructed to maintain regular summer break habits. HRV was assessed via heads-up tilt (supine at 0° and tilt at 30°) and arm curl strength strength at 36°C. We used paired t-tests/Wilcoxon non-parametric tests to compare baseline vs. 8-week data.

RESULTS: TP increased at rest and with tilt following 8 weeks of activity (resting pre 7479.759±2136.283 to post 12007±3392.293 and tilt pre 2183.125±850.642 to post 2938.125±1121.615). LF/HF show significant increases at rest for 8 weeks of activity (pre 0.488±0.06 to post 0.470±0.062) and increases for 8 weeks control (pre 0.052±0.075 to post 0.644±0.072). LF/HF increased after 8 weeks training (pre 0.40±0.062 to post 0.51±0.062) and decreased following the control period (pre 0.394±0.072 to post 0.336±0.071). LF/HF ratio was better preserved in the 8 week activity group (pre 115.2±60.347 to post 115.262±78.235) vs. the control group (pre 263.55±69.682 to post 199.25±90.338).

CONCLUSIONS: 8 weeks of play-based physical activity can increase HRV enhancing sympathovagal balance in adolescents.

Supported by a grant from the BeActive/Appalachian Partnership. (PI - Scott Collier, PhD, FACSM)
Exercise training lowers blood pressure (BP) 5-7 mmHg, but the relation between the BP response to exercise training and detraining is unclear.

**PURPOSE:** To examine the BP response after 6m of training followed by 2wk of detraining among a subsample from the Studies of a Targeted Risk Reduction Intervention through Defined Exercise study.

**METHODS:** Subjects were 38 men and 37 women 50±10.6y with a body mass index of 30.5±3.2 kg/m2 and resting BP of 120±13.7/79±19.2 mmHg. Subjects completed 1 of 3 types of exercise training: aerobic (AE) vigorous intensity (n=34); resistance training (RT) (n=28); or AE vigorous and RT (n=13). Simple linear and multivariable regression tested the response of BP to exercise and detraining. Chi square tested the frequency of subjects that increased/decreased BP after training and detraining.

**RESULTS:** Among the total sample, BP was not different after training and detraining, regardless of modality (p>0.05). However, subjects who responded to the BP lowering effects of exercise training reduced BP 10.0±6.7/9.1±6.9 mmHg; whereas those that did not respond increased BP 9.6±7.6/2.6±5.3 mmHg (p<0.01). The SBP/DPP response to training and detraining was negatively correlated (r=-0.474/0.540, p<0.01). Interestingly, 65.5% of participants that reduced SBP after training (n=19), increased SBP after detraining; and 73.7% of the participants that increased SBP after training (n=28), decreased SBP after detraining (p<0.05). Similarly, 80.6% of the participants that decreased DBP after training (n=28), increased DBP after detraining, and 81.3% of the participants that increased DBP after training (n=26), decreased DBP after detraining (p<0.01). The SBP response to detraining (r=0.521, p<0.01), resting SBP (r=0.444, p<0.01), and the metabolic syndrome (r=0.288, p<0.01) accounted for 44.8% of variability in the SBP response to training (p<0.01). The DBP response to detraining (r=0.553, p<0.01), resting DBP (r=0.450, p<0.01), and the metabolic syndrome (r=0.463, p<0.01) accounted for 60.1% variability in the DBP response to training (p<0.01).

**CONCLUSIONS:** Future work is needed to elucidate mechanisms that explain why some people lower BP with exercise training, while others lower BP with detraining. Grant: 1R01HL57354, 2003-2008; NCT00275145
balance, self-reported abilities, mobility, instrumental activities of daily living, fatigue, anxiety and depression. All outcomes were assessed in a repeated measurement design for 24 weeks. Between-group differences were analyzed using random coefficient analysis, according to intention-to-treat analysis.

RESULTS 126 patients were included in the CCT group and 124 in the usual PT group. One patient dropped out from the CCT and seven from the usual PT group. CCT was a safe intervention and no serious adverse events were reported. Significant differences were found for gait speed (β= 0.091 [0.023], p<0.001), and walking distance (β= 20.002 [7.442], p=0.004) in favour of the CCT group, but no significant between-group differences were found for the SIS-mobility domain (β= -0.049 [0.682]; p=0.47) at 12 weeks. No significant between-group differences were found for the secondary outcomes, except for the Nottingham Extended ADL Leisure and the memory and thinking domain of the Stroke Impact Scale at 12 weeks. With exception of gait speed (β= 0.035 [0.017], p=0.05), no significant between-group differences were found at follow-up.

CONCLUSION Task-oriented CCT is a safe replacement for usual PT in patients who are discharged from an inpatient rehabilitation setting to the community and need further training of gait- and gait-related activities in an outpatient clinical setting.

1661 Board #69 May 30 2:00 PM - 3:30 PM Stroke Outpatients with Different Physical Fitness Level Need Individualized Exercise Prescription? Long Pio Chao1, Pei Jhen Lee2, Hsuei Chen Lee2, Ku Chou Chang3, Jin Jong Chen3. 1Institution of Physical Therapy and Assistive Technology, National Yang-Ming University, Taipei, Taiwan. 2Taipei Medical University, Taipei, Taiwan. 3National Yang-Ming University, Taipei, Taiwan. 4Chang-Gung Memorial Hospital, Kaohsiung, Taiwan.

PURPOSE: Previous studies showed that moderate intensity physical activity could promote physical fitness in stroke patients. However, there is a diversity of the mild stroke, the exercise recommendation may not fit all patients. This study aimed to investigate the effects of exercise on physical fitness for mild stroke outpatients with different fitness level.

METHODS: This was a quasi-experimental study. The participants were distributed into exercise and control group. Each group was categorized into three subgroups: low(Lf), moderate(Mf) and high(Hf) fitness group based on the quartile of baseline 6-minute walk test (6MWT) performance. Exercise group received 3 sessions of supervised exercise class(1 session/month) and 12-week home-based exercise program. Each exercise educational class contained the warm up, cardiopulmonary fitness training, strengthening and balance training for 40 minutes. Control group received only one exercise consultation session during the first 12 weeks. Outcome measures include the body composition, muscle strength, 6MWT, gait speed, flexibility, and Berg balance scale(BBS). Measurement was conducted at baseline and the 12th week.

RESULTS: Eighty five mild stroke patients were recruited: 42 in exercise group and 43 in control group. There were 71 males and 14 females; with mean age 62.8±9.5yrs. After 12 weeks, the exercise group demonstrated greater improvements on the control group on most physical fitness measure. The exercise program seemed to have more positive effects in Mf group than the LF and HF groups, including waist circumference (β=1.89 vs. 0.38cm, p=0.01), 6MWT (197.8 ± 73.6m., p=0.001), 10 meter walk time (β=1.84 vs. 0.04sec, p<0.001), upper limb muscle strength index (lb/kg, β=0.41 vs. 0.12, p<0.001), lower limb muscle strength index (lb/kg, β=0.73 vs. 0.22, p=0.001) and BBS (β=1.64 vs. 0.14, p=0.04).

CONCLUSION: Supervised exercise class combined with home exercise program potentially improved physical fitness for mild stroke outpatient, especially in Mf group. The result may attribute to that (1) LF group may have more disabilities that affect them to participate in the exercise; (2) the exercise intensity is not enough for the HF group. More studies are recommended to find out the individualized prescription for patients with different fitness.

1662 Board #70 May 30 2:00 PM - 3:30 PM Improvements in Lipoprotein Subfractions and Oxidized Low-Density Lipoprotein Following Lifestyle Intervention in Obese Latino Adolescents Justin R. Ryder1, Sonia Vega-Lopez2, Rocio Ortega3, Darwin Tsainjinnie4, Dawn Coletta5, Gabriel Shaibi1. 1Arizona State University, Phoenix, AZ. 2Mayo ASU, Tempe, AZ.

PURPOSE: The distribution of cholesterol among different low-density lipoprotein (LDL) and high-density lipoprotein (HDL) subfractions, in conjunction with oxidized LDL concentrations are novel biomarkers of cardiovascular disease risk. These measures may be more responsive to lifestyle changes than traditional cholesterol measures and may give light to early alterations in the atherogenesis process. Whether these measures can be improved through diet and exercise in high-risk populations of youth has not been established. Therefore, the purpose of this study was to examine the impact of a lifestyle intervention on the distribution of cholesterol among LDL and HDL subfractions as well as oxidized LDL in a sample of high-risk Latino adolescents.

METHODS: Fifteen (7 male; 8 female) obese (BMI percentile = 96.4 ± 4.5) Latino adolescents (15.0 ± 1.0 years) completed a 12-week lifestyle intervention that included weekly nutrition education classes and 180 minutes of moderate to vigorous exercise per week (3 X 60 minute sessions). Fasting blood samples were collected at baseline and 12-week follow-up. The distribution of cholesterol in HDL and LDL subfractions was measured via polyacrylamide gel electrophoresis and oxidized LDL was quantified via competitive enzyme-linked immunosorbent assay. Paired sample t-tests were used to determine difference (p<0.05) between baseline and 12-week post-intervention.

RESULTS: The intervention resulted in an increase in mean LDL-particle size (269.3 ± 0.9 to 271.6 ± 0.7Å, p=0.0003), a 65.6% decrease in the amount of total cholesterol in the more atherogenic small LDL particles (1.6 ± 0.5 to 0.6 ± 0.3%, p=0.007), a 19.6% increase in the amount of HDL cholesterol in the more antiatherogenic large HDL particles (22.4 ± 2.9 to 26.8 ± 2.7%, p=0.007) and a 21.8% decrease in oxidized LDL (58.7 ± 10.3 to 45.9 ± 17.5U/L, p=0.001). The improvements in lipoprotein subfractions and oxidized LDL were observed in the absence of significant weight loss (90.7 ± 6.8 to 89.9 ± 7.2kg).

CONCLUSIONS: These findings suggest that lifestyle interventions may improve the cardiovascular health of high-risk youth by shifting the lipoprotein profile towards a less atherogenic phenotype. These measures should be considered as potential targets for determining the success of prevention programs in the future.

1663 Board #71 May 30 2:00 PM - 3:30 PM Effects Of High-intensity Task-oriented Training On Energy-cost Of Walking And Walking Capacity In Subacute Stroke. Jacqueline Outeumans1, Ingrid van de Port2, Harriet Wittink1.

Hogeschool Utrecht University of Applied Sciences, Utrecht, Netherlands. 2Centre of Excellence for Rehabilitation Medicine Utrecht, Utrecht, Netherlands.

PURPOSE: To investigate the effects of high-intensity task-oriented training on the energy-cost of walking and walking capacity in patients with subacute stroke compared to a low-intensity physical therapy program.

METHODS: Forty-four patients with stroke were included in this randomized controlled trial at 2 to 8 weeks post stroke. The high-intensity training incorporated a high aerobic workload during 4 weeks. Energy-cost of walking was calculated using the Physiological Cost Index (PCI) in heartbeats/meter. Heart rate was measured with a Polar Heart Monitor during the 6 Minute Walk Test (6MWT). Walking capacity was assessed using the distance covered during the 6MWT. Between group differences were analyzed using the Students T-test.

RESULTS: Differences between groups on baseline were not significant. Energy-cost of walking decreased by 0.01 beats/meter in the high-intensity group but increased by 0.03 beats/meter in the low-intensity group. Analysis showed a non-significant difference in favor of the high-intensity task-oriented training for the PCI (p = 0.43). Significant differences in favor of the high-intensity group were found for the distance covered during the 6MWT (p = 0.02). The high-intensity group showed an increase on post intervention assessment of 59 m. (mean 460 m. to 519 m.), whereas the low-intensity group only showed an increase of 21 m. (mean 401 m. to 422 m.).

CONCLUSIONS: The effectiveness of a high-intensity task-oriented training program exceeds a low-intensity physical therapy-program in terms of walking capacity in patients with subacute stroke. There is a trend for a positive effect on energy-cost of walking. In a future larger sample study more responsive measures to evaluate energy-cost of walking should be used in a longer intervention.
**PURPOSE:** The arterial blood pressure (ABP) and glycaemia can be controlled by the combination of regular physical exercise (PE) and drugs. There are different types of PE, for instance, continuous and intermittent exercises. It is known that the prescription of circuit training workout intermittent exercise (CTW) for the elderly is not common. Thus, the aim of the present study was to verify the acute (before and after a single session of PE) and chronic (after 12 weeks of training) effects of CTW or walking exercise training (WET) on capillary glucose (CG), arterial blood pressure, and physical fitness of elderly women.

**METHODS:** Twenty-three diabetic-hypertensive subjects, who were medicated with beta-blockers or angiotensin-converting enzyme inhibitor, were subjected to WET (n = 9) and CTW (n = 12) according to four different training programs: the first (P1) was acute intervention (12×30 min); the second (P2) was acute intervention (12×30 min) plus chronic intervention (12×30 min); the third (P3) was chronic intervention only (12×30 min); the fourth (P4) was no intervention. After acute bout of WET and CTW, the arterial blood pressure (ABP) and glycaemia can be controlled by the combination of regular physical exercise (PE) and drugs. There are different types of PE, for instance, continuous and intermittent exercises. It is known that the prescription of circuit training workout intermittent exercise (CTW) for the elderly is not common. Thus, the aim of the present study was to verify the acute (before and after a single session of PE) and chronic (after 12 weeks of training) effects of CTW or walking exercise training (WET) on capillary glucose (CG), arterial blood pressure, and physical fitness of elderly women.

**RESULTS:** After acute bout of WET and CTW, the arterial blood pressure (ABP) and glycaemia can be controlled by the combination of regular physical exercise (PE) and drugs. There are different types of PE, for instance, continuous and intermittent exercises. It is known that the prescription of circuit training workout intermittent exercise (CTW) for the elderly is not common. Thus, the aim of the present study was to verify the acute (before and after a single session of PE) and chronic (after 12 weeks of training) effects of CTW or walking exercise training (WET) on capillary glucose (CG), arterial blood pressure, and physical fitness of elderly women.

**CONCLUSIONS:** The both types of exercise (CTW and WET [both acute and chronic]) contributed to reduced capillary glucose as well as improved glucose metabolism, once, probably, increased the glucose uptake from skeletal muscle cells. In addition, both WET and CTW subjects had positive adherence to the program; this occurrence is suggested to be an important part of the elderly diabetic-hypertensive treatment.

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**Purposes:** To evaluate the effect of a 6 month intervention at the primary care level in conjunction with home BP monitoring technology to decrease risk factors of CVD and type II diabetes in adults with MetS.

**METHODS:** Adults with MetS (n=46; mean ages=56.4 years; 71.6% female) were recruited from rural southwestern Ontario and reported to the rural family health clinic for three visits (baseline, V0; 3 months, V1; 6 months, V2). At each visit, resting BP was measured, waist circumference (WC) was measured, a predictive fitness (VO2max) test was offered and exercise was prescribed using the Step Test Exercise Prescription (STEPTEM). Home-monitoring technology included a BlackberryTM and a BP monitor.

**RESULTS:** Clinic systolic BP (SBP; mmHg) showed a decrease from V0 (141.9±19.4) to V2 (133.1±17.3; p≤0.001) and home SBP followed the same pattern decreasing from 129.4±16.3 at V0 to 124.4±12.9 at V2 (p<0.001). Clinic diastolic BP (DBP; mmHg) showed significant decreases from V0 (86.8±10.9) to V1 (83.8±10.5; p<0.01) and continued to decrease into V2 (81.5±9.7; p<0.05). Home DBP showed the same pattern as clinic DBP, decreasing from 83.4±10.3 at V0 to 81.5±9.2 at V1 (p<0.05) and continuing to decrease to 79.8±9.1 at V2 (p<0.01). VO2max (ml/kg/min) increased from V0 to V1 (30.9±7.3 to 32.3±7.3; p=0.01) and remained elevated into V2. WC (cm) showed a decrease from V0 (105±1.30) to V1 (102±9.12±4; p<0.01) and continued to decrease into V2 (100.7±12.0; p<0.001).

**CONCLUSIONS:** A lifestyle intervention in primary care using STEPTEM with home BP monitoring technology decreased both SBP and DBP at home and in the clinic as well as increased fitness and decreased WC in adults from rural communities with MetS. Supported by CIHR Grant #CCT-83029.

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**May 30 2:00 PM - 3:00 PM**

**Nationwide Prevalence of Ideal Cardiovascular Health and Relationship with Cardiovascular Disease and All-Cause Mortality**

Samuel S. Lee, Chong-Do Lee, FACSM. Arizona State University, Phoenix, AZ.

The American Heart Association recently defined 7 ideal health metrics setting a goal to improve the cardiovascular health of Americans by 20% by 2020. However, the prevalence of ideal cardiovascular health for U.S. adults and its relationship with cardiovascular disease (CVD) and all-cause mortality remain less explored.

**PURPOSE:** We estimated the nationwide prevalence of ideal cardiovascular health (i.e., ideal levels of all 7 factors) and the combined effects of 7 ideal health metrics and CVD and all-cause mortality in U.S. men and women.

**METHODS:** We followed 15,801 men and women, ages 20-89 years, who completed a health and medical evaluation from the Third National Health and Nutrition Examination Survey. We classified all participants as ideal, intermediate, and poor categories of health behaviors (not smoking, BMI, physical activity, healthy diet) and health factors (total cholesterol, blood pressures, glucose, respectively). They were further categorized as having 0 to 7 combined ideal health metrics.

**RESULTS:** Approximately 0.8% had ideal cardiovascular health, and 11.8% had intermediate and 87.4% had poor cardiovascular health. During an average of 13.7 years of follow-up, there were a total of 1,343 CVD deaths and 3,251 all-cause deaths. After adjustment for age, sex, race, alcohol intake, education, poverty-income ratio, and family history of CVD, there was a strong inverse association between the number of ideal health metrics and CVD and all-cause mortality (P for trend ≤0.001). The hazard ratios (95% CI) of CVD events across 0, 1, 2, 3, 4, 5, 6, 7 combined ideal health metrics were: 1.00 (reference), 0.79 (0.67, 0.92), 0.69 (0.59, 0.81), 0.63 (0.53, 0.75), 0.45 (0.36, 0.57), 0.36 (0.25, 0.53), 0.32 (0.16, 0.62), and 0.0 (no events). Approximately 64% (95% CI, 48%-75%) of total CVD deaths might have been avoided if men and women had maintained intermediate or ideal cardiovascular health. Men and women with poor cardiovascular health compared with intermediate or ideal cardiovascular health had a shorter life expectancy by 9.1 years (95% CI, 5.7-12.2 years).

**CONCLUSIONS:** The prevalence of ideal cardiovascular health is extremely low in U.S. men and women. We need to increase healthy low-risk populations at the population and individual levels using the primordial prevention, which is a key to CVD prevention.
years) in the Aerobics Center Longitudinal Study. We followed these participants from the second examination to the date of death or through December 31, 2003. A low-risk profile was defined as not smoking, moderate or high fitness, and normal waist girth; and they were further categorized as having 0, 1, 2, or 3 combined low-risk factors in both examinations. A healthy lifestyle group was defined as those participants who maintained 3 combined low-risk factors at both examinations, whereas an unhealthy lifestyle group was defined as those participants who had maintained “0, 1, or 2” combined low-risk factors in both examinations.

RESULTS: During an average of 11.4 years of follow-up, there were a total of 62 CVD deaths and 216 all-cause deaths. After adjustment for age, examination year, and baseline multiple risk factors (i.e., alcohol intake, high density lipoprotein cholesterol and total cholesterol levels, diabetes mellitus, systolic blood pressure, history of hypertension, family history of CVD, and interval between examinations in years), men who maintained a healthy lifestyle had a 52% lower risk of CVD (95% CI, 11%-74%) and a 38% lower risk of all-cause mortality (95% CI, 16%-55%) compared with men with an unhealthy lifestyle. Men with a healthy lifestyle had an 8.2-year (95% CI: 4.1-10.6) longer life expectancy as compared with men with an unhealthy lifestyle. Approximately 40% (95% CI, 13%-58%) of CVD deaths might have been avoided if the men had maintained a healthy lifestyle over 16 years.

CONCLUSIONS: Maintaining a healthy lifestyle for lifetime is associated with lower risk of CVD and all-cause mortality in men. Comprehensive nationwide primordial prevention efforts are needed to support the attainment of healthy lifestyles for lifetime.

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**RESULTS:**

Lifestyle. Approximately 40% (95% CI, 13%-58%) of CVD deaths might have been avoided if the men had maintained a healthy lifestyle over 16 years.

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**55%)) compared with men with an unhealthy lifestyle. Men with a healthy lifestyle had an 8.2-year (95% CI: 4.1-10.6) longer life expectancy as compared with men with an unhealthy lifestyle.**

**interval between examinations in years), men who maintained a healthy lifestyle had a 52% lower risk of CVD (95% CI, 11%-74%) and a 38% lower risk of all-cause mortality (95% CI, 16%-55%) compared with men with an unhealthy lifestyle.**

**Approximately 40% (95% CI, 13%-58%) of CVD deaths might have been avoided if the men had maintained a healthy lifestyle over 16 years.**

**CONCLUSIONS:** Maintaining a healthy lifestyle for lifetime is associated with lower risk of CVD and all-cause mortality in men. Comprehensive nationwide primordial prevention efforts are needed to support the attainment of healthy lifestyles for lifetime.
METHODS: Sixteen participants (5 male, 11 female, aged 56.3±5.1 years, BMI 28.9±6.2, mean±SD) were exposed to 16 IHE sessions [IHE: 5 min normobaric hypoxia (FI02 = 0.16 at week 1, decreasing to FI02 = 0.10 at week 4); 5 min ambient air, repeated for 1 hour, n=8] and [Control (C): 5 min placebo (FI02 = 0.21): 5 min ambient air, repeated for 1 hour; n=8]. Arterial blood pressure (BP), HRV and oxygen consumption (VO2) were monitored during hypoxic exposure (last 5 min of a 10 min period), standing, sub-maximal exercise (75% of age predicted HRmax) and recovery (last 3 min of a 5 min period) pre- and post- intervention.

RESULTS: Relative to the control group, the IHE group showed decreased HR by 10% (9.1 ± 8.3% (mean ± 90% confidence limits) [IHE: 59.2 ± 6.1 to 56.8 ± 6.2 beats/min; and C: 64.6 ± 11.0 to 66.2 ± 9.2 mean ± SE beats/min for the pre and post groups respectively], Standing HR decreased by 6.8 ± 8.6% in the IHE compared to the control group (IHE: 70.8 ± 5.7 to 68.8 ± 4.9 beats/min; C: 74.7 ± 15.2 to 75.2 ± 12.6 beats/min). HRV (rMSSD) increased in the IHE group relative to the C group during hypoxic exposure (76.8 ± 67.0%: IHE: 32.51 ± 15.12 to 35.95 ± 12.07 rMSSD; C: 21.04 ± 8.75 to 20.35 ± 9.54 rMSSD) and exercise (23.2 ± 27.7%: IHE: 4.13 ± 1.86 to 5.08 ±2.96; C: 4.64 ± 3.84 to 4.06 ± 2.58; rMSSD: mean ± SD beats/min for the pre and post groups). There were no changes between groups in resting BP or VO2, standing or recovery HRV.

CONCLUSIONS: These findings suggest 16 IHE sessions in a sedentary population may improve resting HR and HRV, but has little effect on resting BP or maximal VO2. As HRV is generally associated with improved health, this may prove beneficial for patients unable to engage in more traditional physical activity. More research with a larger population is needed to test these findings.

1671 Board #879 May 30 2:00 PM - 3:30 PM Cardiovascular Health Benefits Of Moderate-To-Vigorous And Vigorous Physical Activity In Healthy Adolescents Thomas Radtke1, Susi Kriemler2, Kerstin Khattab3, Hugo Saner2, Matthias Wilhelm1, 1University Hospital and University of Bern, Inselspital, Bern, Switzerland. 2Institute of Social and Preventive Medicine, University of Basel, Basel, Switzerland. 

(No relationships reported)

PURPOSE: Physical activity (PA) is inversely associated with clustering of cardiovascular disease (CVD) risk factors in children and adolescents. We examined the impact of PA on surrogate markers of cardiovascular health in healthy adolescents.

METHODS: In a prospective, cross-sectional study, 52 adolescents (28 females, mean age 14.5 ± 0.7 years, BMI 20.1 ± 2.5 kg/m2) were investigated. Micromaxar function was assessed by peripheral arterial tonometry to determine the reactive hyperemic index (RHI). Autonomic tone was assessed by time-domain analysis of heart rate variability and vagal activity was measured using the root mean square of successive normal-to-normal intervals (rMSSD). Cardiopulmonary exercise testing was performed to determine peak oxygen uptake (VO2peak) and maximum power output. PA was assessed by accelerometry for 8 consecutive days. We applied two different models and dichotomized the cohort into two activity groups (low vs. high) based on the daily time spent in moderate-to-vigorous PA (MVPA, 3000-5200 counts/min-1, model 1) and vigorous PA (VPA, >5200 counts/min-1, model 2). Data were adjusted for age, sex, skinfold, and pubertal status.

RESULTS: In a multivariate regression analysis MVPA was an independent predictor for rMSSD (beta=0.416, P=0.022), and VPA was independently associated with maximum power output (beta 0.310, P=0.009). In model 1, the high MVPA group exhibited a higher vagal tone (rMSSD 49.9±12.9 vs. 38.4±12.4 mS; P=0.006) and a lower systolic blood pressure (106±7 vs. 113±7 mmHg, P=0.031). In comparison, in model 2, the high VPA group had higher maximum power output values (3.8±0.6 vs. 3.5±0.6 watt·kg-1, P=0.010). In both models, no significant differences were observed for RHI, VO2peak and body composition.

CONCLUSIONS: In healthy overweight adolescents, PA intensity reveals different beneficial effects on cardiovascular health-related parameters. In particular, MVPA had favourable effects on vagal tone and systolic blood pressure, whereas VPA contributes to an improvement in exercise capacity.

1672 Board #880 May 30 2:00 PM - 3:30 PM Effects Of Exercise On Postural Balance And Mobility In Rural And Urban-dwelling Elderly Adults Justus D. Ortega, Sarah A. Landis, Humboldt State University, Arcata, CA.

(No relationships reported)

The increased risk of falling among the elderly is closely associated with reduced postural stability and impaired walking performance. Strength and balance exercise has been shown to improve balance, mobility, and reduce risk in urban-dwelling elderly adults. However, it remains unclear whether such exercise programs are as effective among elderly adults living in rural communities.

PURPOSE: To determine the effect of a combined strength and balance exercise program and unstructured exercise on postural balance and mobility in rural-dwelling (RD) and urban-dwelling (UD) elderly adults.

METHODS: A cross-sectional analysis of postural balance and physical performance measures from 106 elderly adults (mean age 77.8 ± 9 years) including 43 RD (23 structured exercisers, 9 unstructured exercisers, and 11 sedentary) and 47 UD (30 structured exercisers, 9 unstructured exercisers, and 8 sedentary) adults was performed. Postural balance was assessed using single limb balance and modified CTIBS tests. Mobility was assessed using Timed “Up and Go” (TUG), 20 meter walking performance (WP), and chair stand (CS) tests. We determined the effects of exercise and dwelling location on balance and mobility using a 2 X 3 MANOVA.

RESULTS: For RD and UD elderly adults, structured exercisers performed 64.7% (p=0.009), 28.8% (p=0.005), and 63.8% (p=0.005) better on the TUG, WP, and CS, respectively, compared to the sedentary group. Although there was no main effect of living location on balance and mobility measures (p=0.075), living location and exercise groups had an interactive effect on balance and mobility (p=0.044). For RD elderly, mobility test scores for the sedentary group (WP 6.5 ± TUG 12.7 ± CS 15.1 ±) were similar to both exercise groups (WP 5.5 ± TUG 10.8 ± CS 11.0 ±). However, UD sedentary elderly adults exhibited greater times for all mobility measures compared to their exercising counterparts (WP 8.20 ± 5.07 ± TUG 15.6 ± CS 19.6 ± 10.80 ± respectively).

CONCLUSIONS: Among both RD and UD elderly, exercise performed in an organized strength and balance class or independently improves mobility. Moreover, RD sedentary elderly exhibit greater mobility as compared to their UD counterparts, possibly due to a higher demand from activities of daily living associated with a rural environment.

1673 Board #881 May 30 2:00 PM - 3:30 PM Effects Of A 15 Week Exercise Intervention On Postural Control Parameters In Community Dwelling Older Adults Forest L. Melton, Pooja Mehta, Christopher Ray. The University of Texas at Arlington, Arlington, TX.

(No relationships reported)

1 in 3 older adults will experience a fall each year. Falls are leading cause of accidental death in adults over 65 years, and are the leading cause of nonfatal injuries and hospital admissions for trauma. Falls often lead to adverse changes in confidence and lifestyle that trigger a cyclical decline in health and postural control. Postural control can be broken down into its component systems: visual, somatosensory, and vestibular. Decreased fitness is known to negatively affect postural control.

PURPOSE: To analyze the impact of a traditional group fitness program (fitness) and a Wii exercise program (fitness + cognition + visual) on individual’s component postural control systems.

METHODS: 89 community dwelling seniors were randomized into 1 of 3 groups (Control, Wii-Fit, Traditional Group-Fit). Interventions were delivered 3 times per week, for 15 weeks. Neurocom SOT was used to assess postural control before and after the intervention.

RESULTS: The Wii-Fit group showed significant improvement in their vestibular and visual components after 15 weeks of exercise. There was a significant difference between pre vestibular scores (0.70 ± 0.17) and post vestibular scores (= 0.75 ± 0.16; p=0.006. The visual scores showed a significant difference between pre (0.80 ± 0.16) and post (0.87 ± 0.07; p=0.011 as well. There was no significant improvement in somatosensory scores. The traditional exercise group did improve significantly in pre (0.84 ± 0.08) and post (0.87 ± 0.06) scores for vision, p=0.002. However, they did not improve significantly in vestibular or somatosensory components. The control group did not show any significant improvements in any components.

CONCLUSIONS: Results indicated that both intervention programs were successful at improving postural control. It appears the ameasurable component to postural control is the visual system, as both groups showed significant improvement. Additionally, interventions that include virtual environments have a greater impact on the vestibular system than traditional exercise programs. This may be due to the added head movement, eye tracking, and cognitive stimulation inherent in gaming. This further elucidates how different exercise programs targeting older adults affect specific components of postural control.
1674 Board #82 May 30 2:00 PM - 3:30 PM
Effect of Tai Chi on Physical Function during Dietary Weight Loss in Obese, Older Women
(No relationships reported)

BACKGROUND: The increased prevalence of obesity-related disability and loss of physical function is a major public health problem, especially in older women. Research has shown that obesity and declines in physical function are preventable and treatable via regular physical activity. Tai Chi, a low-impact martial art, is an alternative exercise modality that shows promise as an intervention strategy to improve physical function. Nonetheless, the addition of Tai Chi exercise to dietary weight loss has not been examined in obese older women.

PURPOSE: The purpose of this study was to study the effects of Tai Chi during dietary weight loss on measures of physical function.

METHODS: A 16 week intervention was performed in 27 obese (BMI = 34.6 ± 4.1 kg/m²) women randomized to either a Tai Chi during weight loss (TCWL, n = 14; age = 60.4 ± 5.9 yrs) or weight loss only group (WL, n = 13; age = 62.7 ± 6.0 yrs). Both groups completed one weekly 45 minute dietary session based on a modified Dietary Approaches to Stop Hypertension diet, while the TCWL group completed three, 45 minute session of a modified Yang style Tai Chi per week. Body mass was measured using a balance beam scale and height via a stadiometer. Outcome measures included 400 meter walk, short physical performance battery (SPPB), timed up and go (TUG), seated sit and reach, grip and leg strength. Between-group comparisons for changes were done using analysis of covariance (ANCOVA) adjusted for baseline values.

RESULTS: There was a decrease in body mass in the TCWL (-2.2 ± 0.9 kg, p = 0.033) and WL (-3.7 ± 0.9 kg, p = 0.001) groups, but there were no between-group differences. The TCWL group had significant improvements in flexibility whereas the WL group did not (5.4 ± 9.9 cm, p = 0.041 vs. 2.5 ± 6.6 cm, p = 0.198; 2.72 ± 3.13 cm, p = 0.393) and leg strength (39.6 ± 67.2 N, p = 0.046 vs. 10.5 ± 42.5 N, p = 0.390; 36.8 ± 18.8 N, p = 0.062). The WL group worsened in their TUG time (1.03 ± 1.0 sec, p = 0.003) but the TCWL group did not (0.48 ± 0.93 sec, p = 0.075; -0.57 ± 0.30 sec, p = 0.069). There were no significant differences between groups in 400 meter walk time, SPPB, and grip strength changes.

CONCLUSIONS: Tai Chi did not have a significant additive effect on most global measures of physical function but may increase leg strength during dietary weight loss in obese older women.

1675 Board #83 May 30 2:00 PM - 3:30 PM
Can Yoga Improve Balance Performance in Older adults?
Man-Ying Wang1, Shin-Yuan Yu1, Michelle Haines2, Rami Hashish1, Sachithna Samarawickram1, Gail Greendale2, George Salem, FACSM1. 1University of Southern California, Los Angeles, CA. 2University of California at Los Angeles, Los Angeles, CA.
(No relationships reported)

Falling is a significant contributing factor to morbidity and mortality in older adults. Improving the ability to modulate postural sway and control center of mass (COM) during static and dynamic tasks may reduce fall risk.

PURPOSE: To study the effects of a 32-week Hatha Yoga intervention on static and dynamic balance performance in healthy older adults.

METHODS: Twenty older adults (70.6 ± 3.8 yrs) participated in a yoga program, twice per week, for 32 weeks. Static sway was assessed under double-legged stance conditions with eyes open and eyes closed and dynamic balance was evaluated during normal walking. Reflective markers were placed on the subject’s bony landmarks (head, trunk, pelvis, upper extremities, and lower extremities) and recorded by an 11-camera motion capture system. Tri-planar COM positions were estimated using a 15-segment, rigid mathematical model based on motion capture data and body mass. Coordinates of the center of pressure (COP) were obtained via force platforms. Outcomes variables for static sway measurement were average displacement and normalized area of sway of COP. Outcome variables of dynamic balance included: displacement, velocity, and acceleration of COM in X, Y, and Z axes and maximum COM-COP separations in the horizontal plane. Paired t-tests and covariate analyses were used to detect significant differences in these variables following the 32-week Yoga intervention.

RESULTS: There were no statistically significant differences in static sway measures after the intervention. Conversely, COM acceleration and COM-COP separation in the anterioposterior direction were significantly smaller than those at the baseline (-16.8%, p < .01; -17.6%, p < .001; respectively), even after adjusting for the walking speed. Moreover, the average COM-COP separation decreased significantly by 15.9% following the Yoga intervention (p < .001).

CONCLUSIONS: Improvements in dynamic balance but not static sway were found after the 32-week Yoga intervention designed specifically for older adults. Significantly reduced COM acceleration and maximum COM-COP separation in the direction of propulsion may decrease the risk of forward falling.

Supported by NIH Grant ROI - AT004869-01

1676 Board #84 May 30 2:00 PM - 3:30 PM
Effect of Wheelchair Tai Chi Intervention on Physical Health among Elderly with Disability
Katherine Dietzel, Kelly FitzGerald, Matthew Hanks, Rebecca Kitiiko, Juliotta Lam, Sarah Martinez, Kara Strauss, Xiang Ke, Yong Tai Wang, FACSM. Georgia State University, Atlanta, GA.
(No relationships reported)

PURPOSE: The purpose of the study was to examine the effect of Wheelchair Tai Chi Modified 10-Form (WTC10) intervention on select physical health variables among the elderly with disability.

METHODS: Thirty elderly with disability (using wheelchair or walker) from 3 assisted living facilities were recruited from Metro Atlanta area. Twelve joined WTC10 intervention group (85.70 ± 7.67 yrs) and 18 joined the control group (89.91 ± 7.71 yrs) at their will after signing the informed consent forms. Only the WTC10 group received a 12 week Tai Chi intervention, twice a week and an hour each time. A pretest and a posttest were performed for both groups at the beginning and at the end of the intervention. Seven in the WTC10 group and 14 in the control group completed the study. The selected physical health measurements included: rest heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP), function reach (FR), and Pain Self Efficacy Questionnaire (PSEQ). A Mixed-Model ANOVA and Bonferroni post hoc test (p < .05) were employed to examine the differences between the pre-test and post-test. Changes in Pain Self Efficacy Questionnaire (PSEQ) were analyzed using paired t-tests.

RESULTS: No statistically significant differences were found from the Mixed-Model ANOVA and Bonferroni analyses among the comparisons of the aforementioned five variables between the two groups. However, the WTC10 group had improvements among the five aforementioned variables with the rest HR decreased 4.25 beats/min, and SBP and DBP decreased 18.75 and 19.25 units, respectively, after the WTC10 intervention. Whereas, the control group had increased rest HR 3.90 beats/min, and increased SBP 14.60 units. Therefore, there were interactions among the heart rate and blood pressure (WTC10 Group: pretest HR 71.5 ± 5.19 vs posttest 70.80 ± 10.05 vs posttest 74.70 ± 11.85 beats/min, and pretest SBP/DBP 137.38 ± 97.25 vs posttest 118.14 ± 78/8 beats/min, and pretest SBP/DBP 112.71 ± 71.18 vs posttest 126.27 ± 86.95/15 units). Conclusion: A 12 week WTC10 intervention may have positive effects on the rest heart rate and blood pressure among the elderly with disability, and the WTC10 is a feasible exercise for the elderly with disability.

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1677 Board #85 May 30 2:00 PM - 3:30 PM
Age-related Site-specific Thigh Muscle Loss Is Associated With Amount Of Vigorous Physical Activity
Takashi Abe1, Madoka Ogawa2, Naotoshi Mitsukawa3, Mark Loftin, FACSM4, 4University of Oklahoma, Norman, OK. 2University of Tokyo, Kashiwa, Japan. 3Toyo Gakuen University, Nagareyama, Japan. 4University of Mississippi, Oxford, MS.
(No relationships reported)

We recently demonstrated that age is associated with site-specific loss of skeletal muscle mass in men and women. Interestingly, in the anterior and posterior regions of the thigh, age-related muscle mass was observed in the quadriceps but not in the posterior region. The cause of age-related site-specific muscle loss is unknown.

PURPOSE: To investigate the relationship between age-related site-specific loss of thigh muscle and accelerometer-determined daily physical activity.

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**METHODS:** Fifty-one middle-aged and older women aged 52-83 years (means [SD], age 66.0 [7.1] yrs, height 1.53 [0.05] m, weight 52.4 [5.4] kg, and body mass index 22.4 [2.5] kg/m2) volunteered. Muscle thickness (MTH) was measured by B-mode ultrasound at five sites on the anterior (quadriceps [QF] 30%, 50%, and 70% of thigh length) and posterior (hamstring [HM] 50% and 70% of thigh length) aspects of the thigh. MTH was expressed in terms relative to thigh length (MTH/L). Habitual daily activities during consecutive 30 days were recorded using an accelerometer, and the exercise intensity was classified 10 graded levels from sedentary (level 0) to light (levels 1-3), moderate (levels 4-6) and vigorous (levels 7-9) exercise. Total duration time (minute) for each level of exercise intensity was calculated. Physical-activity-related energy expenditure (EE) was estimated.

**RESULTS:** The daily step count and physical-activity-related EE averaged 7826 (SD 3183) steps per day and 177 (SD 85) kcal, respectively. Age was inversely correlated with the QF-50% MTHL (r=-0.286, P=0.042), but not the HM-50% MTHL (r=0.102, P=0.474). Age was also inversely correlated with the ratio of QF/HM 50% MTHL (r=-0.330, P=0.018), thus the site-specific muscle loss of the thigh was observed in the present sample. There were no significant correlations between the QF/HM 50% MTH and daily step counts (r=0.205, P=0.150), duration time of light (r=0.204, P=0.150) as well as moderate (r=0.145, P=0.308) intensity exercise, and physical-activity-related EE (r=0.223, P=0.116). However, the QF/HM 50% MTH ratio was significantly correlated to duration time of vigorous intensity exercise (r=0.287, P=0.041).

**CONCLUSIONS:** Age-related site-specific loss of thigh muscle is associated with amount of vigorous physical activity in middle-aged and old women.
Soccer is a worldwide sport professionally and recreationally practiced and has its benefits and risks. In relation to cardiovascular risks (CVR) the intensity of exercise might be the trigger for adverse outcomes.

PURPOSE: To evaluate the CVR of recreational soccer game for senior players.

METHODS: 27 voluntary male subjects were selected by their game skill fullness and assembled in two age groups, under (n=10; 47 ± 2 yrs old; G1) and over (n=17; 57 ± 5 yrs old; G2) 50 yrs old. They all were successfully submitted to a maximal treadmill test (Balke protocol), preceded and proceeded by a blood sampling for analysis of metabolic markers of exertion: acidosis (pH, HCO₃⁻, pCO₂) and blood glucose levels (Hb and HG). Also they were assessed during 20x20 minutes soccer games of 6x6 and 5x5 players in a 814m² court. The game measurements included resting blood pressure (BP) and heart rate (HR) before and immediately after the game. During the game were registered maximum, average, and minimum HR, distance, maximum and minimum speed (GPS monitor - Garmin® Forerunner 305). The two groups (G1 and G2) were set up in teams either inside the group (6x6 or 5x5) or mixed teams. In both age groups, the maximum HR registered during the game surpassed the expected values from the treadmill test, although in both cases the HR remained under the maximum values predicted by age.

RESULTS: Both groups were similar in anthropometry, resting values of BP, HR and responded similarly to the maximum treadmill test by reducing blood levels of pH, HCO₃⁻, and pCO₂ and increasing values of Hb, Hb, AST and CK. However, the younger group presented slightly higher VO₂max (11.9%) than the older (p=0.07). The game performance differed groups only by younger covering larger distance (16.1%) with higher average speed (21.1%) and presenting higher average HR (10.7%) than the older. However these differences disappeared during the aged-mixed teams. In both age groups, the maximum HR registered during the game surpassed the expected values from the treadmill test, although in both cases the HR remained under the maximum values predicted by age.

CONCLUSIONS: Besides being intense and emotional, the recreational soccer is yet a suitable physical activity for senior cardiorespiratory fitness. Supported by CNPq, CAPES and FUNDAPE.

1682 Board #90
May 30 2:00 PM - 3:30 PM
Aging And Strength Reduction; Inactivity Or Aging?
Eivind Wang, Lubomir Kafonek, Jan Helgerud, Klaus Jungbluth, Jan Hoff. Norwegian University of Science and Technology, Trondheim, Norway.

PURPOSE: Muscle strength shows an average decrease with age. The reduced strength is related to the ageing process, but might to a larger degree be a result of inactivity. The hypothesis for this study is that strength training responses in young and old subjects are not different.

METHODS: 12 old (60 ± 6 yrs) and 13 young (22 ± 2 years) subjects trained maximal strength training 4 sets of 4 repetitions at 90% of one repetition maximum (1RM) 3 times a week for 8 weeks in a hack squat and a knee extension apparatus. None of the subjects performed strength training on a regularly basis before participating in the study.

RESULTS: At pretest the old group showed significantly (p<0.05) lower 1RM in hack squat (190 ± 35 kg vs. 207 ± 37 kg including bodyweight) and knee extension (84 ± 13 kg vs. 105 ± 15 kg) compared to the young group. Following training 1RM improved significantly (p<0.05) in both squat: 33 ± 15% (old); 30 ± 14% (young) and knee extension: 28 ± 12% (old); 31 ± 10% (young), but with no differences between the groups. Also dynamic rate of force development (RFD) displayed no differences between groups. Knee extension static RFD and electromyogram root mean square (EMG RMS) and maximal M-wave (Mmax) measured in vastus lateralis, vastus medialis and rectus femoris displayed no significant differences within or between groups except for a vastus laterals increase of 21 ± 26% within the old group.

CONCLUSIONS: Old and young subjects showed similar training responses when employing maximal strength training. Young subjects showed a higher initial strength baseline compared to old. EMG RMS/MMX could not detect the strength responses following the training intervention. The old subjects seem to have a large potential for strength improvements similar to the young subjects, indicating that the major part of strength reduction with age might be an activity component rather than an aging component.
RESULTS: MMSE and ADL score were significantly enhanced in exercise group with senile dementia, compared to these of control group (p<0.05). Exercise capacities in exercise group also increased as period dependent manner.

CONCLUSIONS: These results suggested that senile dementia may improve by participating in a regular exercise program.

1686  Board #94  May 30  2:00 PM - 3:30 PM
Growth Mixture Modeling of Screening Time Among US Children
Youngdeok Kim, Peter D. Hart, Rose M. Carter, Joshua T. Haley, Minsoo Kang, FACSM. Middle Tennessee State University, Murfreesboro, TN.

PURPOSE: The screening time, such as TV viewing and computer/video game, are the growing risk factors of obesity among the children, which may consequently be linked to chronic diseases in later years. Given that the childhood is an important period in which one’s habitual behaviors are being confirmed, more information is needed in order to reduce the screening time during this period. The purpose of this study was to explore the longitudinal trajectory of screening time for better understanding of individual variations in the development of screening time.

METHODS: Data from the Youth Media Campaign Longitudinal Survey (YMCLS) which was conducted from 2002 to 2006 among US children aged 9-13 were analyzed in this study. A remaining sample of 1,623 children in 2006 after completion of follow-up surveys for each of four consecutive year were used. The screening time was obtained by a self-reported measure asking time spent in watching TV, playing video or computer games at a day before interview with the exception of time spent doing homework on computer. Latent growth modeling (LGM) was applied to investigate the latent trajectory of screening time and growth mixture modeling (GMM) was further applied for taking into account population heterogeneity of growth parameters (i.e., intercept and slopes) across unknown subpopulations using latent trajectories classes. Demographic variables used in GMM for predicting latent trajectories classes and growth parameters were gender, baseline age, parental education level, and family income.

RESULTS: The LGM with a quadratic function showed better model fit indices with the parameter estimates of 98.65 for minutes of screening time at baseline, 10.93 minutes for growth rate, and -1.64 minutes for acceleration rate. Following GMM revealed three latent trajectories classes with heterogeneous growth parameters [i.e., normal incliners (87.6%), decliners (6.3%), and drastically incliners (6.1%)].

CONCLUSIONS: The findings indicated that the growth trajectories of screening time among US children varied across different subpopulations. Disparities in screening time among these subpopulations should be take into consideration when targeting the population in promoting healthy behaviors.

1687  Board #95  May 30  2:00 PM - 3:30 PM
The effect of Arch Rehabilitation Exercise Program on Plantar Pressure and Growth index in Children with Obesity Autistic

The purpose of this study was to the effect arch rehabilitation exercise program on plantar pressure and growth index in children with obesity autistic. Following written, informed consent, 10 obesity autism(mean age = 9.11*1.45 years; mean wt = 46.92*9.53 kg; mean ht = 127.27*10.71 cm; mean BMI = 28.97*2.41) and 10 normal obesity children(mean age = 9.62*1.50 years; mean wt = 50.26*9.39 kg; mean ht = 133.46*11.55 cm; mean BMI = 28.23*3.84) completed a battery of test to determine growth index(height, weight and BMI) and plantar pressure.

RESULTS from the intermittent arch rehabilitation exercise program have shown that growth index was improved [height increased significantly before exercise in between obesity autism group and normal obesity children group(p<0.05), before and after exercise in autism group(p<0.01) and normal children group(p<0.01)]. BMI decreased significantly after exercise in between obesity autism and normal obesity children(p<0.05). ] and plantar pressure measurement was improved [average pressure left increased significantly before and after exercise in obesity autism group(p<0.01), average pressure right increased significantly before and after exercise in obesity autism group(p<0.01), rear foot pressure left increased significantly before and after exercise in obesity autism(p<0.05), rear foot pressure right increased significantly before and after exercise in obesity autism(p<0.05). ]

CONCLUSIONS: The lower plantar pressure found in obesity autistic children suggests that foot pressure characteristic of obesity autism children may be caused by obesity. It is postulated that these foot pressure changes, which may affect the functional capacity and stabilization of rear foot pressure might be normalized if moderate weight bearing and arch rehabilitation exercise program continues throughout childhood and into adulthood.

1688  Board #96  May 30  2:00 PM - 3:30 PM
Long-term Effects Of Exercise And Activity Prescription In Children With CMT: An Exercise-Is-MedicineTm Case Study
Robert D. Cheffin, Corrie Mancinelli, Steven Wheeler, Laurie Gutmann. West Virginia University, Morgantown, WV. (Sponsor: Robert R. Kraemer, FACSM)

Charcot-Marie-Tooth disease (CMT), the most commonly inherited peripheral neuropathy (1-in-2,500 persons), affects motor & sensory nerves and is characterized by progressive extremity weakness & atrophy, foot & gait abnormalities, chronic pain/fatigue, and balance deficits. ~30 CMT types/subtypes are known; CMT1a is most common (~70% of all cases). There is no treatment to slow or prevent the disease process.

PURPOSE: To evaluate the effects of a 1-year, home-based exercise & activity Rx, combining resistance and endurance training, in a CMT1a pediatric patient.

METHODS: A 16 year-old girl, genetically diagnosed with CMT1a, participated in the study. Subject followed a home-based training program, with resistance (using “Therabands”) and aerobic (using “Dance-Dance-Revolution”) exercise, each performed 3 days/week for 1 year. Outcomes included isometric strength, body composition, MVO2, blood lipids, and postural stability, taken at baseline, 6 months, and 1 year. Percent changes were calculated over the study duration.

RESULTS: Clinical improvements were seen in max upper & lower body strength, lean mass, bone mineral density, body fat %, MVO2, exercise tolerance, triglycerides, LDLs, total cholesterol, and sensory responses associated with balance and postural stability.

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RESULTS: There was a significant increase in the intervention group pre and post content knowledge (p<0.05), however no significant changes were detected in the self-efficacy or (No relationships reported)

CONCLUSIONS: This pilot online PA intervention mode demonstrated feasibility in application and promoted increases in knowledge for the participants.

1689 Board #97 May 30 2:00 PM - 3:30 PM
Using a Technology-Based Prenatal Physical Activity Program: A Pilot Study
Bridget Melton1, Helen Blund1, Elaine Marshall2, Michael Schmidt2, Kent W. Guion3, Jacqelynn Nagle4. 1Georgia Southern University, Statesboro, GA. 2University of Georgia, Athens, GA. 3Georgia Health Sciences University, Augusta, GA. 4University of Pittsburgh, Pittsburgh, PA. (Sponsor: Jim Morrow, FACSM)
(No relationships reported)

Recent studies have linked excessive gestational weight gain to childhood obesity. Health educators now use pregnancy as a critical point of intervention to impact health outcomes for mother and child. However, little is known about the feasibility of using technology enhanced intervention modalities to impact women’s health behaviors.

PURPOSE: To examine the feasibility of a technology enhanced physical activity (PA) program to control excessive gestational weight gain in pregnant women. A 6-week online PA course was administered while the participants were in their second trimester. The learning module included: Benefits of Exercise During Pregnancy; Safety Concern for Pregnancy; Nutrition During Pregnancy; Improving Birth Outcomes; Childhood Obesity; and After the Baby Is Here. Each module included an online presentation, discussion, ask the expert blog, a knowledge test (self-quizzes) and weekly PA logs.

METHODS: The study was a pilot non-randomized controlled trial with pregnant women who followed women from their first trimester (intervention group, online education n=16; control group, usual care n=6). PA patterns were assessed via accelerometer data at 1st, 2nd and 3rd trimester; content knowledge, self-efficacy and benefits and exercise precaution were assessed pre and post intervention. Content satisfaction was assessed by a participant focus group (N = 11). Repeated measure ANOVA analyses determined significant differences between pre- and post-test.

RESULTS: There was a significant increase in the intervention group pre and post content knowledge (p<0.05), however no significant changes were detected in the self-efficacy or benefits/safety of prenatal exercise (p>0.05). There was a trend toward an increased in PA patterns, normal birth weights, and normal gestational weight gain. Although gestational weight gain and birth weight were measured, the sample size did not allow for significance to be detected. The results from the focus group showed good feasibility and acceptability for delivery of online content material, web link, social networking and self-monitoring.

CONCLUSIONS: This case study demonstrated that an Exercise-Is-MedicineTM rubric (1-year combined resistance & endurance training), clinically improved strength, body composition, MVO2, exercise tolerance, balance, postural stability, and heart disease risk in a 16 year-old girl with CMT1a. This is also the first clinical or scientific exercise study, to our knowledge, which resulted in beneficial changes in afferent function in a CMT patient.

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1690 Board #98 May 30 2:00 PM - 3:30 PM
Physical Activity Patterns in Postpartum Latinas: Madres para la Salud
Colleen Keller1, Barbara E. Ainsworth, FACSM2, Michael Belyea1, Allison Nagel-Williams1, Stephen Herrmann2, Sonya Vega-Lopez2, Paska Permana2, Kathie Records1, Dean V. Coonrod3, Arizona State University, Phoenix, AZ. 1University of Kansas, Kansas City, KS. 2Phoenix VA Health Care System, Phoenix, AZ. 3Maricopa Integrated Health System, Phoenix, AZ.
(No relationships reported)

INTRODUCTION: The post-partum period is a critical time for loss of pregnancy-associated weight gain. Among young Latinas, overweight and obesity rates are high and leisure-time moderate- and vigorous intensity physical activity (PA) is low.

PURPOSE: To describe the volume and types of PA performed by postpartum Latinas prior to initiating Madres para la Salud, a social-support mediated walking intervention to promote postpartum weight loss.

METHODS: 139 women (age = 28.3 ± 5.6 years and BMI = 29.7 ± 5.5 kg.m2) completed the Stanford Brief Activity Survey (SBAS) and concurrently wore an ActiGraph GT3X accelerometer (AG) and an Omron HJ-720ITC pedometer, and kept a PA record (PAR) to identify the type and duration of activities performed. The SBAS rates occupational and leisure-time PA to compute a 5-point PA rating from inactive to very hard PA. The AG Freedson and Matthews cut-points were used to compute PA intensities. AG min.d-1 and steps.d-1 were averaged over 7 days. The PARs were coded using the 2011 Compendium of PA with MET intensity cut-points as sedentary (1.0-1.5), light (1.6-2.9), moderate (3.0-5.9), and vigorous (≥ 6.0).

RESULTS: Only 33 women in the sample were employed. Most demonstrated inactive-to-low PA (SBAS categories: inactive (51%), light (37%), moderate (11%)). AG wear time was: 849.7 ± 140.6 min.d-1 (14.1 hr.d-1). AG durations in min.d-1 were: sedentary (512.0 ± 169.9), light (242.4 ± 51.4), moderate lifestyle (78.3 ± 39.9), moderate walking (16.6 ± 14.4), and vigorous (0.34 ± 1.5). Pedometer steps.d-1 were low (total = 4,973 ± 2,202 steps; aerobic = 412 ± 774). PAR showed most min.d-1 in sedentary (158.2 ± 75.4) and light-intensity PA (412.4 ± 131.0), with less moderate (157.8 ± 106.1) or vigorous (9.8 ± 32.4) intensity PA.

CONCLUSIONS: Post-partum Latinas enrolled in our study showed low levels of moderate- and vigorous intensity PA on all measures. An intervention designed to increase walking to 150 min.wk-1 and/or 30 min.d-1 is warranted. Supported by NIH R010356-01A2
Individuals with a low ankle brachial index (ABI) are often inactive and both characteristics are associated with an increased risk for cardiovascular (CVD) events. Given that individuals with a low ABI may have difficulty performing activities of higher intensity due to symptoms incurred during exercise, examining the role of lower intensity physical activity (PA) on CVD risk in these individuals is important.

**PURPOSE:** To examine the relationship between intensity of physical activity and cardiovascular risk in a nationally representative sample of United States adults with a normal and below normal ABI.

**METHODS:** In 2003-04, the National Health and Nutrition Examination Survey included an accelerometer PA module and collected ABI data. Sedentary activity, light intensity PA (LPA), and moderate-to-vigorous intensity PA (MVPA), were defined with the following cutpoints values: 0-100, 100-1952, >1952, respectively. Individuals were classified as having a normal (1.4) or below normal (0.4-0.99) ABI. The Framingham risk score was used to determine 10 year risk of developing CVD. Multivariable regression models were used to determine the relationship between average time spent per day in various PA intensities and CVD risk in both ABI groups.

**RESULTS:** Individuals with a normal ABI spent significantly more time engaging in MVPA (p=0.001) and less time in sedentary pursuits (p=0.018) when compared to those with low ABI. Time spent engaging in LPA was similar between the groups. MVPA, but not LPA, was inversely related to the 10-year risk of developing CVD in both normal and low ABI groups (p<0.001 and p=0.001, respectively).

**DISCUSSION:** While on average, individuals with a low ABI did not accumulate much time in MVPA, CVD risk does appear to decrease linearly with increasing levels of activity of this intensity. Encouraging individuals with a low ABI to gradually increase their participation in MVPA may reduce future risk of cardiovascular events.

**1692**

**Board #100 May 30 2:00 PM - 3:30 PM**

**Aerobic Exercise Training Induces Muscle Hypertrophy in Both Young and Old Men**

Adam R. Konopka, Matthew P. Harber, Miranda K. Undem, Leonard A. Kaminsky, FACSM, Todd A. Trappe, Scott W. Trappe, FACSM. Human Performance Laboratory, Ball State University, Muncie, IN.

(No relationships reported)

We have previously reported that aerobic exercise training induces substantial (12±2%) muscle hypertrophy in older women (70±2 yr). However, it is unclear if this is an age and/or gender dependent response.

**PURPOSE:** To examine the influence of progressive aerobic exercise training on aerobic capacity, whole muscle size, and knee extensor muscle function in young and old men.

**METHODS:** Seven young (Y; 20±1 yr) and six old (O; 74±3 yr) men performed 12-weeks of exercise training on a cycle ergometer. Training workload was based on relative intensity (% heart rate reserve) and progressively increased throughout the training program. Aerobic capacity, quadriiceps muscle volume (via magnetic resonance imaging), and knee extensor muscle function (peak isometric torque and power) were assessed before and after the training intervention.

**RESULTS:** The training program improved (p<0.05) aerobic capacity in both Y (14±4%) and O (17±3%), however the absolute increase was greater (p<0.05) in Y (0.5±0.1 L·min⁻¹) compared to O (0.2±0.1 L·min⁻¹). Quadriiceps muscle volume was higher (p<0.05) after training in both Y (54±13 cm³; 5±1%) and O (49±11 cm³; 6±1%). Peak work output during the graded cycle exercise test was ~20% higher (p<0.05) in both Y and O after training while knee extensor isometric torque, peak power, and peak angular velocity were not influenced.

**CONCLUSIONS:** The potential for muscle hypertrophy in response to aerobic exercise training is preserved with aging in both men and women. These data further support the use of aerobic exercise as a successful countermeasure to the age-related loss of muscle mass and aerobic capacity.

Supported by NIH Grant AG032127

**1693**

**Board #101 May 30 2:00 PM - 3:30 PM**

**Correlates of Exercise Capacity in Elderly Individuals with and without Coronary Artery Disease**

Sandra Mandic, Rob Walker, Emily Stevens, Casey Brown, Diana Giraldo Ocampo, Edwin R. Nye, Dianne Body, Leanne Barclay, Michael J A Williams. ¹University of Otago, Dunedin, New Zealand. ²Dunedin Public Hospital, Dunedin, New Zealand. (Sponsor: Jonathan Myers, FACSM)

(No relationships reported)

Exercise capacity declines with aging and in the presence of coronary artery disease (CAD). However, mechanisms underlying reduced exercise capacity in elderly individuals with stable CAD compared to age-matched healthy individuals remain unclear.

**PURPOSE:** To compare correlates of peak oxygen consumption (VO2peak) in age- and gender-matched elderly individuals with stable CAD and without CAD (no-CAD).

**METHODS:** Seventy-six elderly individuals (age: 72±5 years (range: 61 to 82), 37% women) with CAD (n=38) and no-CAD (n=38) completed: 1) symptom-limited graded exercise test with expired gas analysis and bioimpedance assessment of cardiovascular response to exercise; 2) physical function testing (Short Physical Performance Battery); 3) bioimpedance assessment of body composition; 4) lower-extremity muscle strength (30-second chair stand test); and 5) 12-month physical activity recall.

**RESULTS:** The CAD group had significantly lower VO2peak (19.6±4.8 vs. 22.2±4.9 ml/kg/min; p=0.027), maximal heart rate (122±17 vs. 139±19 bpm; p<0.001), maximal cardiac output (12.5±2.2 vs. 14.4±3.1 L/min; p=0.002) and decreased percentage of body fat (32.8 vs. 27.5%; p=0.026) compared to the no-CAD group. In both groups, VO2peak was positively related to maximal cardiac output (no-CAD: r=0.44; CAD: r=0.38), maximal heart rate (no-CAD: r=0.32; CAD: r=0.56), percentage of muscle mass (no-CAD: r=0.62; CAD: r=0.73) and last year physical activity (no-CAD: r=0.65; CAD: r=0.41) (all comparisons p<0.05) but not age (no-CAD: r=0.13, p=0.438; CAD: r=0.01, p=0.959). In addition, in the CAD group VO2peak was positively related to muscle strength (r=0.54, p=0.001) and physical function (r=0.43, p=0.007) and negatively related to percentage of body fat (r=-0.73, p<0.001).

**CONCLUSIONS:** In addition to impaired cardiovascular function, reduced muscle strength and increased body fat contribute to reduced VO2peak in elderly individuals with stable CAD. Long-term cardiac rehabilitation programs should focus on improving these outcomes.
Anaerobic threshold determination has usually been employed in the training process. Anaerobic threshold can be calculated using ventilatory parameters (VT2, Beaver 1986) or acidity parameters in blood (Lactate, Coyle 1984). The purpose of this study was determinate if the anaerobic threshold, for people with spinal cord injury, can be calculated using ventilatories or blood lactate methods. Methods. Data were obtained from the project “Central fatigue in athletes: role of the cerebral cortex in relation to the effort in healthy and injured spinal cord”. 18 parameters in blood (Lactate, Coyle 1984). The porpouse of this study was determinate if the anaerobic threshold velocity was compared between groups, it was observed that an habituation of exercise over the wheelchair, was reflected in a higher anaerobic threshold velocity. It was observed in the results from VT2 (SCI: 7.6 ± 1.9 km•h-1 y CON: 5.0 ± 0.6 km•h-1, P<0.05.) or Blood Lactate (SCI: 8.0 ± 2.0 km•h-1 y CON: 5.4 ± 1.6 km•h-1, P<0.05). Discussion. Results show that despite ventilatory differences in SCI, the methods based on ventilatory parameters (VT2), are valid in people with spinal cord injury (SCI). Combined arm and leg ('hybrid') exercise develops a greater cardiovascular demand compared to outdoor cycling exercise. Virtual reality technology may provide new opportunities for exercise rehabilitation in the SCI population.
1697  Board #105  MAY 30  3:30 PM - 5:00 PM
Lower Extremity Functional Electrical Stimulation Isometric Contractions Augment Arm Cycling Peak Oxygen Uptake In Spinal Cord Injured Individuals
Berit Brurøk, Norwegian University of Science and technology, Trondheim, Norway.
(No relationships reported)

Functional electrical stimulation (FES) cycling augment arm cycling (ACE) peak oxygen uptake (VO_{2peak}) in spinal cord injured (SCI) individuals, but high resources demands limits its access. Thus equally effective but less resource demanding training modalities are needed.

PURPOSE: To determine if FES lower extremity isometric muscle contractions augments ACE VO_{2peak} in individuals with SCI.

METHODS: Cross sectional single-subject design. Fifteen individuals with C3 to T2 SCI, and ASIA Impairment Scale A, mean age of 40.2 (13.6) years were recruited and divided into two groups; injury above (SCI-high n=8) or below (SCI-low n=7) the T4 level. VO_{2peak} was measured during and compared between; 1) ACE combined with FES isometric contractions (FES is hybrid), 2) ACE combined with FES cycling (FES hybrid cycling), and 3) ACE alone.

RESULTS: In the SCI-high group, FES iso hybrid and FES hybrid cycling increased VO_{2peak} compared to ACE alone from 17.6 (±5.0) to 23.6 (±3.6) mL·kg^{-1}·min^{-1} and from 17.6 (±5.0) to 24.4 (±4.1) (P = 0.001) respectively. VO_{2peak} and related parameters were not different between the two FES hybrid modalities. In the SCI-low group, there was no difference in VO_{2peak} and related parameters between the three test modalities.

CONCLUSIONS: FES lower extremity isometric contractions and FES cycling augmented arm cycling VO_{2peak} in individuals with SCI high level injuries in the present study. However a portable FES apparatus may serve as a less resource demanding alternative to stationary FES cycling. These findings may have important implications for training compliance and exercise prescription for SCI.

1698  Board #106  MAY 30  3:30 PM - 5:00 PM
Failure To Reproduce VO_{2max} In Patients With Chronic Fatigue Syndrome As An Objective Indicator Of Disease
(B.A. Keller: Contracted Research - Including Principle Investigator; NIH Grant A1090553-01, PI - Maureen Hanson.)

PURPOSE: To assess the reproducibility of VO_{2max} in subjects diagnosed with chronic fatigue syndrome (CFS) compared to healthy controls. Prior research demonstrates that VO_{2max} in healthy subjects is highly reproducible over days and even months (r>.95), with a SEM of < 6-7%.

METHODS: Subjects were 10 females and 2 males (41.3±1.11 yrs) diagnosed with CFS by a physician, and completed a diagnostic of CFS, and 3 male and 4 female healthy controls (23.3±1.11 yrs). Each subject completed two maximum exercise tests on a cycle ergometer separated by 24 hrs to assess the reproducibility of VO_{2max} and associated measures. VO_{2max}, max heart rate (HR_{max}), anaerobic threshold (AT), max workload (W_{max}), workload at AT (AT_{work}), and respiratory exchange ratio (RER) were measured.

RESULTS: For CFS subjects, significant decreases from test 1 to test 2 were 13.5% for VO_{2max} (21.5 to 18.6 mL·kg^{-1}·min^{-1}; p<0.01), 8 bpm for HR_{max} (p<0.01), 18.8% for AT (12.0 to 9.7 mL·kg^{-1}·min^{-1}; p<0.05), 9.4% for W_{max} (121 to 109 W; p<0.05), and 17.3% for AT_{work} (58.3 to 48.2 W; p<0.02). However, max RER did not change (1.11 to 1.12; p>0.23) indicating that CFS subjects effort was consistently high for both tests. As expected for healthy controls, there were no significant differences in VO_{2max} (mean diff=1.5%; 47.5 to 48.2 mL·kg^{-1}·min^{-1}), HR_{max} (181.6 to 183.1 bpm), AT (26.4 to 25.9 mL·kg^{-1}·min^{-1}), W_{max} (264 to 271 W), AT_{work} (150 to 143 W), and max RER (1.17 for both tests).

CONCLUSION: Healthy controls were able to reproduce VO_{2max} as expected. In contrast, CFS subjects were unable to reproduce VO_{2max} and/or AT, despite evidence of maximum effort during both tests. A maximum graded exercise test-retet protocol with ventilatory gas exchange could provide CFS patients with an objective indicator of underlying physiologic dysfunction.

1699  Board #107  MAY 30  3:30 PM - 5:00 PM
Forced And Voluntary Exercise Improve VO_{2max} In Parkinson’s Patients
Amanda L. Penko, Gordon Blackburn, Michael Crawford, Jay L. Alberts. Cleveland Clinic, Cleveland, OH.
(No relationships reported)

High cadence exercise, or forced exercise, has been shown to be beneficial in symptom reduction in Parkinson’s disease (PD) patients. With the increase in knowledge of the benefits of forced exercise to PD, it is important to examine the cardiovascular responses to forced and voluntary exercise interventions.

PURPOSE: To examine changes in VO_{2max} in PD patients who have completed an eight-week exercise intervention, either forced or voluntary.

METHODS: 60 males and females (58.62 ± 8.47 yrs) with a clinical diagnosis of idiopathic PD completed two maximal progressive cycling exercise tests separated by eight weeks. Heart rate (HR) and VO_{2} was monitored throughout the test.

RESULTS: Both modes of exercise resulted in a significant (p=0.003) improvement in VO_{2max}, however greater improvements were observed in the voluntary group. Neither group exhibited any change in peak exercise heart rate pre- to post-intervention (p=0.705).

CONCLUSION: VO_{2} was significantly different pre-exercise to post exercise as determined during a progressive exercise test to maximal exertion for both the forced exercise group and the voluntary exercise group. These data support the efficacy of aerobic exercise for increasing aerobic capacity in PD patients. This project supported by R01NS065198-01 and Lincy Foundation.

1700  Board #108  MAY 30  3:30 PM - 5:00 PM
Cardiopulmonary Exercise Testing and Reduced Work Efficiency In Chronic Fatigue Syndrome
(No relationships reported)

PURPOSE: Reduced functional capacity and post-exertional fatigue following physical activity are hallmark symptoms of Chronic Fatigue Syndrome (CFS). That these symptoms are often delayed may explain the equivocal results for clinical cardiopulmonary exercise testing among individuals with CFS. Test reproducibility in healthy subjects is well documented. This may not be the case with CFS due to delayed recovery symptoms. The objectives for this study were to compare results from repeated exercise tests as indicators of post-exertional fatigue and reduced work efficiency in CFS.

METHODS: Gas exchange data, workloads and related physiological parameters were compared between 51 individuals with CFS and 10 control subjects, all females, for two maximal exercise tests separated by 24 hours.

RESULTS: Multivariate analysis showed no significant differences between controls and CFS for test 1. However, for test 2 the individuals with CFS achieved significantly lower values for oxygen consumption and workload at peak exercise and at the ventilatory/anaerobic threshold. Follow-up classification analysis differentiated between groups with an overall accuracy of 86.9%.

CONCLUSIONS: The lack of any significant differences between groups for the first exercise test would appear to support a deconditioning hypothesis for CFS symptoms. However, results from the second test indicate the presence of a CFS related post-exertional fatigue. It might be concluded that a single exercise test is insufficient to reliably demonstrate functional impairment in individuals with CFS. A second test may be necessary to document the atypical recovery response and protracted fatigue possibly unique to CFS which can severely limit productivity in the home and workplace.
Economy of Pedaling in Individuals With Down Syndrome

Myriam Guerra1, Eduardo Garrido2, M Carmen Martin-Borras1, Maria Gine-Garriga1, Guillermo Oviedo1, Be Fonhall, FACSM1, 1FPCEE Blanquerna (URL), Barcelona, Spain. 2Hospital General de Catalunya, Sant Cugat del Valles, Spain. 3University of Illinois at Chicago, Chicago, IL. (No relationships reported)

INTRODUCTION: Individuals with Down Syndrome (DS) have low aerobic capacity. Because of motor disabilities, cycling is difficult for them. Little is known about VO2 economy when they perform tests over cycle ergometry.

PURPOSE: We investigated the relation between VO2peak and peak power during a maximal exercise test in persons with DS when cycling.

METHODS: 10 individuals with DS (age=20±2 years; BMI=24.5±4.1) and 7 without DS (age=20±2 years; BMI=23.3±2.7), all of them males, participated in this study. They completed a maximal cycle ergometer exercise test consisting of a 3-min warm-up exercise followed by an increase in load of 16 watts every minute until exhaustion. Metabolic data were continuously collected. Aerobic economy (peak VO2 / peak power) was calculated in both groups and compared to predicted values.

RESULTS: Individuals with DS exhibited lower (p<0.05) VO2peak (15.6±0.38 vs 32.2±4.64 L/min; 26.5±7.0 vs 44.1±4.7 ml/kg/min) and lower peak power (102.6±32.1 vs 231±36.1; 15.9±0.6 vs 3.2±0.3 W/kg). When comparing the actual economy (15.9±3.1 L/min/W) to the predicted value (10.3 L/min/W) it was significantly higher (p<.05) in DS group, meanwhile there was no significant difference, even though the DS group had a higher mean

CONCLUSIONS: Individual with DS exhibit poorer cycling economy than expected based on current formulas. However, there was no significant difference between persons with DS and controls, although this may have been influenced by a lack of statistical power. Thus, individuals with DS have low aerobic capacity and low exercise economy, which may partially explain their reduced ability to exercise. (Supported by MEC; reference DEP2005-00202-C04-01)
RESULTS: Menstrual irregularity incidence was 57% in total, 27% in controls, and 63% in athletes ($\chi^2(1)=9.494, p=0.002$). Menstrual irregularity incidence was 100% in Kendo, 100% in judo, 91.7% in basketball, 67.7% in Taekwondo, and 33.3% in fencing athletes, which was higher than other sports type athletes ($\chi^2(7)=61.798, p<0.0001$). Otherwise, menstrual irregularity incidence was 0% in gymnastics, 8.3% in field hockey, and 16.7% in badminton athletes, which was lower than controls. As total bone mineral density (BMD) was increased, menstrual irregularity incidence was decreased in controls ($\chi^2(5)=8.225, p=0.016$) and was increased in athletes ($\chi^2(5)=4.025, p=0.13$). As percent body fat (%BF) was increased, menstrual irregularity incidence was increased in athletes ($\chi^2(5)=25.954, p<0.0001$). As muscle mass was increased, menstrual irregularity incidence was increased in athletes ($\chi^2(5)=8.249, p=0.016$). As weekly training hours increased, menstrual irregularity incidence in athletes was significantly increased.

CONCLUSIONS: Regular over training might cause menstrual irregularity incidence in athletes even though they had higher BMD, and not lower %BF. It would be more be needed to find out what body composition factors mainly affect health concerns of female athletes and what levels of each body composition factor they need to maintain.

Many manual therapy techniques and therapeutic modalities are utilized to return patients to functional activities or activities of daily living. Assessing the change in a patients perception of their functional ability after receiving Instrument Assisted Soft Tissue Mobilization (IASTM) treatment has yet to be determined.

PURPOSE: The purpose of this project was to assess the efficacy of the Instrument Assisted Soft Tissue Mobilization (IASTM) technique at changing a patients functional ability as well as their perception of functional ability of the functional squat test.

METHODS: Twenty-seven college-aged students (21.29±1.89 years, 64.81±15.52 kg, 170.05±9.89 cm) participated in this study. Thirteen subjects (8 female, 5 male) were randomly selected to receive the IASTM treatment (TG) and 14 subjects (11 female, 3 male) were selected for the control group (CG). All subjects completed the Perception of Functional Ability Questionnaire (PFAQ) and then performed a baseline functional squat test in a 3-D Marker-less Motion Capture System (Dynamic Athletic, Overland Park, KS). The TG received a bilateral IASTM treatment to the posterior lower leg and the CG rested in a prone position for 10 minutes and did not receive the treatment. After the IASTM or 10 minute rest period all subjects performed a follow-up functional squat test in the motion capture system and completed a follow-up PFAQ. All data was analyzed using a 2x2 repeated measures ANOVA (pc.05).

RESULTS: There was no significant difference in data from the PFAQ between the TG and CG. There was significantly more stability in body weight distribution found in the TG following the IASTM treatment compared to the CG. There was also significantly more posterior heel shift in the TG following IASTM compared to the CG.

CONCLUSION: Though not statistically significant, all components of perception of functional ability improved following IASTM with the healthy, college-aged subjects. IASTM treatment did significantly increase critical components of the functional squat test. These data indicate that IASTM is an effective modality for increasing functional ability with the functional squat test.

Skin cancer, specifically melanoma, is the deadliest and most preventable type of cancer in the world. Athletes have an increased risk for developing serious malignant growths due to unavoidable sun exposure during practice and competition times, and the lack of recommended sunscreen use.

PURPOSE: The purpose of this study was to assess skin cancer knowledge, attitudes, and behaviors among collegiate athletes. Behaviors that expose the athletes to UV rays, such as tanning bed use and sunlight exposure during peak hours, were of question. Strategies that athletes take to avoid overexposure to UV radiation when their practice/game times are scheduled outdoors during peak exposure hours were also examined.

METHODS: Three-hundred-forty-three athletes, from various intercollegiate sports at a mid-sized southern university, completed a modified version of the Melanoma Risk Behavior Survey during peak exposure hours, we re of question. Strategies that athletes take to avoid overexposure to UV radiation when their practice/game times are scheduled outdoors during peak exposure hours were also examined.

RESULTS: The total mean score for knowledge was 8.88 ± 4.39, with a total possible score of zero - 24. A majority of the athletes were unable to identify basal cell carcinoma as the most common skin cancer. The mean score for attitude was 41.91 ± 6.22, with a total possible score of 11-55. A majority of the athletes felt a good tan was worth the increased risk of skin cancer. The mean score for behavior was 3.00 ± 2.70, with the total possible score of zero - 12. Less than 15% of the athletes attempted to avoid the sun during peak UV hours or wear protective clothing. Less than 25% regularly applied sunscreen before practice or during non-practice sun exposure.

CONCLUSION: Our results show that college athletes lack knowledge regarding skin cancer and sun protection, and engage in high-risk behaviors such as indoor tanning. There is a need to educate the collegiate athletic population about low-risk sun protection behaviors and skin cancer in general. Athletic directors, athletic trainers, coaches, and other individuals involved in the health and safety of college athletes need to include sun safety procedures in their discussions with the athletes during meetings and practice sessions.

RESULTS: The mean score for behavior was 3.00 ± 2.70, with the total possible score of zero - 12. Less than 15% of the athletes attempted to avoid the sun during peak UV hours or wear protective clothing. Less than 25% regularly applied sunscreen before practice or during non-practice sun exposure. Strategies that athletes take to avoid overexposure to UV radiation when their practice/game times are scheduled outdoors during peak exposure hours were also examined.

CONCLUSION: Regular over training might cause menstrual irregularity incidence in athletes even though they had higher BMD, and not lower %BF. It would be more be needed to find out what body composition factors mainly affect health concerns of female athletes and what levels of each body composition factor they need to maintain.
with 95% confidence intervals) for professional treatment of joint, cardiopulmonary, and psychosocial health concerns, in SA compared to NA.

RESULTS: Older alumni SA (ages 43+) had nearly 8x the risk of treatment for joint concerns, compared to age-matched NA; odds ratio = 7.9 (1.5 - 4.3). Current and younger alumni SA had similar risk vs. NA. Collapsed across groups, older alumni were 9x as likely as current students to be treated for cardiopulmonary concerns, but risk was similar for SA and NA. Treatment for psychosocial concerns was similar, irrespective of age and athletic participation.

CONCLUSIONS: These data suggest that intercollegiate athletic participation increases risk for treatment of joint concerns later in life. Despite high levels of exercise as young adults, SA demonstrated no protective cardiopulmonary health effects, and no differences in psychosocial health. This may offer valuable guidance for interventions seeking to optimize lifespan outcomes in this population. Additional studies are necessary to evaluate exercise and HRQL outcomes, and generalize these results to larger & more diverse populations.

1709 Board #117 MAY 30 3:30 PM - 5:00 PM
Differences on the Upper Quarter Y Balance Test Between High School and College Baseball Players
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(No relationships reported)

Athlete injury screening tests have received significant attention recently with the aim of reducing sport related injuries. Few tests have been developed to screen for upper extremity injury risk. The Upper Quarter Y Balance Test (YBT-UQ) was developed to provide a more fundamental upper extremity assessment. The YBT-UQ requires stance hand stability combined with reach mobility and coordination while maintaining a three point plank position.

PURPOSE: To examine how competition level affects performance on the YBT-UQ in baseball athletes.

METHODS: 37 male high school (HS) baseball players and 26 male college (COL) players were screened on the YBT-UQ prior to the spring season. Athletes with pain were excluded from the study. YBT-UQ performance was collected bilaterally in the medial, inferolateral, and superolateral directions. The maximum score for each direction was normalized to upper extremity length (C7 spinous process to tip of the middle finger) and used for analysis. The average of the normalized scores was used to develop a composite score. The bilateral normalized scores (%AL) were averaged and compared between groups. Reach symmetry was determined as the difference (cm) between the left and right side for each direction prior to normalization. Specific differences between the HS and COL players were statistically analyzed using independent samples t-tests (p<0.05).

RESULTS: HS baseball players had a significantly shorter average arm length (90.9 ± 4.4 cm) when compared to the COL players (93.9 ± 3.9 cm). No significant differences existed for the medial (HS: 96.2 ± 5.3 %AL, COL: 95.8 ± 7.1 %AL), inferolateral (HS: 86.4 ± 6.9 %AL, COL: 88.2 ± 7.4 %AL), superolateral (HS: 69.3 ± 9.6 %AL, COL: 69.2 ± 7.1 %AL) or composite (HS: 84.0 ± 5.7 %AL, COL: 84.2 ± 5.9 %AL) scores. Similarly no significant differences were observed for bilateral symmetry in the medial (HS: 4.2 ± 4.2 cm, COL: 4.9 ± 4.1 cm), inferolateral (HS: 5.1 ± 4.4 cm, COL: 4.3 ± 3.6 cm) or superolateral (HS: 4.5 ± 3.8 cm, COL: 5.5 ± 6.0 cm) directions.

CONCLUSIONS: Performance on the YBT-UQ does not appear to be dependent on the competition level in baseball players. Future studies should examine how athletes in other overhead sports perform on the test as well as examining if performance on the test is associated with an elevated injury risk.

1710 Board #118 MAY 30 3:30 PM - 5:00 PM
Gender Differences on the Upper Quarter Y Balance Test in Collegiate Swimmers
Michael P. Reiman, Duke University, Durham, NC. (Sponsor: Mitchell J. Ruoh, FACSM)

(No relationships reported)

Recently the Upper Quarter Y Balance Test (YBT-UQ) was developed to examine injury risk and provide a more fundamental assessment of upper extremity ability that minimizes the role of strength and power. Currently there is no reported research on YBT-UQ performance.

PURPOSE: To examine how gender affects performance on the YBT-UQ in athletes participating in swimming.

MATERIALS/METHODS: Twenty-four male and twenty-six female Division I college swimmers were recruited for the study prior to the pre-season. All athletes who reported pain or current injury at the time of testing or were currently under the sports medicine team’s care for an injury were excluded from the study. YBT-UQ performance was collected for the left and right limb in the medial, inferior-lateral, and superior-lateral directions. The maximum score for each direction was utilized for analysis. The scores were normalized to upper extremity length (C7 spinous process to tip of the middle finger). The average of the normalized reach scores was used to develop a composite score. For analytical purposes, left and right side normalized scores (%AL) were averaged. To examine reach symmetry between genders, the difference (cm) between the left and right side was calculated for each direction prior to normalization. Statistical analysis was conducted using an independent samples t-tests (p<0.05).

RESULTS: Statistically significant differences were observed for the medial (p<0.01, F: 89.7 ± 7.4 %AL, M: 97.4 ± 7.3 %AL) and composite (p<0.04, F: 80.6 ± 7.3 %AL, M: 85.1 ± 8.1 %AL) scores. No statistically significant differences were observed for reach symmetry in the medial (F: 3.8 ± 3.3 cm, M: 3.2 ± 1.9 cm), inferior-lateral (F: 5.5 ± 5.4 cm, M: 3.2 ± 2.8 cm) or superior-lateral (F: 5.1 ± 4.2 cm, M: 5.6 ± 4.5 cm) directions.

CONCLUSIONS: Performance on several YBT-UQ indices appears to be lower for females than male collegiate swimmers. Future research should be conducted to assess if performance on the test has any validity as an assessment of injury risk.

1711 Board #119 MAY 30 3:30 PM - 5:00 PM
Alcohol, Cigarette, Marijuana and Anabolic Steroid Consumption Among University Athletes in Bogota, Colombia
Natalia Cano1, Laura Cárdenas2, Carolina Donado1, Olga Lucia Sarmiento1, John Duperly1, 1Universidad de los Andes, Bogota, Colombia. 2Fundacion Santa Fe de Bogota, Universidad de los Andes, Bogota, Colombia. (Sponsor: Michael Pratt, FACSM)

(No relationships reported)

PURPOSE: University athletes (UA) are considered to have more alcohol (OH) and other illicit drugs than socially expected for athletes in Colombia. In Colombia there are no studies on this topic, as well as no clear evidence concerning the use of anabolic steroids. We aimed to estimate the prevalence of OH, cigarettes (CC), marijuana (MJ) and anabolic steroids (AS) consumption amongst UA that competed in the Colombian University Association (ASCUN) tournament during 2011.

METHODS: In this cross sectional study, 801 males and females UA were randomly selected for a survey in an anonymous and voluntary way, as they participated in different competitions organized by ASCUN in the fall semester of 2011. The sample size was representative of all UA in Bogotá, Colombia. A translated and adapted version of the National Collegiate Athletic Association (NCAA) survey was used. The survey evaluated the patterns of OH, CC, MJ, and AS consumption. The life time prevalence of consumption of these substances was calculated by gender, sport (team vs. individual sports) and team captaincy.

RESULTS: Overall, of those surveyed 56.0% were male. The consumption of OH (85.0%) was the most prevalent, followed by CC (39.0%) and MJ (14.3%). The highest prevalence of consumption was among indoor soccer, volleyball and soccer players, for OH (14.9%, 13.5% and 11.4% respectively), CC (6.4%, 6.7% and 5.9% respectively), and MJ (2% for the three sports). In general for each substance the consumption was higher in males participating in a team sport (35.2% OH, 38.1% CC and 43.0% MJ). We didn’t find a significant difference between team captains and other athletes, for OH (58.8% vs. 53.3%; p=0.22) or for consumption of other substances. The prevalence of AS use was 0.9% (85.7% males; 14.3% females), mostly among soccer athletes.

CONCLUSIONS: This study, the first on this topic in Latin America, shows a worrisome prevalence of OH, CC and MJ consumption among UA. Consumption was highest in men’s team sports. This data should be taken into account for future interventions to reduce this burden in Colombia.
B-28 Free Communication/Poster - Concussion

Board #121 MAY 30 3:30 PM - 5:00 PM
Influence of Gender on Knowledge, Attitude, Perceived Social Pressures, and Perceived Behavioral Control Concerning Concussion among High School Athletes

John K. Register-Mihalik\(^1\), Laura A. Linnan\(^1\), Tamara C. Valovich McLeod\(^1\), Stephen W. Marshall\(^1\), Frederick O. Mueller, FACSM\(^1\), Kevin M. Guskiewicz, FACSM\(^2\), The University of North Carolina at Chapel Hill, Chapel Hill, NC, \(^3\) A.T. Still University, Mesa, AZ.

\(^{no relationships reported}\)

Few studies have examined gender differences in health behavior concepts such as knowledge, attitude, perceived social pressures, and perceived behavioral control concerning concussion among high school athletes.

**PURPOSE:** To examine the association between gender and knowledge, attitude, perceived social pressures, and perceived behavioral control concerning concussion.

**METHODS:** A pre-validated, cross-sectional survey was completed at home and returned via mail by a convenience sample of 162 high school athletes (98 males, 64 females; age=15.7±1.4 years). The main outcome measures were attitude total score (total of the 14 attitude Likert score answers), knowledge total score (number of questions correct out of 35), subjective norm average score (average of five separate question concerning social pressures, and norms), and perceived behavioral control average score (average of three questions concerning perceived control over concussion reporting). Higher regression models were used to examine the association between gender and these outcomes. Mean differences were examined as male scores minus female scores.

**RESULTS:** Gender was significantly associated with attitude (MD=4.18; 95% CI: 7.99,-0.38; p=0.030), perceived social pressures (MD=-0.49, 95% CI:-0.91,-0.08; p=0.018), and perceived behavior control (MD=-0.43; 95% CI:-0.83,-0.03; p=0.018) with females having higher scores for each outcome. No association was observed between gender and knowledge scores (MD=0.77; 95% CI: 0.15,1.69; p=0.10).

**CONCLUSIONS:** Although knowledge regarding concussion is similar between males and females, females may have a better attitude toward concussion reporting, a more favorable perception that important social referents (parents, teammates, and coaches) feel positively about concussion reporting, and more perceived control over concussion reporting. Clinicians should be mindful of these differences when educating males and females about concussion in an effort to improve attitudes and beliefs concerning concussion and concussion reporting in high school athletes. These findings may help direct the educational efforts mandated by recent statutes and legislation.

Fundied by an NFL Charities Medical Research Grant

INTRODUCTION: The APOE e4 allele is significantly associated with poor outcome after severe TBI in non-athletic subjects. Previous prospective cohort studies (PCS) on athletes have studied the association of APOE e4 with acute concussion (conc) have been limited by small sample size. In addition, no other genetic polymorphisms (GPs) were included in prior studies. We report on the largest PCS involving college football and men’s/women’s soccer players in the literature and include the APOE G-219T promoter and two Tau gene exon 6 GPs in our analysis.

**PURPOSE:** To evaluate the association between sport related concussion and baseline neuropsychological (NP) test scores with several genetic polymorphisms (GPs) [GPs are APOE, APOE G-219T promoter and two Tau GPs] on a convenience sample of 162 high school athletes

**METHODS:** A multi-center PCS of 1186 college athletes from 15 institutions completed a conc/medical history (hx) questionnaire, genetic sampling (buccal swab, saliva, and blood), and baseline web-based NP testing (Headminder\(^1\)). The overall population was 87% male, 59% white and mainly played football (67%) and soccer (24.4%).

**RESULTS:** Chi Square showed no significant association between experiencing an acute conc and the GPs. The Tau Ser TT genotype was associated with a trend towards reduced prospective conc ( p=0.094). T tests showed that baseline NP test results such as Simple Reaction Time (SRT), Complex RT (CRT), CRT Errors, and Processing Speed (PS) had no significant association with any genotype from the GPs. The APOE e4 allele was associated with a significantly lower SRT Errors score (p=0.013) and the TauSer TT genotype was associated with a significantly prolonged SRT (p=0.017). The APOEProm TT genotype trended towards having a significant association with PS (TT having slower PS than GG/TT genotypes). The APOEProm TT/GT genotypes trended towards significantly prolonged CRT scores (p=0.088).

**CONCLUSION:** This large PCS of college athletes showed no significant association between APOE, APOE Prom, Tau exon 6 Ser33Pro and His477Tyr and experiencing an acute conc. Future plans are to study the association between various GPs and post conc neurocognitive recovery.

**Acknowledgements:** NOCSAE and the AMSSM Foundation provided funding for this study.

Board #122 MAY 30 3:30 PM - 5:00 PM
Association Of Genotype With Concussion Severity In Prospective Cohort Study Of College Athletes

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\(^{no relationships reported}\)

**INTRODUCTION:** The APOE e4 allele is significantly associated with poor outcome after severe TBI in non-athletic subjects. Previous prospective cohort studies (PCS) on athletes have studied the association of APOE e4 with acute concussion (conc) have been limited by small sample size. In addition, no other genetic polymorphisms (GPs) were included in prior studies. We report on the largest PCS involving college football and men’s/women’s soccer players in the literature and include the APOE G-219T promoter and two Tau GPs in our analysis.

**PURPOSE:** To evaluate the association between sport related concussion and baseline neuropsychological (NP) test scores with several genetic polymorphisms (GPs) [GPs are APOE, APOE G-219T promoter (APOE Prom), Tau exon 6 Ser33Pro (Tau Ser) and Tau His477Tyr (Tau His)] in college athletes.

**METHODS:** A multi-center PCS of 1186 college athletes from 15 institutions completed a conc/medical history (hx) questionnaire, genetic sampling (buccal swab, saliva, and blood), and baseline web-based NP testing (Headminder\(^1\)). The overall population was 87% male, 59% white and mainly played football (67%) and soccer (24.4%).

**RESULTS:** Chi Square showed no significant association between experiencing an acute conc and the GPs. The Tau Ser TT genotype was associated with a trend towards reduced prospective conc ( p=0.094). T tests showed that baseline NP test results such as Simple Reaction Time (SRT), Complex RT (CRT), CRT Errors, and Processing Speed (PS) had no significant association with any genotype from the GPs. The APOE e4 allele was associated with a significantly lower SRT Errors score (p=0.013) and the Tau Ser TT genotype was associated with a significantly prolonged SRT (p=0.017). The APOE Prom TT genotype trended towards having a significant association with PS (TT having slower PS than GG/TT genotypes). The APOE Prom TT/GT genotypes trended towards significantly prolonged CRT scores (p=0.088).

**CONCLUSION:** This large PCS of college athletes showed no significant association between APOE, APOE Prom, Tau exon 6 Ser33Pro and His477Tyr and experiencing an acute conc. Future plans are to study the association between various GPs and post conc neurocognitive recovery.

**Acknowledgements:** NOCSAE and the AMSSM Foundation provided funding for this study.

Board #123 MAY 30 3:30 PM - 5:00 PM
Balance Testing of Concussion Patients Using Dual-Task Interference

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\(^{no relationships reported}\)

As proper medical care for sports concussions is increasingly emphasized, balance testing (BT) is emerging as a relatively new and promising method of concussion evaluation that warrants further investigation.

**PURPOSE:** To examine the diagnostic value of a novel BT protocol using dual-task interference from a cognitive challenge and compare longitudinal data from this and other concomitantly-used clinical concussion assessment tools.

**METHODS:** Clinically relevant data were collected from 68 concussed individuals (14-24 y) through standard symptom score evaluations, a computer-based neurocognitive test (ImpACT\(^3\)), and the dual-task BT protocol. Additionally, 26 healthy, age- and sex-matched individuals performed identical BT on two separate occasions to provide normative data. Postural stability (AMTI force platform) was assessed during four BT conditions: eyes open (O), eyes open + cognitive task (OC), eyes closed (C), and eyes closed + cognitive task (CC). The cognitive task required subjects to recite the months of the year backwards.

**RESULTS:**
RESULTS: Normative BT values for each condition were determined from the control data. An abnormal test was defined as 2.0 SD or more above the normative mean. Using these criteria, five distinct categories of concussion patients were identified: no balance deficits (ND), balance deficits only when vision was removed by closing the eyes (VD), balance deficits only during a cognitive task (CD), balance deficits during both the VD and CD conditions (VCD), and non-specific balance deficits (BD). ANOVA analysis revealed higher symptom score reports by the BD vs. ND group in total symptom score (p = 0.014), total physical symptoms (p = 0.005), total cognitive symptoms (p = 0.018), severity of complaint of balance problems (p < 0.001), and severity of complaint of difficulty with attention and concentration (p = 0.003).

CONCLUSION: Non-specific BT deficits in concussed patients are associated with greater reporting of symptoms. Dual-task interference BT with a cognitive challenge is a potentially valuable method of evaluation; yet, its clinical relevance is just now being established. Validation of this novel methodology may help to further establish BT as an effective tool in concussion treatment and research.

1716 Board #124 MAY 30 3:30 PM - 5:00 PM
Incidence And Neurocognitive Effects Of Concussion In Youth (8-12 Yrs) American Football: A Prospective Study
Anthony P. Kontos, R. J. Elbin, Scott Burkhart, Michael W. Collins. University of Pittsburgh-School of Medicine, Pittsburgh, PA. (Sponsor: Janet Buckworth, FACSM)
(No relationships reported)
As many as 5.5 million youth play American football each year, and recent reports indicate a two-fold increase in emergency department visits for sport-related concussions in youth (8-13 yrs) sport participants (Balhous et al., 2008). Surprisingly, research on sport-related concussion in American football has been limited to high school, collegiate, and professional populations. There has been no research to date on concussion and its effects in youth American football.

PURPOSE: The purpose of the current study was to examine the incidence and neurocognitive effects of concussion in youth (8-12 yrs) American football using a newly developed, youth-specific computerized neurocognitive test.

METHODS: The study employed a prospective repeated measures design involving 453 youth football players aged 8-12 yrs. Participants completed the Pediatric Immediate Post-concussion Assessment and Cognitive Test (Pediatric ImPACT) and concussion symptom inventory at pre- and postseason. Concussed athletes also completed Pediatric ImPACT and reported symptoms at 1-3 days, 5-7 days, and 10-14 days post-injury. Additional injury information was obtained from parents using the Acute Concussion Evaluation (ACE). Player exposure and incidence rates for practices and games were recorded throughout the season. A series of correlations, reliable change estimates (RCE), and ANOVAs were conducted to analyze the data.

RESULTS: A total of 20 (4.4%) athletes incurred a concussion during the season. All concussions occurred during tackling and were the result of helmet to ground or helmet to helmet impacts. Clinical decreases (i.e., RCE) in neurocognitive performance were evident at 1-3 days and 5-7 days post-concussion, but returned to baseline levels by 10-14 days post-concussion. Pre- to post-season test-retest correlations for the Pediatric ImPACT individual test modules were moderate and ranged from .20 to .52.

CONCLUSIONS: The results suggest that youth American football has a relatively low rate of concussion compared to high school and college levels. The results also suggested that the Pediatric ImPACT test was effective in measuring neurocognitive deficits in youth following concussion. Most deficits resolved by 10-14 days. This research was supported by a grant from the National Football League Charities.

1717 Board #125 MAY 30 3:30 PM - 5:00 PM
New Concussion Symptom Factors: Age and Sex Differences among High School and College Athletes
R.J. Elbin1, Anthony P. Kontos2, Phil Schatz3, Tracey Covassinn4, Jamie Pardini1, Michael W. Collins1, 1University of Pittsburgh, Pittsburgh, PA. 2St. Joseph’s University, Philadelphia, PA. 3Michigan State University, East Lansing, MI. (Sponsor: Janet Buckworth, FACSM)
(No relationships reported)
PURPOSE: The primary purpose of the current study was to examine using exploratory factor analyses (EFA) the factor structure of the 22-item Post-concussion Symptom Scale (PCS) in independent samples of baseline and post-concussion high school and collegiate athletes. A secondary purpose of the study was to examine sex and age differences in the symptom factor scores.

METHODS: Baseline participants included 30,455 athletes (27,008 high school, 3,447 collegiate; 14,295 female, 16,160 male). Post-concussion participants included 1,438 athletes (944 high school, 494 collegiate; 477 females, 961 males) within 1-7 days of a concussion. Participants completed the PCS. Two EFAs for baseline and post-concussion samples were conducted. A series of 2 (age) x 2 (sex) ANOVAs with Bonferroni correction for multiple comparisons were conducted for the baseline and post-concussion factors.

RESULTS: Baseline EFA supported a four factor solution (49.1% variance): 1) Cognitive-Migraine, 2) Sleep, 3) Vestibular-Headache, and 4) Emotional. The post-concussion EFA supported a four factor solution (58.3% variance): 1) Cognitive-Migraine, 2) Emotional, 3) Somatic, and 4) Sleep. High school athletes reported higher baseline Migraine (1.28±1.16) and Vestibular factors (.83±.61), but lower Sleep factor scores (1.86±1.99). Females reported higher Migraine (1.43±1.12), Sleep (2.13±1.65), Vestibular (.95±.67), and Emotional factors scores (1.57±.85). High school athletes reported lower post-concussion Sleep factor scores (1.41±2.03). Females reported higher post-concussion Emotional factor scores (1.56±.90).

CONCLUSIONS: The results supported a four factor structure for both the baseline and post-concussion samples. However, several differences between baseline and post-concussion factor and age and sex differences were apparent and should be considered by clinicians and researchers.

1718 Board #126 MAY 30 3:30 PM - 5:00 PM
Dual-task Assessment Of Concussion: Switch-task Stability Reliability Estimation
Phillip D. Tomporowski, FACSM, Stephanie L. Cooper, Michelle S. Okumura, Michael S. Ferrara. University of Georgia, Athens, GA.
(No relationships reported)
The incidence of sport-related concussion is high, with 1.6 to 3.0 million sport-related concussions reported annually. Standardized, computer-based neurocognitive test batteries have been used in the assessment and management of sport-related concussion; however these tests are limited to cognitive functioning only. The dual-task methodology combines a physical and a mental task and closely replicates practice and game conditions, which can yield valuable information for return to play decisions.

PURPOSE: To examine the stability reliability of a dual-task test that combines stair stepping with an auditory detection task.

METHODS: 59 young adults (Mean age = 20.32 years; 40 female) performed a 5-min modified Harvard step test and an auditory switch test during two sessions separated by 7 days. The switch task measures the time required for an individual to inhibit an ongoing mental task and to initiate a different mental task, processes that are characteristic of executive function. Switch-task trials involved letter (vowel/consonant) or number (even/odd) discriminations to stimuli presented on headphones and recorded via two keys on a hand-held computer mouse. The stability reliability was assessed for switch-task tests consisting of 30, 40 and 60 items.

RESULTS: Intraclass correlations (ICC) estimated the stability of response time for switch and non-switch trials The ICCs for the 30-item test were 0.60 (switch) and 0.61 (non-switch). The 40-item test yielded ICCs of 0.89 (switch) and 0.72 (non-switch). The 60-item test yielded ICCs of 0.85 (switch) and 0.75 (non-switch).

CONCLUSION: The dual-task methodology shows acceptable reliability for both the 40 and 60 item tests. As part of a comprehensive concussion management plan, the dual task methodology may prove to be especially useful for making return-to-play decisions as it closely mimics physical activity and on-field performance by combining controlled motor movements and complex mental task performance.
Athletes are inherently less motivated when completing preseason concussion baseline testing than during post-concussion evaluations. When comparing back to baseline values during post-concussion evaluations, improved effort may mask deficits.

PURPOSE: To determine if baseline neurocognitive and postural control performance differ between athletes who demonstrate poor effort (PE) and those who demonstrate satisfactory effort (SE).

METHODS: 165 incoming student-athletes completed baseline testing including a computerized neurocognitive test (CNS Vital Signs), a postural control exam (SOT; Sensory Organization Test), and a measure of test-taking effort (DCT; Rey Dot Counting Test). PE was defined as a DCT combination score ≥ 15 and SE was defined as a DCT combination score < 15. We first identified 27 athletes (16%) that demonstrated PE at baseline. Each athlete in the PE group was matched based on gender, concussion history, learning disability diagnosis, and ADHD diagnosis to a single control who demonstrated SE at baseline (PE: n=27, SE: n=27). Separate one-way ANOVA models were used to compare the SE and PE groups on 8 CNS Vital Signs standard scores (composite memory, psychomotor speed, reaction time, complex attention, cognitive flexibility, processing speed, executive functioning, and reasoning) and a postural control score (SOT composite score) with an a priori alpha level of 0.05.

RESULTS: The PE group performed significantly worse than the SE group on composite memory (PE:98.4±17.4 vs. SE:99.8±14.6, F_1,52=6.1, p=0.05), psychomotor speed (PE:100.2±11.3 vs. SE:106.1±9.4, F_1,52=4.4, p=0.04), reaction time (PE:93.5±18.6 vs. SE:102.3±9.6, F_1,52=4.6, p=0.04), cognitive flexibility (PE:81.9±26.9 vs. SE:95.4±21.8, F_1,52=4.1, p=0.05), and processing speed (PE:88.6±22.7 vs. SE:101.5±14.5, F_1,52=6.2, p=0.03). No other significant differences were observed.

CONCLUSION: Athletes who demonstrated PE at baseline performed significantly worse on several neurocognitive domains. This supports the notion that baseline neurocognitive scores are only as good as the effort that an athlete extends. Sport medicine professionals administering baseline testing may consider incorporating this brief measure of effort at baseline and post-concussion to determine an appropriate evaluation plan.
Concussions are the most common form of head injury in recreational and competitive sports and have recently been identified as a major public health concern worldwide. With greater ever-increasing involvement of individuals in athletic endeavors has resulted in sport-related concussion receiving major attention over the last decade. Concussion is frequently seen in recreational and competitive sports, and is a major public health concern worldwide. There have been considerable changes to the diagnosis, classification and management of concussion in recent years, causing confusion due to a lag in knowledge translation to the end users.

**PURPOSE:** This study sought to identify current knowledge, practice patterns, and optimal forums for fostering knowledge translation among family physicians in Alberta, Canada.

**METHODS:** Family physicians were mailed letters of recruitment through the Alberta Family Practice Research Network (AFPRN), and asked to reply with their willingness to participate in the on-line survey. Seventy-eight of 3154 family physicians responded (2.5% response rate).

**RESULTS:** While 96% of these physicians reported diagnosing and treating concussions in their work settings, only 54% consistently utilized current concussion guidelines. Sport-related activities constituted the majority (71%) of concussions seen. Physicians relied primarily on clinical examination (32%), and player self-report of symptoms (32%) to make return-to-play decisions. Only 2% reported using any form of neurocognitive testing, and (surprisingly) 5% were still using concussion grading scales. Physical rest was recommended as treatment by 96%, but only 71% also suggested cognitive rest. Seventy-one percent (71%) of physicians had taken continuing medical education (CME) credits to learn more about concussion. Physicians rated CME courses (14%), conferences (12%), training in medical school or residency (18%), consultation with colleagues (15%) or specialists (10%), and websites (14%) as their best sources of information regarding concussion. However, they rated CME courses and on-line courses with CME credits (total 46%) as their most preferred method to gain further knowledge.

**CONCLUSION:** Significant gaps still exist in knowledge transfer to family physicians about up-to-date practices for clinical diagnosis and treatment of sport-related concussion. More educational efforts and training opportunities are needed to optimize physician management of this common condition.

**Board #132**

MAY 30

3:00 PM - 5:00 PM

No Evidence of Neuropsychological Performance Deficits in a Group of Male Collegiate Soccer Players from Purposeful Heading

Thomas W. Kaminski, FACSM, Jennifer Halterman, Charles B. Swainik, Joseph J. Glutting, University of Delaware, Newark, DE.

(No relationships reported)

Purposeful heading is an inherent and strategic part of soccer, and has the potential to result in concussion if performed incorrectly. Some have questioned whether or not each episode of heading results in minor insults to the brain and if there are cumulative effects resulting in impaired neurocognitive functioning.

**PURPOSE:** This study examined the relationship between heading exposure, playing position, and neuropsychological test scores.

**METHODS:** The database consisted of collegiate male soccer athletes who completed yearly pre and post-participation ImPACT neuropsychological tests; however only 16 players had data from three consecutive playing seasons. The number and type of header were tracked for each player at both practices and games. Bivariate correlation coefficients were calculated between the three predictors: total practice (totheadpx), game (tothead) and combined headers (tothead). The criteria included the six ImPACT composite scores. Additionally, differences between playing positions (midfield/offense vs. defenders) were examined using independent samples t-tests.

**RESULTS:** The total headers ranged from 160 to 422. Correlations table:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Predators</th>
</tr>
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<tbody>
<tr>
<td>verbmem</td>
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<tr>
<td>attention</td>
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<tr>
<td>score</td>
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</tr>
</tbody>
</table>

None of the correlation coefficients were statistically significant; nor were there significant differences between any of the ImPACT scores and the position groups.

**CONCLUSIONS:** Despite many anecdotal reports suggesting links between purposeful heading and deficits in brain function, this study indicates that no relationship exists between the number of headers and neuropsychological test performance in male collegiate soccer players. Despite some player positions accumulating more total headers, there were no differences in ImPACT scores between groups.

**Board #133**

MAY 30

3:00 PM - 5:00 PM

Sport Concussion Knowledge, Clinical Practices, and Needs for Continuing Education: A Survey of Family Physicians

B. Joel Tjarks, Verle D. Valentine, Constance M. Lebrun, FACSM, Jason C. Dormair, Martin Mrazik, Abhaya S. Prasad, Thayne A. Munce, Michael F. Bergeron, FACSM, University of South Dakota, Vermillion, SD. Sanford USD Medical Center, Sioux Falls, SD. University of Alberta, Edmonton, AB, Canada.

(No relationships reported)

Concussions are the most common form of head injury in recreational and competitive sports and have recently been identified as a major public health concern worldwide. With greater clinical and scientific appreciation of effects and recovery time, new research and discoveries, newly adopted legislation and revised management guidelines, sport-related concussion has received considerable attention recently from the media and healthcare organizations. Concomitantly, it is challenging for healthcare professionals to remain informed of the latest evidence-based concussion information.

**PURPOSE:** To identify current knowledge and practice patterns of family physicians in North Dakota and South Dakota regarding their clinical management of patients with sport-related concussion; and to examine their preferred delivery methods of knowledge transfer and exchange on this subject.

**METHODS:** A brief, internet-based survey (21 questions) was distributed to family physicians in North Dakota and South Dakota from a database provided by the American Academy of Family Physicians. One hundred nine (109) out of five hundred forty-five (545) family physicians completed the survey (20% response rate).

**RESULTS:** Only nine physicians (9.4%) said they are currently using the most up-to-date guidelines established at the 3rd International Conference on Concussion in Sport held in Zurich in
2008. Physical rest is recommended by 75% of physicians, while only 65% recommend cognitive rest. Outdated grading scales are still being used by physicians for their initial assessments (27%) and return-to-play decisions (12%). There were assorted answers regarding these physicians’ current sources for learning about concussions, but the most preferable method (66.7%) was through a Continuing Medical Education (CME) course (online or otherwise). The majority of respondents (84%) indicated that they would like to receive additional education on concussions.

CONCLUSIONS: Myriad family physicians are managing sport-related concussions using clinical diagnoses and management practices that are inconsistent with current information and guidelines. Accordingly, a more deliberate and effective effort to re-educate and maintain knowledge in family physicians is critical to enhance patient care in this population.

1726 Board #134 MAY 30 3:30 PM - 5:00 PM
Concussion History and Exertional Heat Illness-Related Symptomatology Among Division-I Collegiate Athletes
Michael L. Alosco, Crysten Knecht, Ellen Glickman, FACSM, Michael F. Bergeron, FACSM, John Gunstad, 1Kent State University, Kent, OH. 2University of South Dakota, Sioux Falls, SD.

(No relationships reported)

Sports-related concussions are prevalent and increasingly recognized to be associated with a variety of adverse short- and long-term clinical outcomes. Recent findings indicate that traumatic brain injury is associated with disruption of the autonomic nervous system (ANS). However, while exertional heat illness (EHI) is also a familiar problem in many sports, the effect of concussion history on EHI risk has not been elucidated.

PURPOSE: This study examined the association between concussion and EHI symptomologies histories among a sample of NCAA division-I athletes.

METHODS: Analyses were conducted on 100 baseline assessments of NCAA division-I football, soccer, and field hockey athletes (58 males, 42 females; 19.8±1.4 years). All athletes completed baseline ImPACT™ testing and a brief questionnaire assessing history of EHI-related symptomatology.

RESULTS: Concussion history was common in the sample, with 28% reporting a history of at least one concussion. Chi-square statistics revealed a greater frequency of EHI symptoms in athletes with a history of concussion compared to those without such history, including getting tired faster than normal (χ² (1, N = 100) = 5.08, p = .02), very fast heart rate (χ² (1, N = 100) = 6.86, p = .01), muscle cramps (χ² (1, N = 100) = 5.90, p = .02), and feeling light headed (χ² (1, N = 100) = 4.58, p = .03). When restricting the sample to only football players, similar findings emerged, specifically for muscle cramps (χ² (1, N = 99) = 6.14, p = .01), feeling like they might black out (χ² (1, N = 99) = 6.65, p = .05), and fast heart rate (χ² (1, N = 99) = 4.59, p = .03).

CONCLUSIONS: Athletes with a history of concussion may be at greater risk for EHI than those without such history and thus might warrant more deliberate EHI prevention measures and closer monitoring. Prospective studies of ANS function following concussion and concomitant effects on exertional heat strain will clarify potential changes in EHI risk.

B-29 Free Communication/Poster - Energy Balance
MAY 30, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

1727 Board #135 MAY 30 3:30 PM - 5:00 PM
The Relation Between Bone Mineral Density And Cardiovascular Factors Among Iranian Female Athletes With Amenorrhea/oligomenorrhea
Haleh Dadgostar, 1Ghazaleh Soleimani, female, 2Sara Lotfian, female, 3Mazuyar Moradi lakeh, male, 3Elham Dadgostar, female, 3Shafieh Movaseghi, female, 3Talía Alenabi, female, 31Sports Medicine Research Center, Tehran University of Medical Sciences, Tehran, Iran, Islamic Republic of; 2Rafideh akram hospital, Tehran University of medical sciences, Tehran, Iran, Islamic Republic of; 3Sports Medicine Research Center,Teheran University of Medical Sciences, Tehran, Iran, Islamic Republic of.

PURPOSE: Oligoamenorrhea, as a part of the Female Athletic Triad has adverse effects on the athlete’s bone mineral density and cardiovascular system. Hypoestrogenism, due to suppression of PHO axis as a result of energy imbalance, is the possible cause of the Triad. This study was designed to clarify the effects of hormone therapy on bone mineral density and cardiovascular factors.

METHODS: The study is a 9-month clinical trial in the first part of which 22 female athletes with a history of at least 2 years of oligo/amenorrhea, bone mineral densitometry (BMD) and some of the cardiovascular factors were measured. In the second part of the study 18 athletes were randomized in two groups of OCP (n=10) and control (n=8). After 9 months densitometry and cardiovascular lab study were repeated.

RESULTS: In the first assessment, Mean of all cardiovascular factors was in the normal range except for HDL, however, most of the athletes had abnormalities in their lipid profile. Inverse relationship between the increase in the BMD of spine and total cholesterol, Apo A, and VLDL and also positive correlation between BMD of spine and HbA1C were significant. In the second part, VLDL and Apo B reduced significantly in the OCP group. Increase of Apo A was observed in control group. Changes in the ratio of Apo B to Apo A was significant in both groups.

CONCLUSIONS: There may be a common factor affecting both skeletal and cardiovascular systems, as with the increase of the BMD of spine, there is a decrease in the amount of serum total cholesterol, Apo A and VLDL. Results of this study imply that although estrogen administration may not increase bone density, it could have positive effects cardiovascular system, especially lipid profile. In order to evaluate the long-term effect of estrogen administration in athletes suffering from menstrual irregularities, studies with larger sample size and longer duration is required.

1728 Board #136 MAY 30 3:30 PM - 5:00 PM
Need For A Tool: Handling Professional Soccer Players Biochemical Data
Giulio Tempesti, 1Alice Bartolini, Niccolò Gori, 1Giovanni Romagnoli, 2Paola Pezzati, 1Laura Stefaní, 1G iorgio Galanti, 2Sports Medicine, Florence, Italy. 3Engineering Informatic Facuity, Florence, Italy. 4General Laboratory Diagnostic Department, Florence, Italy.

(No relationships reported)

PURPOSE: According to Italian regulation, professional athletes undergo to a periodical biochemical parameters evaluation addressed to maintain health. A software toolkit analyzes biochemical parameters focused on monitoring of Least Significant Change (LSC) for hematological variables. Method: Since January 2008 to July 2011 professional soccer players blood samples were collected. According to quality standard reference Clinical Laboratory, a dedicated software (“Victory”) allows the user retrieving LSC in the team’s athletes. LSC = 2.77(CV% + CV%)² equation, including every athlete’s data, derived from soccer seasonal training period. The software identifies hematological values exceeded the LSC values.

RESULTS: Standard hematological mean team values (2009/2010), examined considering ethnicity, age and role, were within the normal range (Hb 15.2±0.6g/dL, min 13.9, max 16.6; Hct 43.0±1.9 %, min 41.0, max 49.0; MCV 87.3 ± 3.0f L, min 82.0, max 93.5; reticulocytes 0.0433 ±0.0128 x 10¹²/L, min 0.0186, max 0.0732). In parallel the LSC for Hb (5.80%), Ht (8.20%) and MCV (2.41%) and reticulocytes count (17.96%) resulted to be normal, with the exclusion of soccer players data that exceed LSC value in consequence of the training period at the same work load. In the 6.2 % of the all samples investigated for each athlete, the hematological parameter was over the LSC.

CONCLUSION: The software retrieves epidemiological information based on the physiological changes of the hematological parameters occurring during the seasonal competitions. It can therefore be propose to clarify several clinical questions related to regular training or to risk factors particularly if in presence of different work load or recurrent injuries.
1729  Board #137  MAY 30  3:30 PM - 5:00 PM
A Long Term Sport Activity and Micordacular Performance In Breast Cancer Women
Lauria Stefani, Gabriele Innocenti, Valentina Di Tante, Baria Corsani, Gabriele Mascherini, Irene Scacciati, Alessio De Luca, Giorgio Galanti. Sports Medicine, Florence, Italy.

(Purpose: The beneficial effects of the exercise as prescription in cancer is well known, however few information are now available on the cardiovascular performance when competitive sport is regularly practiced. The study was aimed to evaluate in a group of breast cancer women (BCW), the effects of dragan boat sport on the myocardiac performance during a 4 years follow up study.

Methods: Since 2006 to 2010, one year after breast cancer treatment, a group of 30 regularly trained (Dragon- Boat ) women, without metastasis, has been followed at Sports Medicine Center in Florence - Italy. They were yearly submitted to a maximal cardio-pulmonary test and to an ECG echocardiographic exam evaluating morphological and functional cardiac parameters in addition to Heart Rate (HR) and Blood Pressure (BP) values, measured at rest and at the end of the effort. All data were compared ( T-Student Test) to a group of competitive healthy women (HW).

Results: At the end of the 4 follow-up years all the echo parameters were within the normal range in both groups. (Fig1) Despite CMI and BMI were significantly higher in HW than in BCW, the EF resulted to be similar. After 4 years of training in BC group the HR at rest was lower (78.12±13) than at the beginning (80.7±11.7) of the study. Systolic and Diastolic BP were comparable to the healthy athletes normal values.

Conclusions: The results obtained are suggestive for a beneficial effect of sports activity in cancer with an excellent exercise tolerance. A long term competitive sport activity does not seem to have any negative impact on the myocardiac performance in them.

1730  Board #138  MAY 30  3:30 PM - 5:00 PM
Cardiovascular Performance And Prevalence Of Menstrual Disorders
Silvia Lorin1, Laura Stefani1, Loira Toncelli1, Maria Concetta Robertina Vono1, Metella Dei2, Giorgio Galanti1. 1Sports Medicine, Florence, Italy. 2Child and Women Health Department, Florence, Italy.

(Purpose: The incidence of anomenorhea is much grater among the athletes than in sedentary, however the implication of this feature with the cardiovascular performance remain less clear. The study is aimed to investigate this aspect in a larger group of athletes from sports at different static and dynamic component.

Methods: Two groups of athletes 1Group (1G of 50 subjects ) aged 16±2, from swimming and dance at high dynamic and low static load and 2Group (2G of 50 subjects ) from volley-ball and gymnastic artistic at moderate/high dynamic and static load, were submitted to a questionnaire to evaluate the prevalence of menstrual disorders and also to an echocardiographic exam to verify the associated morphological and functional pattern.

Results: The menstrual disorders result to be generally low (13 % ) with an exclusive presence in the 2G. All the echo parameter are within the normal range in both without any significant variation with the exclusion of the Cardiac Mass Index(CMI ) value that results to be significantly lower in the 2G respect of the 1G(Fig1). Otherwise the nutrition parameters show a significant increase of the Fat Free Mass (FFM) in the 1G vs the 2G. An inverse behavior (Fig2has been observed for the Fatty Mass (FM)

Conclusions: The results support the hypothesis that the prevalence of the irregular menstrual cycle are independent from the nutritional parameters in sports at high-moderate dynamic component. An opposite trend is evident for the CMI that seems to be associated to a superior and more equilibrated body composition.

1731  Board #139  MAY 30  3:30 PM - 5:00 PM
Ferritin, Hematocrit, And Hemoglobin As Biochemical Markers Of Iron Deficiency In Collegiate Runners
Lindsey E. Eberman1, Leamor Kahanov1, Nicholas Long1, Heather Adams1, Michelle L. Landis2, Janis Ingebretsen3. 1Indiana State University, Terre Haute, IN. 2Union Hospital, Terre Haute, IN.

(Purpose: We sought to observe serum ferritin, hematocrit, and hemoglobin levels of collegiate runners.

Methods: As part of the pre-participation physical exam in an NCAA Division I Institution in the mid-western US, male (n=23; age=20±1; height=69.7±2.5in; weight=147.4±16.3lb; in-season mileage=39.3±5.9/wk; off-season mileage=60.2±19.6/wk) and female (n=19; age=20±1; height=64.2±2.7in; weight=126.0±14.5lb; in-season mileage=40.1±7.9/wk; off-season mileage=39.3±5.9/wk) cross country and track athletes underwent blood-draw and physical history examinations. Following the examinations, we acquired access to the anonymous data for further analysis. We collected age, height, weight, gender, ferritin, hematocrit, and hemoglobin levels from all participating athletes.

Results: Overall, the collegiate runners demonstrated within normal limits ferritin (males=63.4±29.3ng/mL; females=44.1±50.8ng/mL; normal range=13-150ng/mL), hematocrit (males=41.7±2.2%; low range<45%; females=38.9±2.2%; low range<40%), and hemoglobin levels (males=14.6±0.8g/dL; normal range=13.8-18.0g/dL; females=13.7±0.7g/dL; normal range=12.1-15.1g/dL). However, when determining athletes with low levels, we found differences in at-risk athletes based on the criteria. We identified lower than normal ferritin levels in 2 males and 1 female. We identified 22 males and 12 females with insufficient levels of hematocrit. Hemoglobin was lower than normal in 6 males.

Conclusions: The collected hematological levels may be an indication of overtraining; however, such levels are expected of the body’s response to stress and return to normal levels during periods of rest/off-season. The research suggests that observing ferritin levels alone may not be sufficient to determine iron deficiency. Hematocrit level is a more sensitive indicator of iron deficiency when triangulated with ferritin and training regime.

1732  Board #140  MAY 30  3:30 PM - 5:00 PM
Diet Versus Diet Plus Exercise On Weight And Depression In The Severely Obese

(Purpose: To examine the effect of diet with delayed exercise (D) versus diet plus exercise (DE) on depressive symptoms and weight in individuals classified with Class II (BMI: 35.0-39.9 kg/m^2) or III (BMI: ≥40 kg/m^2) obesity.

Methods: 118 obese individuals (age=46.2±6.3 years; BMI=43.5±5.4 kg/m^2) were randomized to a D or DE intervention. Both D and DE received a reduced calorie diet (1200-2000 kcal/wk) through a behavioral modification program. DE was also prescribed exercise that progressively increased to 300 min/wk by month 6. Weight and the Beck Depression Inventory (BDI) were measured at baseline and 6 months.

Results: Weight loss was significantly different between D (8.1±5.9 kg) and DE (11.0±7.3 kg) (p<0.05). Both D and DE significantly decreased BDI score with no difference between groups. Subjects were grouped as having lower (BDI<13, N=89) and higher baseline BDI scores (>13, N=29). There was no significant difference in weight loss or improvement in BDI score between D and DE for those a lower baseline BDI. However, weight loss was significantly different in D (6.5±6.3 kg) vs. DE (12.3±8.6 kg) for those with a higher baseline BDI, but no difference for improvement in BDI.

414

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RESULTS: Low energy availability (EA) in endurance-trained women may develop by intentional or unintentional means in the presence of diverse eating attitudes and behaviours. This study investigated the ability of an on-line web-based survey to identify the clustering and prevalence of at-risk factors for low EA in endurance-trained women.

METHODS: Women registered for endurance running events in New Zealand completed an anonymous web-based questionnaire comprising questions pertaining to eating attitudes and behaviours, medical, menstrual and injury history. Descriptive information (e.g. self-reported age, height, body weight and training load) was also sought.

RESULTS: Data were completed by 698 respondents (29.6±7.1y). Cluster analysis encompassing at-risk factors for low EA identified three distinct subgroups. One cluster classified 57.6% of the sample ‘not-at-risk’ for low EA as defined by normal Eating Disorders Inventory drive for thinness (DFT, 1.5±2.0), Three Factor Eating dietary restraint (TFE-R, 5.0±3.0) and Eating Disorder Examination restraint (EDE-R, 0.6±0.8) scores. Elevated DFT (7.0±3.9) and TFE-R scores (13.3±2.5) classified 29.8% of respondents in a second cluster ‘at-risk’ for low EA. High DFT (18.1±2.7), TFE-R (15.3±1.0) and EDE-R (3.3±1.2) scores classified 13.3% of respondents in a third cluster ‘at-high-risk’ for low EA. The frequency of answering yes to “do you think you may have an eating disorder?” and weight loss attempts for sport and social reasons was also high (36.4%, 31.8% and 46.6% respectively) in this cluster. A high number of respondents (38.8%, 45.7% and 69.3%) in clusters 1, 2 and 3 respectively did not attempt to increase energy intake when exercise energy expenditure was increased.

CONCLUSION: A web-based questionnaire identified diverse subgroups of eating attitudes and behaviours and a high prevalence of at-risk factors for low EA in a large sample of endurance-trained women. Online tools that consider the complexity of eating attitudes and behaviours and other currently established at-risk factors (e.g. BMI, menstrual irregularity) may be useful for wide-spread screening for low EA in endurance-trained women.

CONCLUSIONS: Results suggest severely obese adults lose significantly more weight with DE compared to D; however, both result in similar improvements in depressive symptoms. DE and D were equally effective for weight loss in individuals with less depressive symptoms. OF importance is that for those with more severe depressive symptoms, DE was more effective for weight loss than D, suggesting the clinical implication of prescribing DE for weight loss in these individuals. Strategies to maximize adherence to both diet and exercise are recommended.

Supported by the Pennsylvania State Department of Health
PURPOSE: To determine whether having an ongoing medical condition has any influence on successfully finishing this ultra-marathon and to determine the frequency of NSAID use during the race.

METHODS: All participants completed either electronic or paper surveys before the race. Information regarding runners’ age, gender, and race time is also available to the public online.

RESULTS: Out of 625 competitors who started the race, 616 (98.6%) completed the medical questionnaire and the survey. Average age was 40.9 (range 17-85) years. Most participants (84%) were male. More than half (n = 346, 55.4%) finished the race under the cut-off time of 30 hours. Only 53 (8.6%) runners reported having an ongoing medical condition and 46 (7.4%) were taking prescribed medications. Less than one third of the runners (28.2%) reported wearing OTC or custom-fit orthotics. Interestingly, 169 runners (27.6%) were planning to take NSAIDs during the race. There was no statistical correlation (p > 0.05) between successfully finishing the race and whether or not the runners reported having ongoing medical conditions, taking prescribed/OTC medications, and wearing orthotics.

CONCLUSION: It seems that having an ongoing medical condition, taking prescribed/OTC medications, or wearing orthotics have no significant influence on successfully completing this high-altitude ultra-marathon. Significant numbers of participants still planned to take NSAIDs despite discouragement by race medical team.

<table>
<thead>
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<th>Serum Sodium Level of 35.10K Runners</th>
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<td>2</td>
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</table>

**Board #145**  MAY 30  3:30 PM - 5:00 PM

**Changes In Serum Sodium Before And After A 10 Kilometer Race**

Mark Troxler, FACSM, USA Track & Field, Allen, TX.

(No relationships reported)

**PURPOSE:** To demonstrate that a clinically significant change in serum sodium occurs before and after a 10 Kilometer race.

**METHODS:** A randomized controlled trial with each subject acting as their own control. 35 randomized volunteer participants of a 10K run. Two hours before the race each study athlete was taken for a post-urine/bowel void weight measurement and 5cc of blood was drawn. After the race each athlete reported how many 8oz cups of water they drank and 5cc of additional blood was drawn as well as each athlete was weighed. The change in the serum sodium was the primary outcome and the body weight change and fluid consumption was the secondary outcomes. Change in serum sodium versus change in body weight and fluid consumption was analyzed.

**RESULTS:** 55 run participants volunteered for the study. After randomization 35 randomized volunteer participants of the 10K run entered the study. 24 were male and 11 were female. Of the 35 runners, zero had a serum sodium level above 145mmol/L, three had a serum sodium level below 135mmol/L, and thirty two had a serum sodium of 135-143mmol/L. Of the hypotremic (sodium <135mmol/L) participants two runners (Premenopausal Females) were low before the race and one runner (Postmenopausal Female) was low after the race. Only three runners, all men, drink a greater total amount of water than the female post-race hypotenormotic runner. Only 6 runners, all men, drink more water before the race then the two pre-race hypotenormotic female runners. Ten runners had a reduction in serum sodium during the race.

**CONCLUSIONS:** Premenopausal women should limit their fluid intake before the race regardless of the distance. Postmenopausal women should limit their fluid intake during the 10K race.

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**Board #146**  MAY 30  2:00 PM - 3:30 PM

**Resistance Training Induces Similar Hypertrophy in the Arm and Thigh Musculature of Young Women.**

William J. Booth1, Adam N. Upshaw2, Sarah B. Wilkinson1, Peter W. R. Lemon, FACSM1, Charles L. Rice, FACSM2, Greg D. Marsh1, 2The University of Western Ontario, London, ON, Canada. 3University of Guelph-Humber, Toronto, ON, Canada.

(No relationships reported)

Muscle strength is strongly related to muscle cross-sectional area (CSA). Resistance training can increase muscle CSA and this hypertrophy can be optimized by combining resistance training with post exercise dietary supplementation. Previous research has shown that following resistance training young men hypertrophy to a greater extent in the arm (+16.0%) than in the thigh (+8.5%). This differential hypertrophy has been less well studied in women.

**PURPOSE:** To compare hypertrophy of the thigh to the arm in young women following a 10 week resistance training program with post-workout supplementation.

**METHODS:** Forty untrained females (23±4y) engaged in supervised resistance training three times per week targeting both the upper and lower body for 10 weeks. Participants performed 1-RM testing at pre-, week 3, week 6 and week 9 to ensure that the resistance remained between 80-85% of their 1-RM. All participants refrained from any food intake for at least 1 h prior to their workouts. Immediately after each session, participants ingested a protein, carbohydrate drink containing at least 21g of protein. All participants were assessed with 3T magnetic resonance (MR) imaging on their non-dominant side prior to the 10 week program and again at least 5 days (no more than 8 days) after their final session. The largest CSA (averaged over 5 slices) pre-training was analysed using computer software and compared to the same CSA post-training.

**RESULTS:** Post-training both arm and thigh musculature CSA significantly increased (1.6cm2 and 6.8cm2, respectively) (p<0.05). However, the increase in the thigh (7.3%) was not significantly different than the increase in the arm (8.0%).

**CONCLUSIONS:** Although CSA significantly increased in both the thigh and arm musculature, the change for these women was not significantly different between upper and lower limbs. Further, the % increase in arm CSA was similar to that previously reported in men while the thigh hypertrophy was less than that found in men. Differences between male and female hypertrophy may be explained by fibre type differences, hormonal influences, or body mass distribution differences.

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**Board #147**  MAY 30  2:00 PM - 3:30 PM

**The Effects of Low Intensity Resistance Training and Detraining on Isokinetic Strength in Postmenopausal Women.**

Meng-yu Chen1, Chiao-Hsin Chen2, Linda Lin1. 1National Cheng Kang University, Tainan, Taiwan. 2Chi-Mei Medical Center, Tainan, Taiwan.

(No relationships reported)

**PURPOSE:** To examine the effects in isokinetic strength and body composition’s factors after one year of low intensity resistance training, and 24 weeks of detraining in postmenopausal women.

**METHODS:** There were 15 healthy volunteers matched for strength were assigned to a control (n=7, age: 55.26±3.09 years, BMI: 23.89±5.02 kg/m2) or exercise group (n=8, age: 55.63±5.03 years, BMI: 21.36±3.41 kg/m2). The exercise group exercised one year by using the elastic bands or body weight for resistance. The training program consisted of 2 sessions per week of a supervised progressive high repetition and low intensity training. The measurement was performed by Biodex System to collect data of muscle strength of upper and lower limb. Body composition was estimated by dual energy X-ray absorptiometry (DEXA). The body fat and lean body mass were assessed at baseline, after training and detraining. Pearson product-moment correlation and Mann-Whitney U test were used for data analysis.

**RESULTS:** The exercise group demonstrated significant improvements in peak torque divided by weight of biceps (2.01%) after one year training. And the fat percentage of legs were significantly greater in exercise group (+7.5 %) than the control groups (+2.0 %) (p<0.05). The muscular isokinetic strength was positively correlated with lean body mass in the upper limb.
Supported by JSPS KAKENHI 23500780.

**CONCLUSION:**

RF was not correlated with the performance time or VO2peak.

The 2000 m performance time and VO2peak were significantly improved (415 ± 9 sec and 62.1 ± 5.6 ml/kg/min, respectively) while only VL T increased (14.5 ± 44.6%, p<0.07) while only VL T increased (and 6.6 ± 11.1%, p<0.05).

**RESULTS:**

The results indicated that there was no significant (p > 0.05) time x velocity interaction, but significant main effects for time and velocity. The follow-up t-tests for the marginal means for time (collapsed across velocity) indicated that there was no significant difference between pretest 1 and pretest 2, but the posttest was greater than both pretest 1 and pretest 2 (p < 0.05).

Thus, the short-term training resulted in increases in PT at all velocities. The follow-up t-tests for the marginal means for velocity (collapsed across time) indicated that PT decreased significantly with velocity.

**CONCLUSIONS:**

Thus, unlike a previous short-term training study that found no increases in PT for the forearm flexors after 2 days of isokinetic training, these findings indicated that 3 days of concentric isokinetic training for the forearm flexions was sufficient to elicit increases in PT. These findings provide specific information for use by allied health professionals, such as physical therapists and athletic trainers, who are responsible for developing resistance training programs to prepare injured athletes to return to practice and competition. In addition, the results of the present study may be useful for physical and occupational therapists in prescribing rehabilitation programs to help patients return to work.

**PURPOSE:**

To determine whether a 15-week marathon training program alters skeletal muscle architectural parameters (thickness [T], pennation angle [Θ], and fascicle length [FL]) in the vastus lateralis (VL) and lateral gastrocnemius (LG) of 10 recreationally active but untrained college-aged subjects.

**METHODS:**

Before and after training, VL and LG architecture was imaged using B-mode ultrasonography in addition to maximal voluntary contraction (MVC) and treadmill cardiovascular testing. T and Θ was measured offline using NIH imaging software and FL was formulated using a prediction equation. Dependent t-tests were used to compare pre-post values for each parameter.

**RESULTS:**

LG T and Θ increased (3.8 ± 6.7% and 19.3 ± 2.2%, respectively [p<0.05]) and LG FL decreased (14.5 ± 44.6%, p<0.07) while only VL T increased (and 6.6 ± 11.1%, p<0.05).

Fractional oxygen utilization at 11.1 ± 0.5 km/hr improved (70.3 ± 2.4% vs 65.9 ± 2.1%, p<0.05) while other cardiovascular parameters and MVC were unchanged.

**CONCLUSION:**

15 weeks of endurance run training modifies LG architecture and fractional oxygen utilization. These muscle-specific architectural adaptations reflect single muscle fiber observations from the same training program in that the LG seems to be more sensitive to run training than the VL. Further, LG alterations substantiate previous cross-sectional data gathered in distance runners (high pennation angle and shorter fascicles), implying that the distance runners’ architectural profile can at least partially be attributed to training. The functional implications of these adaptations warrant further investigation.

**PURPOSE:**

The purpose of this study was to examine whether the preparation period training improved the aerobic power and muscle oxygenation during preparation period rowing.

**METHODS:**

Fourteen male collegiate rowers participated (age: 20 ± 1 yrs, height: 178.4 ± 7.9 cm, weight: 75.8 ± 7.9 kg) in this study. Subjects were tested before and after a 3-month preparation period training. We evaluated the performance time and the peak pulmonary oxygen uptake (VO2peak) during a 2000 m rowing ergometer test and the half-recovery time of muscle reoxygenation (1/2reoxy time) using near-infrared spectroscopy in the vastus lateralis (VL) and rectus femoris (RF) during the recovery phase following the 2000 m rowing ergometer test.

**RESULTS:**

The 2000 m performance time and VO2peak were significantly improved (415 ± 9 → 411 ± 11sec and 62.1 ± 5.6 → 63.7 ± 6.1 ml/kg/min, respectively, p<0.05). The 1/2reoxy time of the VL was not significantly different between pre- and post-training. On the other hand, 1/2reoxy time of the RF was significantly increased post-training. The value of change in 1/2reoxy time of the VL was significantly correlated with both the 2000 m performance time (r=0.545, p<0.05) and VO2peak (r=-0.573, p<0.05). The value of change in 1/2reoxy time of the RF was not correlated with the performance time or VO2peak.

**CONCLUSION:**

The result suggested that the improvement of performance in the preparation period rowing training was correlated not only with VO2peak, but also with the muscle oxidative capacity.

Supported by JSPS KAKENHI 23500780.
Effect of Different Frequency Of Endurance And Strength Training on Muscle Functional Deterioration During Immobilization

Masako Fujikawa,1 Takafumi Hamaoka, FACSMD, Yukai Osada2, Norio Murase2, Ryotaro Kime2, Yuki Kurosawa3, Shiro Ichimura3, Toshikazu Homma1, Kazuki Esaki1, Fumiko Nakamura1, Toshiharu Katsumura1, 1Ritsumeikan University, Shiga, Japan. 2Tokyo Medical University, Tokyo, Japan. 3Tokyo University of Science, Tokyo, Japan. 4Japan Institute of Sports Sciences, Tokyo, Japan. 5Shiga University, Shiga, Japan. 6Kokugakuin University, Tokyo, Japan. (Sponsor: Hamaoka Takafumi, FACSMD)

(No relationships reported)

In our previous research, muscle functions declined after a 3-week forearm immobilization (3W-IMM) (Kitahara et al., 2003), and endurance and strength handgrip exercise training twice weekly during 3W-IMM prevented the decrease in muscle oxidative capacity and strength (Matsumura et al., 2008). However, the effect of lower amount of exercise training on muscle functions has never been examined.

PURPOSE: To investigate the effects of different training volume (once weekly and twice weekly) on muscle functions, particularly, on muscle energy metabolism during exercise pre- and post-3W-IMM.

METHODS: Twenty healthy male subjects participated in this study and the non-dominant arm was immobilized for 3 weeks with a cast. The subjects were assigned to an immobilization-only group (IMM-group), endurance (30% of maximum voluntary contraction (MVC), 1 contraction every second until exhaustion) and strength (70% MVC, 10 repetitions) grip exercise training once weekly (EST1-group, n=6) or twice weekly (EST2-group, n=7) during the 3W-IMM period. The MVC and the endurance performance evaluated as maximal workload achieved during handgrip exercise test (30% MVC, 1 Hz, until exhaustion) were examined both pre- and post-3W-IMM. Muscle phosphocreatine (PCr) and muscle pH were evaluated using 31-phosphorus magnetic resonance spectroscopy.

RESULTS: The difference in maximal workload during endurance test between pre- and post-3W-IMM decreased more markedly in IMM-group than in EST2-group (p<0.074). Muscle PCr and muscle pH were not significantly different between three groups during endurance exercise test and between pre- and post-3W-IMM. The difference in MVC between pre- and post-3W-IMM was significantly greater in IMM-group than both in EST1-group and EST2-group (p<0.05).

CONCLUSIONS: The endurance and strength training, not only twice weekly but also once weekly, was effective for preventing the decrease in muscle strength during 3W-IMM. The training twice weekly was effective, but not for the training once weekly, to maintain endurance performance. Muscle PCr and muscle pH kinetics during endurance test were unchanged with 3W-IMM.

Improvements with Electrical Stimulation Resistance Training in Men and Women with Complete Spinal Cord Injury

Jared T. Brizendine, Terence E. Ryan, Melissa L. Erickson, Kevin K. McCully, FACSMD. University of Georgia, Athens, GA.

(No relationships reported)

Eighty percent of the individuals with spinal cord injury (SCI) in the United States are male consequently little research exists concerning females with SCI. Electrically induced resistance training has been shown to improve muscle mass and muscle strength in males with spinal cord injury. The current hypothesis is that resistance training will result in less changes and slower gains.

PURPOSE: To compare training improvements with electrical resistance training in males and females with SCI

METHODS: Ten male and three female subjects with complete spinal cord injury gave informed consent prior to inclusion in this study. A training session consisted of four sets of leg extensions on each leg with up to 10 repetitions per set. Two sessions were performed per week for four months. Stimulation current was recorded and maintained constant after the first week, weight was increased after two successful sessions. Performance adaptations were measured as change in weight pre and post training, change in repetitions pre and post training, and time to 16 pounds lifted.

RESULTS: Two out of ten males and two out of three females reached the goal weight of 20 pounds by conclusion of training. Seven men who reached 10 pounds did so in 49, 55, 65, 80, 103, 111, and 124 days. The two women who reached ten pounds reached so in 34 and 63 days. One male and one female were much weaker than the other participants prior start of training. The man went from no lifts to completing at least one lift at the end of training and the woman went from six lifts to forty lifts at the end of training. The average gains in quadriceps muscle mass were similar between males and females as measured with MRI.

CONCLUSIONS: There was no evidence that females with SCI improve less rapidly than males with SCI in response to electrical induced training. More females need to be tested to confirm this finding, though females are certainly not limited in their response to training. Supported by NIH R01 HD039676.

Peak Power Training Reduces SDH Activity In Type Iib Fibers Of Rat Medial Gastrocnemius Muscle


(No relationships reported)

Muscle fibers are limited in increasing size and oxidative capacity simultaneously. The combination of resistance training to increase muscle size and peak power and endurance training to increase oxidative capacity can cause conflicting situations at the molecular level. Since several sports require both, high peak power and oxidative capacity, strategies may have been adopted to deal with this problem. Using specific recruitment of different muscle fibers during resistance and endurance training may allow increasing both. The rat medial gastrocnemius muscle (GM) is composed of a high and a low oxidative compartment which are recruited task specifically (the latter only being recruited during high intensity activities).

PURPOSE: To investigate whether task specific recruitment of the rat GM allows the muscle to increase in size and oxidative capacity simultaneously in response to combined peak power and endurance training.

METHODS: 39 rats were assigned to peak power training (PT, n = 10), resembling resistance exercise, endurance training (ET, n = 10), both peak power and endurance training (PET, n = 10), or controls (n = 9). Trainings were progressive and performed on a treadmill 5 days per week for 6 weeks (PET performed both training sessions each day with 8 hours rest in between). After 6 weeks, fiber cross-sectional area (CSA) and succinate dehydrogenase (SDH) activity (representing mitochondrial activity) were assessed for all fiber types in both compartments. SDH mRNA levels in both compartments were quantified by RT-PCR.

RESULTS: None of the training modalities induced a change in CSA in either compartment. In the high oxidative compartment, SDH activity was not significantly different between the groups, although SDH mRNA levels were increased after ET (p < 0.05). In the low oxidative compartment, for PT and PET groups, SDH activity of type Iib fibers was ~30% lower than in the ET and control groups (p < 0.05), whereas SDH mRNA levels remained constant.

CONCLUSIONS: Peak power training induced a substantial decrease in SDH activity in the type Iib fibers of the low oxidative compartment without a decrease in SDH mRNA levels, indicating that peak power training reduced the rate of translation of mitochondrial proteins and/or enhanced mitochondrial degradation.
Myogenin, MyoD and IGF-I mRNA expression was not associated with changes in the fiber-type frequency.

METHODS: C57Bl/6 were assigned to 4 weeks of treadmill or sedentary behavior. After 4 weeks mice were randomly injected intraperitoneally with TNF-α or saline. Force was determined in diaphragm bundles using an electrotetametric stimulation protocol. Expression and activity of glutathione peroxidase (GPX) and the NAD(P)H oxidase and protein carbonylation were measured using standard methods.

RESULTS: TNF-α reduced force at 125 Hz in sedentary animals. E prevented this force reduction (S NaCl: 11.6±1.0, S TNF: 6.8±0.9, E NaCl: 11.2±0.8, E TNF: 10.8±1.2 N/cm², p<0.01). TNF-α led to an increased activity of NAD(P)H oxidase in both sedentary and exercised animals (S NaCl: 1.0±0.1, S TNF: 1.8±0.2, E NaCl: 1.1±0.2, E TNF: 1.5±0.3 mU/mg, p<0.01). Carbonylated proteins as a marker of oxidative stress were only elevated under the influence of TNF-α in sedentary animals, whereas E prevented the TNF-α induced increase in carbonylated proteins. TNF-α induced loss in muscle force correlated with the total amount of carbonylated proteins (r=-0.62, p<0.05). TNF-α led to an increased carbonylation of alpha-actin (by ~400%) and creatine kinase (by ~500%), whereas E again prevented the TNF-α induced increase.

CONCLUSION: TNF-α administration leads to reduced force development in the diaphragm of mice. This effect is attenuated by preconditional exercise training. This may be, at least in part, a result of reduced carbonylation of alpha-actin and creatine kinase due to an increased expression in radical scavenger enzymes resulting in a reduced ROS concentration.

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Cachaexia is a condition involved with the loss of bodyweight, muscle mass, and adipose tissue mass. The ApoMim/+ mouse develops an IL-6 dependent cachexia which can be accelerated with IL-6 overexpression.

METHODS: The purpose of this study was to determine the effect of moderate intensity treadmill exercise training on skeletal muscle energy status in cachectic mice.

RESULTS: Cachexia induced a 12% decrease in quadriceps weight and moderate aerobic exercise training attenuated muscle mass loss. Cachexia induced a 3 fold increase in the activation of the energy sensor AMPK, p<0.05, and exercise training attenuated this induction; however, the combination of exercise and cachexia still stimulated a 2 fold increase in AMPK activation compared to control animals, p<0.05. Neither exercise nor cachexia had an effect on total AMPK levels. Activation of a downstream target of AMPK, ACC, was also increased with cachexia and exercise was able to attenuate this increase.

CONCLUSIONS: Our data demonstrated that the decrease in skeletal muscle mass with cachexia is associated with an altered energy state of the muscle. Exercise needs to be explored further as potential a therapy to alleviate muscle energy imbalance with cachexia.

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Myogenin, MyoD and IGF-I mRNA expression was not associated with changes in the fiber-type frequency.

METHODS: Male Wistar rats (80 days old, 250-300 g) were randomly divided into two groups (n=8 per group): 8-week control (C8) and 8-week trained (T8). T8 group was submitted to progressive RT program (four sets of 10-12 repetitions at 65-75% of the 1RM, 3 day/week) for 8 weeks. At the end of the experiment, the animals were euthanized by decapitation and the muscles were collected for the analyses.

RESULTS: RT promoted an increase in muscle fibers area (T8 vs. C8: 29.0% increase, p < 0.05) that was accompanied by the increases in myogenin (T8 vs. C8: 44.8% increase, p < 0.05), MyoD and IGF-I mRNA expression by RT-qPCR analysis. Fiber-type frequency data were analyzed using the Goodman Test for contrasts between intermultinomial and intramultinomial populations.

CONCLUSIONS: These results indicate that the decrease in skeletal muscle mass with cachexia is associated with an altered energy state of the muscle. Exercise needs to be explored further as potential a therapy to alleviate muscle energy imbalance with cachexia. Funded by RO1CA121249-01.
Increased muscle capillarity is a normal adaptation to exercise training. We hypothesized that VEGF expression in mature skeletal myofibers is necessary for this angiogenic response and contributes to an improvement in locomotor muscle function and exercise capacity.

**PURPOSE:** To determine whether a reduction in myoVEGF-expressed VEGF limits the adaptive response to exercise training.

**METHODS:** Using a tamoxifen-inducible skeletal myofiber-specific VEGF gene deletion mouse model (HAS-Cre-ER; X VEGFlacP), VEGF levels are reduced by >80% in skeletal muscle of adult myoVEGF gene-deleted mice (myoVEGF/-) compared to control littermates (WT). Exercise capacity was evaluated by measuring maximal treadmill speed and endurance running time before tamoxifen-induced gene deletion, 3 weeks after tamoxifen treatment, and after an additional 8 weeks of progressive exercise training (1 hr/d, 5 d/wk). The capillary/fiber ratio was measured in the soleus, plantaris and gastrocnemius after treatment. Maximal tension in the EDL and soleus was measured in vitro.

**RESULTS:** Exercise endurance was impaired in myoVEGF/- mice 3 weeks after VEGF deletion (WT, 97 min ± 26, myoVEGF/-, 54 min ± 34, p<0.05), but maximal speed was unaffected (WT, 62 cm/s ± 4.5, myoVEGF/-, 59 cm/s ± 6). Post-training, exercise endurance (WT, 161 ± 16 min, myoVEGF/-, 57 minutes ± 29, p<0.001) and maximal speed (WT, 72 cm/s ± 3.4, myoVEGF/-, 54 cm/s ± 12, p<0.001) were improved only in the WT mice. Capillary/fiber ratio post-training was less in myoVEGF/- (Gastroc, WT, 1.75 ± 0.20, myoVEGF/-, 1.03 ± 0.11. Soleus, WT 1.85 ± 0.21, myoVEGF/-, 1.65 ± 0.18. Plantaris, WT 1.66 ± 0.35, myoVEGF/-, 1.39 ± 0.21). Post-training maximal tetanic tension (N/cm²) produced by the EDL and soleus was not different between groups.

**CONCLUSION:** Mice deficient in skeletal myoVEGF were unable to improve exercise capacity in response to training. This is accompanied by a lower skeletal muscle capillary/fiber ratio in locomotor skeletal muscle. These data suggest myoVEGF is required to regulate the adaptive response to exercise training.

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**Board #157**

May 30, 2:00 PM - 3:30 PM

**Skeletal Myofiber-expressed VEGF Is Required For Adaptation To Exercise Training**

Hamid Delavari, Leonardo Nogueira, Kechun Tang, Michael C. Hogan, Peter D. Wagner, Ellen C. Breen. University of California, San Diego, La Jolla, CA.

(NO RELATIONSHIPS REPORTED)

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**Board #158**

May 30, 2:00 PM - 3:30 PM

**Diabetic Patients With Different Training Status Show Different Levels Of Muscle Weakness And Electrophysiological Impairment.**

Jonida Hazzi1, Stefano Baldacci2, Ileneia Bazzucchi2, Alessandro Scotto di Palumbo1, Flaminia Carucci1, Giuseppe Pugliesi2, Massimino Sacchetti1. 1University of Rome "Foro Italico", Rome, Italy, 2Second Medical School, "La Sapienza" University, Rome, Italy. (Sponsor: Carl Foster, FACSM)

(NO RELATIONSHIPS REPORTED)

**PURPOSE:** Diabetes is associated to muscle weakness and disability. We investigated neuromuscular function, in the upper and lower limb, in 31 T2D patients and 12 Controls.

**METHODS:** Subjects comprised 4 groups: sedentary diabetic patients with lower (1st quartile-D1) and higher (4th quartile-D2) motor nerve conduction velocity (MNCV), trained diabetic patients (TD) and non-diabetic sedentary control subjects (C). Isokinetic and Maximal isometric strength (MVC) for a wide angular-velocity range (0°/s to 240°/s) were assessed for the knee extensors (KE) and elbow flexors (EF). Muscle fiber conduction velocity (MFCV) was estimated from sEMG recordings of the vastus lateralis (VL) and biceps brachii (BB) activity.

**RESULTS:** EF and KE MVC were similar between groups. Sedentary diabetics showed significantly decreased dynamic strength of KE at all velocities, when compared to Controls and TD (% decrease M±SD, 15°/s to 240°/s, p < .05: D1 = 58.6% ±3.0; D2 = 61% ±3.3 vs. C = 43.9% ±4.0; TD = 58.0% ±2.6), with C and TD being similar to each other, especially at low angular velocities. D2 showed higher KE strength than D1, but differences reached statistical significance only at 90°/s. Strength in the elbow flexors was affected at higher contraction speeds, with the untrained diabetics showing significantly lower strength at 180°/s (Nm M±SD: D1=34.1±30.6; D2=28.8±2.4 vs. C=42.1±2.8; p<0.05) and 240°/s (Nm M±SD: D1=28±0.27; D2=24±1.9 vs. C=36±4.2). No strength differences resulted between D1 and the arm for the arm. There were significant within-group differences in the ratio between leg torque and arm torque for the D1 (-35%), D2 (-31%) and TD (-31%), but not for the control group. Groups showed differences in isometric MVC for the VL, but not for the BB. MVC was significantly lower in D1 (-24%, p = .01) and D2 (-23%, p = .02) compared to the control group. TD was not different from C, in terms of MVC.

**CONCLUSIONS:** Muscle weakness is dependent on contraction velocity, especially in the lower limbs, whereas MNCV has only a marginal effect. The different neuromuscular impairment is confirmed by differences in MVC. Training status is associated with better neuromuscular function. Finally, MVC could represent a sensitive marker for monitoring neuromuscular function impairment and training-induced reconditioning.

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**Board #159**

May 30, 2:00 PM - 3:30 PM

**Exercise-Induced Improvement Of Impaired Muscle Glucose Metabolism Is Associated With Muscular Sex Steroid Hormone Level In Zucker Fatty Diabetics Rats**

Koji Sato1, Kuniko Minato2, Satoshi Fujita1, Hideki Yamauchi1, Noboru Mesaki2, Motoyuki Iemitsu1. 1Ritsumeikan University, Kuotsu, Shiga, Japan, 2Wayo Women’s University, Ichikawa, Chiba, Japan. 3The Iketi University School of Medicine, Tokyo, Japan. 4Teikyo Heisei University, Ichihara, Chiba, Japan. (Sponsor: Takafumi Hamaka, FACSM)

(NO RELATIONSHIPS REPORTED)

**Effect of exercise training in type 2 diabetes patients to improve hyperglycemia via enhancement of muscle glucose metabolism signaling is well known. We have recently reported that sex steroids can be synthesized locally in the skeletal muscle which improves fasting blood glucose level in obese rats.**

**PURPOSE:** To determine whether exercise training-induced secretion of muscular sex steroid hormone may improve insulin resistance in Zucker obese fatty rats.

**METHODS:** Thirty Zucker fatty diabetic rats (6-week old) were randomly assigned to either control, exercise training or exercise training with continuous infusion of 5α-reductase inhibitor groups. Exercise training was conducted by voluntary wheel running for 6 weeks, with average running distance of 2.752 m per day.

**RESULTS:** The results indicate that 6 weeks of exercise training significantly attenuated serum insulin and fasting glucose levels compared with the control group. Muscle concentrations of DHEA and DHT, and protein expression levels of 5α-reductase were all significantly higher in the exercise-training group. Moreover, exercise training upregulated GLUT4 translocation with concomitant increases in protein kinase B and protein kinase C-γ phosphorylations. Furthermore, significant correlations were observed between fasting glucose levels and muscular DHEA (r = -0.87, P < 0.001) and DHT (r = -0.80, P < 0.001). Interestingly, exercise training-induced improvements in serum insulin and fasting glucose levels concomitant with GLUT4-regulated signaling were all suppressed with 5α-reductase inhibitor.

**CONCLUSIONS:** These results indicated that exercise-induced improvements in muscle glucose metabolism signaling and fasting glucose level may be attributed to the increased muscular levels of sex steroid hormones.
Aerobic exercise has been known an effective therapy against the muscle endurance fitness.

**PURPOSE:** To clarify the effect of aerobic training on three-dimensional (3-D) capillary architecture in slow muscle has been investigated in the present study.

**METHODS:** Twelve male Wistar rats (9 weeks old) were used and divided into exercise training (EX) and control (Con) groups. The rats in EX group were performed aerobic exercise training on a treadmill (speed = 15 m/min, duration = 60 min) for 3 weeks. The contrast medium-injected capillary in the soleus muscle was visualized using a confocal laser microscope. The succinate dehydrogenase (SDH) activity and vascular endothelial growth factor (VEGF) expression were measured.

**RESULTS:** The SDH activity and VEGF expression in EX were significantly higher than those in Con (p<0.05). The number of capillaries and the number of the anastomoses in the EX were increased than those of Con (p<0.05). The capillary diameter in the soleus of EX rat was thicker than that of Con rat (p<0.05). In addition, the mean capillary volume in EX was significantly higher than that in Con (p<0.05). Whereas the anastomoses diameter was not different in the soleus muscle between EX and Con rat.

**CONCLUSIONS:** These data show that aerobic training builds 3-D capillary architecture in soleus muscle. These results of the present study indicate endurance training creates a powerful stimulus for structural remodeling of the vasculature.

This study was supported by Grants-in-Aid for Scientific Research from the Japanese Ministry of Education, Culture, Sports, Science and Technology no. 23650340, 23650324, 23700660, 23700932 and 2200189.
Supported by NSC Grant NSC100-2815-C-037-003-H.

RESULTS: Post hoc comparisons were conducted to compare changes in reaction time and power over the 4 weeks. The training program involved performing reaction time and power tasks, including vertical jumping, side stepping, and squatting. The training program was 3 times per week, 20 minutes per session, for 4 weeks. Two separate Repeated Measures Analysis of Variance (ANOVA) and post hoc comparisons were conducted to compare changes in static and dynamic balance over the 4 weeks.

CONCLUSIONS: Although no significant differences were found in LTM, FM, or BMD over the one year, meaningful changes are illustrated by the effect sizes. These results suggest that senior adults who participated in high-intensity resistance training can maintain their lean tissue while those who train at a lower intensity are less likely to successfully mitigate the negative age-related changes despite moving the weight at a greater velocity. To our knowledge, this is the first study to examine the impact of velocity on body composition over this length of time. This research is important for helping health professionals to understand proper resistance training interventions when attempting to address age-related body composition changes.

B-31 Free Communication/Poster - Exergaming

MAY 30, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

An active video game combines with exercise training, thus has a potential to improve health-related fitness, as well as train skill-related fitness in the general population. Reaction time and power are skill-related fitness components that can help individuals maintain their quality of life and deal with unexpected life events. Whether an active video game can be used as a training tool to improve one’s reaction time and power is unknown.

PURPOSE: The purpose of this pilot study was to examine the training effects of an active video game on reaction time and power in a group of healthy college students.

METHODS: Fourteen subjects (mean age 21.6 ± 9 yr, 4 males and 10 females) were recruited from university campus. Subjects were excluded from the study if they answered “YES” to one or more questions in the Physical Activity Readiness Questionnaire (PAR-Q). All eligible subjects completed measures of reaction time and power (Side Step) at study entry and every two weeks during the 4-week training program. When playing the active video game, subjects would encounter different obstacles and must immediately respond to the game with vertical jumping, left and right side stepping, and squatting. The training program was 3 times per week, 20 minutes per session, for 4 weeks. Two separate Repeated Measures Analysis of Variance (ANOVA) and post hoc comparisons were conducted to compare changes in reaction time and power over the 4 weeks.

RESULTS: For reaction time, the results showed no significant change after 4 weeks of training (p > 0.05). For power, the results showed significant improvements in subjects’ power after the training program (p < 0.01). In addition, the subjects’ power began to improve in as early as 2 weeks (p < 0.01) and continue to improve from 2 to 4 weeks (p < 0.01).

CONCLUSIONS: The results of this pilot study indicate that a 4-week active video game training program appears to be effective in improving reaction time and power in college students. On the other hand, it may require a longer training duration to show improvements in reaction time in this population. It is suggested that an active video game can be used as a training tool for improving power in young healthy adults.

Supported by NSC Grant NSC100-2815-C-037-003-H.

B-157 Board #165 MAY 30 2:00 PM - 3:30 PM

The Training Effects of an Active Video Game on Reaction Time and Power

Hsuan Su, Yuh-Jen Lin, I-Hua Chu. Kaohsiung Medical University, Kaohsiung, Taiwan.

(Please review differences in LTM, FM, and BMD over the one year, meaningful changes are illustrated by the effect sizes. These results suggest that senior adults who participated in high-intensity resistance training can maintain their lean tissue while those who train at a lower intensity are less likely to successfully mitigate the negative age-related changes despite moving the weight at a greater velocity. To our knowledge, this is the first study to examine the impact of velocity on body composition over this length of time. This research is important for helping health professionals to understand proper resistance training interventions when attempting to address age-related body composition changes.

1759 Board #167 MAY 30 3:30 PM - 5:00 PM

The Training Effects of an Active Video Game on Balance

Yuh-Jen Lin, Hsuan Su, I-Hua Chu. Kaohsiung Medical University, Kaohsiung, Taiwan.

(Please review differences in LTM, FM, and BMD over the one year, meaningful changes are illustrated by the effect sizes. These results suggest that senior adults who participated in high-intensity resistance training can maintain their lean tissue while those who train at a lower intensity are less likely to successfully mitigate the negative age-related changes despite moving the weight at a greater velocity. To our knowledge, this is the first study to examine the impact of velocity on body composition over this length of time. This research is important for helping health professionals to understand proper resistance training interventions when attempting to address age-related body composition changes.

Supported by NSC Grant NSC100-2815-C-037-003-H.
Exergaming couples exercise with gaming and may increase physical activity, fitness, and health in its players. While all exergaming systems require physical activity, differences in motion detection capability between the gaming platforms may cause some systems to less accurately measure activity in players.

**PURPOSE:** To determine whether the superior motion tracking of the Xbox Kinect (Xbox) system requires players to expend more energy than players of the Wii Fit (Wii) and PlayStation Move (PS3) platforms.

**METHODS:** Subjects played each of the three exergaming systems at high intensity (High) and tried to earn the highest possible score. They also played with the lowest effort possible (Low) that still allowed them to reach the same high score as during the High trial. Energy expenditure was estimated during game play by SenseWear activity monitors and by the exergaming systems.

**RESULTS:** As measured by the SenseWear device, the Wii and PS3 allowed less vigorous activity in the Low trial than in the High trial. However, the Wii and PS3 gaming systems did not recognize decreased activity in the Low compared to the High trial. The Xbox tracked player movement very well and required players in the Low trial to expend relatively the same amount of calories as players in the High group.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Trial</th>
<th>System (cal)</th>
<th>( \Delta )-High-Low (cal)</th>
<th>p-value SenseWear (cal)</th>
<th>( \Delta )-High-Low (cal)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wii</td>
<td>High</td>
<td>74</td>
<td>19</td>
<td>90</td>
<td>46</td>
<td>.049*</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>55</td>
<td>6</td>
<td>52</td>
<td>52</td>
<td>.023*</td>
</tr>
<tr>
<td>PS3</td>
<td>High</td>
<td>107</td>
<td>6</td>
<td>118</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>104</td>
<td>52</td>
<td>52</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Xbox</td>
<td>High</td>
<td>99</td>
<td>3</td>
<td>72</td>
<td>3</td>
<td>.766</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>54</td>
<td>3</td>
<td>69</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSION:** Both the Wii and PS3 platforms allowed players to perform well in games while exerting very little effort in the Low trial. The Xbox exergaming platform only rewards high physical activity levels with high gaming scores. This study suggests that the Xbox platform is a better option than the Wii and the PS3 systems for players trying to increase their physical activity through exergaming.

**1761**

**Board #169**

**MAY 30 3:30 PM - 5:00 PM**

**Influence of Wii Fit Plus Exercises on Lower Extremity Strength and Balance in Middle-Aged Adults**

Renee M. DeSalvo, Brandon S. Pollock, Nicholas T. Potenzini, Ronald Otterstetter, Judi A. Juvancic-Heltzel, Carrie Fister, The University of Akron, Akron, OH.

(Sponsor: Gary H. Kamimori, FACSM)

(No relationships reported)

**BACKGROUND:** Regular exercise can decrease the risk of falls, fractures, low back pain, and joint injuries by improving balance and strength. The WiiFit Plus incorporates programs such as yoga, strength training, aerobics, and balance games which are intended to improve balance, strength, flexibility, fitness, and general well-being.

**PURPOSE:** The purpose of this study was to examine the effect of WiiFit Plus exercises on lower leg muscular strength and balance in middle-aged adults.

**METHODS:** Three (3) healthy males (age 53.3 ± 2.3 yrs) and 22 healthy females (age 51.4 ± 6.2 yrs) were randomized into a control group (n=12) and experimental group (n=13) based on Godin Leisure Time Exercise Questionnaire results. Baseline strength (quadriceps, hamstrings, peroneals and tibialis anterior) using a computerized dynamometer and balance (overall stability index, anterior/posterior index and medial/lateral index) were assessed. The experimental group attended 40 minute WiiFit Plus exercise sessions on 2 non-consecutive days for eight weeks. Workload was modified on a biweekly basis based on heart rate and rate of perceived exertion (RPE). The control group continued normal activities of daily living. After eight weeks, post-intervention strength and balance measurements were assessed for both groups.

**RESULTS:** The experimental group demonstrated greater (p<0.02) gains in quadriceps strength at 90° (8.28 ± 15.8 ft-lbs) than the control group (-11.57 ± 22.0 ft-lbs). No significant gains were observed (p>0.08) in all other dependent variables for lower extremity strength and balance.

**CONCLUSION:** Based on the results achieved, positive trends comparing the mean differences of the experimental population to the control group indicate that the Wii Fit Plus may be an effective supplement to exercise and a useful tool in preventing and/or improving functional deficiencies in the knee or ankle.
Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat against either a computer or human opponent for 8 minutes in each condition.

The participants then engaged in a maximal exercise test evaluating heart rate, oxygen consumption, and ventilation. On another day, in a randomly assigned manner, the participants played

**METHODS.** Twelve college aged participants (19.7 ± 1.0 y, 175.2 ± 6.8 cm, 76.0 ± 20.7 kg, 25.9 ± 9.9 % Body Fat) were assessed for resting heart rate, oxygen consumption, and ventilation. The participants then engaged in a maximal exercise test evaluating heart rate, oxygen consumption, and ventilation. On another day, in a randomly assigned manner, the participants played Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat.

Playing Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat all increase heart rate, oxygen consumption, and ventilation above resting levels. However, the magnitude of increase in heart rate, oxygen consumption, and ventilation is not influenced by gaming system, or playing against another person. Overall, playing a "physically active" home video game system meets only the minimal threshold for moderate intensity physical activity.

### CONCLUSIONS.

Playing Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat all increase heart rate, oxygen consumption, and ventilation above resting levels. However, the magnitude of increase in heart rate, oxygen consumption, and ventilation is not influenced by gaming system, or playing against another person. Overall, playing a "physically active" home video game system meets only the minimal threshold for moderate intensity physical activity.

#### RESULTS:

<table>
<thead>
<tr>
<th>Wii Boxing (Computer vs. Human)</th>
<th>Move Gladiatorial Combat (Computer vs. Human)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate (beats/min)</td>
<td>104.1 ± 14.0 vs. 109.6 ± 9.2</td>
</tr>
<tr>
<td>VO2 (mL/kg/min)</td>
<td>8.9 ± 3.8 vs. 9.0 ± 1.9</td>
</tr>
<tr>
<td>VO2 (L/min)</td>
<td>0.7 ± 0.3 vs. 0.7 ± 0.3</td>
</tr>
<tr>
<td>VE/L/min</td>
<td>19.5 ± 7.0 vs. 19.5 ± 6.1</td>
</tr>
</tbody>
</table>

### Table 1. Heart rate, oxygen consumption, and ventilation (Data are means ± sd).

#### CONCLUSIONS.

Playing Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat all increase heart rate, oxygen consumption, and ventilation above resting levels. However, the magnitude of increase in heart rate, oxygen consumption, and ventilation is not influenced by gaming system, or playing against another person. Overall, playing a "physically active" home video game system meets only the minimal threshold for moderate intensity physical activity.

### Board #174  MAY 30  3:30 PM - 5:00 PM

#### Is Exergaming Appropriate For At-Home Physical Therapy?

Enrique A. Becwar1, Ellis B. Jensen2. 1Viterbo University, La Crosse, WI. 2Utah Valley University, Orem, UT. (Sponsor: Tim Gavin, FACSM)

**INTRODUCTION:** Today’s sedentary American lifestyle has led to decreased health and greater rates of obesity in recent years. Some physical therapy clinics have begun to use exergaming (video games that include an exercise component) to help patients complete at-home exercises prescribed to improve patient recovery. Key to this function is the exergaming system’s ability to accurately track specific body motion.

**PURPOSE:** To assess the ability of the Wii Fit (Wii), PlayStation Move (PS3), and Xbox Kinect (Xbox) to track body motion.

**METHODS:** Volunteer subjects played the Wii, PS3, and Xbox systems at two intensities: high intensity (Full) and low intensity (Relaxed). During Full trials, subjects tried to obtain the highest score possible. During Relaxed trials, subjects used as little energy as possible while earning the same scores they had during Full trials. Total energy expenditure was estimated using SenseWear activity bands and the exergaming systems. Paired t-tests identified systems that were not able to detect motion differences in subjects during Full and Relaxed trials.

**RESULTS:** The PS3 and the Wii were both unable to detect motion differences in subjects exercising at high or low intensity. The Xbox differentiated high from low-intensity movements and required subjects to expend similar energy during Full and Relaxed trials.

**CONCLUSION:** The Wii and PS3 are unable to differentiate between vigorous and relaxed body movement while the Xbox was able to differentiate body movements and hold the user to higher movement standards. This ability may allow the Xbox to play a role in at-home physical therapy.

#### Board #175  MAY 30  3:30 PM - 5:00 PM

#### Assessment of the Aerobic and Muscular Demands of Playstation Move’s Table Tennis and Gladiator Games.

Randi Lite, Dana Griffin, Natalie Moy. Simmons College, Boston, MA.

**PURPOSE:** to determine central demand (HR, METS) and local demand (EMG) while playing Playstation Move’s Table Tennis and Gladiator Games. Muscle activity while gaming is compared with muscle activity while performing a muscle endurance test specific for each of the four muscles assessed.

**METHODS:** Eight healthy, college-aged volunteer had EMG recordings of the dominant side of rectus femoris, rectus abdominus, lattisimus dorsi, and pectoralis major during a 1-minute curlup test, a 1 minute pushup test, a 1 minute modified pullup test, and the Forestry Step Test. The subjects completed a 20-minute tutorial, then played each game for 3 minutes in randomized order with 2-3 minutes rest between games. EMG activity, heart rate, RPE, and VO2 were recorded. RMS values for each muscle were calculated, both while playing the games and while performing the muscle endurance tests.

### Board #176  MAY 30  3:30 PM - 5:00 PM
RESULTS: Gladiator produced a HR of 67.0 ± 7.6% of predicted HRmax and an intensity of 2.87 ± 1.21 METs. The mean RPE was 10.2 ± 3.0. There was no significant difference in RMS for any muscle compared with its corresponding 1-minute muscle endurance test. Table Tennis produced a HR of 57.3 ± 7.83% of predicted HRmax and an intensity of 2.13 ± 0.39 METs. The mean RPE was 7.5 ± 1.6. The RMS for the rectus femoris during table tennis was significantly less than the RMS during the Step Test. Gladiator had a significantly greater RPE (p=0.02) and HR (p=.01) compared with Table Tennis.

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Muscle Endurance Test RMS</th>
<th>Gladiator RMS</th>
<th>Table Tennis RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pectoralis major</td>
<td>0.47 ± 0.18</td>
<td>0.65 ± 0.56</td>
<td>0.41 ± 0.32</td>
</tr>
<tr>
<td>Rectus abdominis</td>
<td>0.42 ± 0.56</td>
<td>0.94 ± 0.87</td>
<td>0.78 ± 0.86</td>
</tr>
<tr>
<td>Latissimus dorsi</td>
<td>0.38 ± 0.23</td>
<td>0.61 ± 0.51</td>
<td>0.40 ± 0.37</td>
</tr>
<tr>
<td>Rectus femoris</td>
<td>2.07 ± 0.79</td>
<td>1.13 ± 0.70</td>
<td>0.81 ± 0.57*</td>
</tr>
</tbody>
</table>

*p=0.02

CONCLUSION: ACSM Guidelines suggest 30 minutes of moderate activity (3-6 METS) for 5-7 days/week. Both games were below the 3 MET level. The RMS for four muscles were not different from standard muscle endurance activities, suggesting that the games may develop muscle endurance at least on the dominant side.

### Free Communication/Poster - **Fitness and Performance Testing I**

**Board #174  MAY 30  3:30 PM - 5:00 PM**

**Anaerobic Power Output in College Division 2 Athletes**

Steve Burns, Brian Hughes, Andrew Gai, Aryn Lessmeier, Curtis Sarin, Trevor Swaine, Halie Thomas, Casandra Davis. University of Central Missouri, Warrenton, MO.

(No relationships reported)

The Wingate anaerobic test is considered to be an accurate measure of anaerobic capacity of an individual.

**PURPOSE:** The purpose of this study was to begin development of updated norms of division 2 college athletes for peak power (PP) mean power (MP), and fatigue index (FI) on the Wingate anaerobic test using advanced technology (RacerMate® Velotron).

**METHODS:** A total of 337 athletes participated in their respective preseason weeks. After signing IRB approved informed consent, subject’s height and weight was measured (Inbody520, Biospace Inc, CA). Subjects were guided through the Wingate procedures, after a 5 minute warm-up including 2-3, 10 sec sprints. Wingate 30 second test consisted of a 5 second sprint before the calculated resistance was applied (.075kg • kg-1). Peak Power (PP) and Mean Power (MP) in both watts and watts/kg were recorded in addition to fatigue index (FI).

**RESULTS:** The data indicate that football athletes have the highest PP (1604.9 ± 289.0W), MP (787.7 ± 95.6W) and FI (41.6 ± 9.9W • sec-1). Men’s track and cross country produced the highest MP relative to body weight (8.4 ± 7.0W • kg-1) and women’s track and cross country produced the lowest FI (10.7 ± 2.8W • sec-1) (See table below).

**CONCLUSION:** Based on the current data, these results provide norms for comparison of peak anaerobic power and mean anaerobic power in division 2 college athletes. Additionally Football players exhibit higher power output than other sports represented.

<table>
<thead>
<tr>
<th>Sport</th>
<th>N</th>
<th>Wt (kg)</th>
<th>PP (W)</th>
<th>PP (W/kg)</th>
<th>MP (W)</th>
<th>MP (W/kg)</th>
<th>FI (W/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volleyball</td>
<td>27</td>
<td>72.6</td>
<td>776.6</td>
<td>10.7</td>
<td>503.1</td>
<td>7.0</td>
<td>14.7</td>
</tr>
<tr>
<td>Baseball</td>
<td>42</td>
<td>37.7</td>
<td>1359.9</td>
<td>13.3</td>
<td>682.6</td>
<td>7.8</td>
<td>23.9</td>
</tr>
<tr>
<td>Women’s Basketball</td>
<td>12</td>
<td>72.8</td>
<td>816.6</td>
<td>11.0</td>
<td>545.5</td>
<td>7.3</td>
<td>14.8</td>
</tr>
<tr>
<td>Men’s Basketball</td>
<td>16</td>
<td>89.6</td>
<td>1439.9</td>
<td>12.6</td>
<td>719.0</td>
<td>8.0</td>
<td>23.0</td>
</tr>
<tr>
<td>Softball</td>
<td>17</td>
<td>72.7</td>
<td>634.9</td>
<td>9.5</td>
<td>400.4</td>
<td>5.6</td>
<td>12.5</td>
</tr>
<tr>
<td>Wrestling</td>
<td>53</td>
<td>83.1</td>
<td>981.7</td>
<td>12.2</td>
<td>617.2</td>
<td>7.7</td>
<td>19.2</td>
</tr>
<tr>
<td>Women’s Track and CC</td>
<td>11</td>
<td>58.7</td>
<td>617.2</td>
<td>10.9</td>
<td>412.5</td>
<td>7.0</td>
<td>14.7</td>
</tr>
<tr>
<td>Men’s Track and CC</td>
<td>17</td>
<td>71.1</td>
<td>862.1</td>
<td>12.7</td>
<td>597.3</td>
<td>8.4</td>
<td>15.8</td>
</tr>
<tr>
<td>Golf</td>
<td>35</td>
<td>77.7</td>
<td>981.0</td>
<td>11.8</td>
<td>612.6</td>
<td>8.3</td>
<td>20.5</td>
</tr>
<tr>
<td>Soccer</td>
<td>38</td>
<td>61.7</td>
<td>670.9</td>
<td>11.0</td>
<td>422.6</td>
<td>7.0</td>
<td>12.6</td>
</tr>
<tr>
<td>Football</td>
<td>75</td>
<td>102.6</td>
<td>1604.9</td>
<td>15.8</td>
<td>787.7</td>
<td>8.0</td>
<td>41.6</td>
</tr>
<tr>
<td>Bowling</td>
<td>14</td>
<td>75.8</td>
<td>620.2</td>
<td>12.4</td>
<td>575.0</td>
<td>7.7</td>
<td>20.1</td>
</tr>
</tbody>
</table>
RESULTS: The LSSCP was 201.2+/−30.6 watts (mean +/- SD) for men and 179.7+/−24.4 watts for women. The LSSCP significantly correlated with KET (p<0.001), LEP (p<0.05), MWS (p<0.05) and TUGT (p<0.05) in elderly men and women, respectively. The ICC value of LSSCP was 0.73 for men and 0.84 for women, thus indicating a good reliability. A significantly negative correlation was found between LSSCP and age in both genders (p<0.05).

CONCLUSION: From a practical viewpoint for use as a field test, the LSSCP test was found to be useful for assessing the functional leg power levels in community-dwelling elderly people.

1768  Board #176  MAY 30  3:30 PM - 5:00 PM
Leg Power in Elite Male Fencers: A Comparative Study among the Three Competitive Disciplines
Gustavo D. Aquilino, Aldo F. Longo, Néstor A. Lentini. Exercise Physiology Laboratory, National Sport High Performance Center (CeNARD), Buenos Aires, Argentina.

(No relationships reported)

The motor response of a fencer is required to be fast and explosive. Leg power plays a key role in the competitive fencing disciplines.

PURPOSE: To compare leg power performance of elite male fencers by competitive discipline.

METHODS: Data of 18 fencers who took part in the Argentine national team were considered in the study. (Age = 24.38 ± 5.26 yr, Weight = 74.82 ± 8.16 kg, Height = 1.81 ± 0.06 m; mean ± SD). Three groups of 6 subjects each were defined according to the competitive disciplines of the sport: Épée, Foil and Sabre. Leg Power was indirectly measured through the assessment of height jumped following three well-known protocols: Abalakov Jump, Counter Movement Jump and Squat Jump. A contact platform was used to assess height jumped. Lewis formula was employed for calculation of Average Power (AP). Based on data gathered over several years, the best performance of each subject was selected for the analyses. ANCOVs were conducted on AP for Abalakov, Counter Movement and Squat Jumps; Weapon was the independent factor in the analyses and Weight was introduced as a covariable. Linear associations among the three vertical jumps were evaluated on the whole sample by means of Pearson correlation tests; height jumped was used for these analyses.

RESULTS: Sample means of height jumped in cm for Épée, Foil and Sabre were, respectively, 51.77, 51.52 and 53.42 in Abalakov Jump; 44.83, 45.43 and 46.95 in Counter Movement Jump; and 38.97, 39.80 and 41.02 in Squat Jump. ANCOVs on AP were not statistically significant (p>0.05) for Weapon for any of the tests: Abalakov Jump (1159.7, 1168.0 and 1182.1 W; F = 0.14), Counter Movement Jump (1080.6, 1096.1 and 1109.8 W; F = 0.41) and Squat Jump (1011.2, 1024.8 and 1037.1 W; F = 0.24). As predictable, there were found high correlations among the three vertical jumps (r = 0.92, r = 0.83, r = 0.91; p<0.05).

CONCLUSIONS: The results obtained showed negligible differences in AP among the three disciplines of the sport. It would be desirable to obtain further statistical evidence from a larger sample size.

1769  Board #177  MAY 30  3:30 PM - 5:00 PM
Effects of Self Myofascial Release & Static Stretching on Anaerobic Power Output
Jeffrey M. Janot, Brittany Malin, Ryan Cook, Jacob Hagenbucher, Andrew Draeger, Melissa Jordan, Gary Van Gulder. University of Wisconsin-Eau Claire, Eau Claire, WI. (Sponsor: Mark Blegen, FACSM)

(No relationships reported)

The application of pre-exercise self-myofascial release (MFR) techniques to enhance exercise performance is an understudied topic. In contrast, the effects of pre-exercise static stretching (SS) are well-known, especially in regards to changes in anaerobic performance variables such as sprinting speed and vertical jump. Less is known specific to the effects of SS on cycling performance.

PURPOSE: The aim of this study was to determine the effects of SS and MFR on anaerobic power output.

METHODS: Cycling (30-sec Wingate) tests were used to assess power output in 9 male and 14 female subjects. Peak power output (PPO) and percent power drop (PPD) were examined among subjects to determine the differences between interventions.

RESULTS: In female subjects, PPO was significantly reduced following SS, in comparison to control (Control: 536.29 ± 69.11 W; SS: 508.30 ± 67.10 W). PPD was significantly decreased in the SS and MFR treatments compared to the control (Control: 44.95 ± 5.29%; SS: 40.45 ± 6.69%; MFR: 41.53 ± 5.97%). In male subjects, PPO was significantly increased following SS, in comparison to control (Control: 850.62 ± 165.41 W; SS: 881.14 ± 169.33 W). PPD was significantly increased in MFR compared to the control group (Control: 44.69 ± 7.75%; MFR: 48.91 ± 8.27%).

CONCLUSIONS: The effects of MFR on anaerobic power output appear to be gender specific with evidence of a positive effect on performance in women. Given that there is very little scientific inquiry with respect to the influence of MFR on maximal anaerobic power performance, it can only be speculated on the possible mechanisms for the gender disparity.

1770  Board #178  MAY 30  3:30 PM - 5:00 PM
Effects Of Temperature And Prior Sprint Efforts On Maximum Cycling Power And Optimal Pedaling Rate

(No relationships reported)

Warm-up protocols are commonly used prior to exercise, particularly before maximal power performance. Specifically, these protocols may serve to increase muscle temperature and induce muscle fatigue. However, warm-ups must balance increasing muscle temperature and inducing muscle fatigue.

PURPOSE: To determine the effects of passive warm-up, active warm-up, passive cooling, and prior maximal cycling on maximum cycling power (Pmax) and optimal pedaling rate (RPMopt).

METHODS: Twelve participants (mass 69 ± 13 kg, height 173 ± 7 cm, age 25 ± 5 yrs) performed two maximal cycling trials on an inertial load ergometer before and after three different experimental treatments: passive warm-up, active warm-up, and passive cooling. For the passive warm-up and cooling treatments, participants were immersed up to iliac crest for 30 min in 40°C water, respectively. For the active warm-up, participants rested at room temperature for 25 min, then performed a 5 min cycling warm-up at 100-120 rpm.

RESULTS: Pmax increased by 6 ± 5% (906 ± 214 vs. 961 ± 216 W, p < 0.001) and 8 ± 4% (908 ± 230 vs. 983 ± 249 W, p < 0.001) following the passive and active warm-ups, respectively, and decreased by 23 ± 6% (955 ± 238 vs. 738 ± 187 W, p < 0.001) following passive cooling. Compared to baseline, passive and active warm-up increased RPMopt (114 ± 13 vs. 122 ± 15 rpm and 114 ± 9 vs. 127 ± 11 rpm, p < 0.05), whereas passive cooling decreased RPMopt (116 ± 7 to 101 ± 11 rpm, p = 0.01). Following passive and active warm-ups, there was no additional increase in Pmax between the first and second maximal cycling trials.

CONCLUSION: These results indicate that passive and active warm-up increased Pmax by similar magnitudes whereas passive cooling substantially compromised Pmax. Temperature also influenced RPMopt, likely reflecting effects on muscle shortening velocity. Although Pmax increased following passive and active warm-ups, there was no further increase following the first maximal trial, suggesting that no additional potentiation occurred. Finally, these results may have implications for athletes who warm-up before performing short duration maximal effort tasks. That is, passive warm-up may provide an alternative strategy for increasing temperature while minimizing fatigue.

1771  Board #179  MAY 30  3:30 PM - 5:00 PM
Comparison of Peak Power for Cycling on Ergometer and Trainer
Edward M. Heath, FACSM, Andrew I. Miller, Eadric Bressel, Gerald A. Smith, FACSM. Utah State University, Logan, UT.

(No relationships reported)

The ability of a cyclist to produce peak power may be related to the apparatus that is used for testing. Laboratory research has an advantage of tighter control compared to field studies; however, ecological validity is important for application to the target population and environment. A stationary cycle ergometer is often the default instrumentation for lab data collections, but results may not generalize well because a cycle ergometer may differ substantially from a cyclist’s own bicycle. A stationary trainer equipped with the cyclist’s own bicycle compared to an ergometer can be used to address this concern.

PURPOSE: To compare peak power during cycling on an ergometer and a stationary trainer.
METHODS: Highly trained cyclists (n = 5, age = 37.6 ± 4.5 yr, VO2 peak = 63.3 ± 5.3 ml/kg/1-min-1) performed a peak power test, in randomized order, on an modified Monark ergometer and CycleOps SuperMagneto trainer. After adequate warm-up, subjects ramped up by self-selecting gear and cadence on the trainer until self-determined peak power was achieved. On the ergometer, subjects increased to peak cadence just prior to application of a resistance equal to 6.7 ± 1.0% of body weight. For the ergometer, cadence was determined by video analysis (Vicon motion analysis system).

RESULTS: Peak power was significantly (p = .026) greater on the trainer (925.0 ± 162.5 W) compared to the ergometer (840.0 ± 154.7 W).

CONCLUSION: Subjects were able to produce 10% higher power on the trainer compared to the ergometer. The increased ability to produce power on the trainer is likely due to subjects being more familiar and better fitted to their own bicycles.

1772  Board #180  MAY 30  3:30 PM - 5:00 PM  
Revisiting The Relationship Between Power And Time To Fatigue
Ming-Chang Tsai, Scott Thomas. University of Toronto, Toronto, ON, Canada.  
(No relationships reported)

A well-established model, Critical Power, has been extensively used in numerous endurance sports to characterize an individual’s work performance; anaerobic work capacity and critical power. A linear relationship between the work and time to fatigue, given by Work = AWC + CP*t, was initially proposed by Monod and Scherrer in 1965 in small muscle groups and was extended to whole-body exercise by Moritani et al. in 1981. This linear relationship was determined from plotting the limit work expressed in the product of force and limit time against the limit time. Since limit time is indirectly plotted against each other, the relationship will inevitably be linear.

PURPOSE: To revisit the relationship between power and time to fatigue in rowing exercise using a mathematically equivalent critical power model, Power = AWC/Cp + CP.

METHODS: Ergometer testing results (power outputs for 1 minute, 1000m, 2000m, and 6000m) were obtained from 55 male (19.48 yrs ± 3.34) and 35 female (20.63 yrs ± 3.16) athletes. Power output for 1 minute, 1000m, and 6000m were used to determine the relationship (exponent n in the above equation) between power and time to fatigue. This relationship is then used to construct a critical power model for each individual athlete. Together with the theoretical 2000m power output curve, a predicted 2000m power output can be calculated through numerical methods. Power output comparisons were made using two-sample independent t-tests for the traditional model relationship and the new model relationship.

RESULTS: The exponent n of the critical power model was determined to be 0.3998 (p<0.001). The predicted 2000m power outputs from the traditional relationship (n=1) showed a significant difference from the actual 2000m power outputs (t=2.14 p=0.0337), while the 2000m power outputs from the new relationship (n=0.5) showed no significant difference from the actual 2000m power output result (t=1.03 p=0.3045).

CONCLUSION: The new relationship (n=0.5) between power and time to fatigue appears to predict the actual 2000m power output better than the traditional relationship (n=1) between power and time to fatigue.

Supported by the Ontario Ministry of Health.

1773  Board #181  MAY 30  3:30 PM - 5:00 PM  
Effects of Football Equipment on Power in High School Players
(No relationships reported)

Traditional speed testing of football players has normally been done in the absence of game equipment. Research in the area of football equipment’s impact on strength and conditioning assessments is limited. Determining power from 40-yard dash times in the use and absence of football equipment can give coaches valuable insight on athletes’ potential. Changes to functional power (FP) in the presence of game equipment have yet to be investigated in the 40-yard dash.

PURPOSE: To assess changes in FP during the 40-yard dash with football equipment (EQ) and with no football equipment (NEQ).

METHODS: Sixty-four high school football players (weight: 78.28 ±15.45 kg) were timed in the 40-yard dash on a natural grass field using an automatic timing system with a high speed video camera (30 frames/sec), starter pistol, receiver, and timing software. Players performed two trials with nylon shorts and a t-shirt, then two trials with standard issued football game equipment. The fastest times of the two trials for each condition were used for analysis. A paired samples t-Test was utilized to assess the significance between 40-yard dash EQ and NEQ at an alpha level of 0.05.

RESULTS: There was a significant increase in power with EQ condition (t = 11.040, p < .001).

CONCLUSION: Literature suggested that speed decreased with the addition of football equipment, but measuring and understanding power increase can be beneficial to coaches and trainers. Certain players may be capable of handling increased overall lean muscle mass while still having quality on-field performance. Poor FP with equipment can be identified in order for coaches to implement a specific conditioning program.

1774  Board #182  MAY 30  3:30 PM - 5:00 PM  
Football Equipment Effects on 20-yard Agility Power in High School Football Players
Brittany S. Richard, Lauren E. Miller, Brian J. Campbell, Katie C. Morgan, Stefan L. Bergeron, Cole M. Thompson, Torie M. Guidry. University of Louisiana at Lafayette, Lafayette, LA.  
(No relationships reported)

Traditional sports performance test does not incorporate (game like) conditions when determining the speed or agility of an athlete. Agility power testing with equipment (APE) gives more evidence on how the players will perform in game like situations than testing without equipment (APW). This also gives coaches valuable insight on the players potential and further allows them to implement effective conditioning programs specific to the individual.

PURPOSE: To assess the effects of football equipment on agility power in High School Football players. Method: 64 high school football players (weight: 78.28±15.45 kg) were timed in the 20 yard agility run on a natural grass field. Each player was tested in two trials of both APE and APW conditions. Agility time was administered by experienced, hand held timers with the best trial.

RESULTS: A significant difference was noted between APE and APW (t = 5.679, p < .001).

DISCUSSION: The results suggest that players significantly increase their agility power with equipment. Coaches can use this information to target players with higher power output in presence of added equipment. This implies that players with higher power output may transition more lean muscle mass to the football field. Participants who demonstrate less power than average should be targeted for improvement through specific strength and conditioning.

1775  Board #183  MAY 30  3:30 PM - 5:00 PM  
Cross Training Program Induces Specific Changes on Anthropometric Profile and Leg Power in Women Dancer
(No relationships reported)

Cross training is a fitness method which incorporates various activities in a work session; it reduces the risk of overload injury, increases the quality of movement and improves technique. Scientific literature about the results of morphological evaluation of physical performance or administration of dancers training programs is currently limited, therefore, knowledge of the morphology of the dancers will provide training tools to develop the basic and specialized skills in dance activity.

PURPOSE: To evaluate the effect of a specific fitness program based on “cross training” technique on anthropometric and physical performance profile of a semi-professional dancers group.

METHOD: The participants were nine women dancers 20 to 24 years of age. The evaluation of anthropometric profile, the proportional sum of six skinfolds (PS6S), the feeding and physical
performance (aerobic capacity, muscular strength, leg power and others), was performed before and after to apply the cross training program (12 weeks). Descriptive statistics, Student t test and ANOVA were used and statistical significance was set at p < 0.05.

RESULTS: Only five dancers, 22.4 ± 1.4 years old, 51.3 ± 7.0 kg of weight and 161.1 ± 2.0 cm of height, with 8.0 ± 2.8 years of experience in the discipline completed the program. Iliac crest Skinfold decreased from 14.5 ± 6.3 to 11.4 ± 4.8 mm, (p=0.011), abdominal (19.3 ± 7.3 to 15.8 ± 6.5 mm, p=0.014), front thigh from 24.9 ± 6.9 to 17.9 ± 3.6 mm (p=0.013), medial calf (13.6±6.10 to 10.9±4.7mm, p=0.045). The forearm circumference increased (p=0.009), while the hip (p=0.003), ankle (p=0.034) and PS6S (101 ± 32 to 78.8±25.6mm) decreased significantly. Energy intake, aerobic capacity and muscular endurance remained unchanged. The results indicated an Increased potency (jump Grand Jete) of 124.7±11.2 to 152.4±11.5 cm (p = 0.028).

CONCLUSIONS: Cross training program showed effectiveness to improve some of the skills required in the performance of contemporary dance, however it will be interesting to search an increase in aerobic capacity, a basic characteristic for physical training as well as to adapt the diet in this group.

**1776 Board #184 MAY 30 3:30 PM - 5:00 PM**

Attenuated Wingate Test Power Outcomes from “All-Out” Pre-Test Pedaling Cadence Compared to Moderate Cadence

William R. Lunn, Maria Zenoni, Ian Crandall, Ashley Dress, Christopher Fountain, Jason Pereira, Michelle Berghard. Southern Connecticut State University, New Haven, CT.

(No relationships reported)

Published research employing the Wingate Anaerobic Test for muscular power (WAnT) describes instructing the participant to either pedal as fast as possible or maintain a constant, moderate cadence in the seconds before test start. It is unclear whether non-standardized, pre-test pedal cadences can influence power data.

PURPOSE: The aim was to determine the effect of different pre-test pedaling cadences on power outcomes obtained during the WAnT.

METHODS: Vigorously-exercising adult males (n = 14, 24.9 ± 1.2 y, 80.1 ± 2.7 kg, BMI = 24.4 ± 0.6, body fat = 11.0 ± 1.0%) and females (n = 14, 20.4 ± 0.6 y, 61.4 ± 2.6 kg, BMI = 22.2 ± 0.5, body fat = 21.4 ± 1.3%) participated in a randomized study during which they performed the 30 s WAnT on a cycle ergometer on two occasions. Each WAnT was separated by at least 48 h for adequate recovery. Flywheel load was standardized at 0.075 kg/kg body weight. In one trial, the participant was instructed to pedal as fast as possible with an unloaded flywheel during the 5 s before resistance was applied and the test began (FAST). In the second trial, the participant was instructed to maintain a moderate cadence of 80 rpm during the 5 s before resistance was applied (MOD). All other components of the WAnT were identical in both trials. Peak power (PP), mean power (MP), minimum power (MinP), time at peak power (PPtime), and power drop (Pdrop) were recorded. Body composition was determined by 3-site skinfolding. Comparisons were made using a 2x2 factorial ANOVA (gender x cadence).

RESULTS: Regardless of gender, the FAST protocol resulted in 22.2% lower PP (612.6 ± 33.0 W vs. 788.3 ± 43.5 W), 13.3 % lower MP (448.4 ± 22.2 W vs. 517.2 ± 26.4 W), 11.7% lower MinP (280.9 ± 14.8 W vs. 318.3 ± 17.2 W), and 9.0% lower Pdrop (53.5 ± 1.3 % vs. 58.8 ± 1.5 %) than in MOD (p < 0.01; means ± SE). No difference was observed in Ptime. Similar outcomes were observed within gender.

CONCLUSION: Commonly-used protocols which instruct the WAnT participant to pedal either as fast or possible as at moderate cadence with an unloaded flywheel before resistance is applied result in a divergence of anaerobic muscular power indices. Expanding the WAnT protocol to include standardizing the pre-test pedal cadence may be important to exercise testing professionals who are comparing the data to norms or generating norms for specific populations.

**1777 Board #185 MAY 30 3:30 PM - 5:00 PM**

No Difference In Power Output For Seated Versus Standing Position During Wingate Anaerobic Power Test

Jeffrey A. Potteiger, FACSM1, Jacob Hamm2, Mark Walsh3, Dean Smith4, 1 Grand Valley State University, Grand Rapids, MI. 2Miami University, Oxford, OH. 3North Dakota State University, Fargo, ND.

(No relationships reported)

PURPOSE: To determine if differences in power output exist between the seated and standing positions during the Wingate Anaerobic Power Test (WAPT).

METHODS: 14 males (body mass 79.6±7.1 kg) from a College Club level ice hockey team participated in the study. All testing occurred at the same time of day following a 4 h fast. On day one, body fat percent and fat free mass (FFM) were determined using air displacement plethysmography and subjects were given two practice Wingate Anaerobic Power tests (one each in the seated and standing position). On two different days, the subjects performed two 30 s maximal effort WAPT, with each test separated by 7 days. All data were collected using a Monark computerized bicycle ergometer. Following a standard 5 min warm-up, each subject was given a 3 minute rest. The resistance for testing was 7.5% of body mass. Subjects were ramped up during the test with load application and data collection beginning when subjects reached 120 rpm. Differences in power output between the seated and standing position were determined using a paired t-test, with significance set at p≤0.05.

RESULTS: The data (means±SD) for the primary dependent variables are shown in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Peak Power (W)</th>
<th>Peak Power (W/kg)</th>
<th>Average Power (W)</th>
<th>Average Power (W/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seated</td>
<td>759.1±96.7</td>
<td>12.1±1.4</td>
<td>618.6±48.3</td>
<td>8.9±0.7</td>
</tr>
<tr>
<td>Standing</td>
<td>971.5±90.0</td>
<td>12.2±1.5</td>
<td>829.6±45.8</td>
<td>8.9±0.7</td>
</tr>
</tbody>
</table>

There were no significant differences between the two positions for any of the primary dependent variables.

CONCLUSION: During Wingate Anaerobic Power testing subjects should be allowed to select the most comfortable position for testing, as both seated and standing produced similar peak and average power measures.

**1778 Board #186 MAY 30 3:30 PM - 5:00 PM**

Associations of Upper Body Power Tests and Upper and Lower Body Power in ROTC Cadets

Anita M. Gust, Katie Jorissen, Nicklaus Rendenius, John Schuna, Jr., Sarah Hilgers, Bryan Christensen, Gary Liguori. North Dakota State University, Fargo, ND.

(Sponsor: Donna J. Terbiza, FACSM)

(No relationships reported)

Upper and lower body power are important physical attributes for a successful soldier, yet are not part of the current U.S. Army physical fitness assessment.

PURPOSE: This study assessed the relationship between upper and lower body power in U.S. Army ROTC cadets in an attempt to identify useful power measures for future Army testing. Upper body power was measured by a seated medicine ball throw (MB) and a push up test (PU), and lower body power was measured by a counter-movement vertical jump (VJ).

METHODS: A total of 79 cadets (20 females and 59 males) performed all three tests in a single session. The seated MB test consisted of three separate throws of a 4kg medicine ball, measuring for greatest distance. The PU test consisted of three separate, quick and forceful PUs’ performed on an AMTI Accupower force plate (W/kg). The VJ consisted of three separate double leg counter-movement vertical jumps on the AMTI force plate (W/kg). Participants were asked to perform each test with maximal volitional effort and acceleration. Each attempt was recorded with the best score on each test retained for use in further analysis. Pearson product-moment correlations were calculated to assess the relationship between the MB, PU, and VJ. All analyses were conducted using PASW statistics version 18, with alpha set < .05.

RESULTS: For males, a significant moderate correlation was found between the MB and VJ (r=0.44, p = .001). For females, significant moderate correlations were found between the MB and VJ (r=0.45, p = .047) and between the MB and PU (r=0.51, p=0.022).

CONCLUSIONS: Although both the MB and PU tests were intended to measure upper body power and thought to be related, our study found mixed results based on gender. There was a significant relationship between the two upper body tests in the females, but not in the males. A significant relationship between upper and lower body power was found in both males and females with the MB and VJ. Limitations of this study include a small sample of women, and not having a gold standard of an upper body power measure to determine which upper body test

Key words: Leg explosive Power, Intermittent anaerobic power, Speed, Agility, cardiovascular endurance.

CONCLUSIONS: demonstrated better explosive power, anaerobic power, lower power decrement, and better agility ability.

METHODS: Fifteen members of three different basketball wheelchair teams were recruited for this research. It was divided in two stages. The first stage investigated the distance to be traveled six times to be tested with ARAST. It was performed by using the time people usually last to reach each stage. The RAST test was applied in 20 volunteers. Time to cover 35 meters maximal running performance was measured. Then it was determined the distance 20 patients using their wheelchair, were able to cover in this time. We found the proper distance was between 15 and 20 meters. So we tested both distances in 15 basqueteball wheelchair patients The results of 15 meters six times test did not showed negative trend between the last and the first travel. When we tested in 20 meters we found a significant difference pe 0.5 between the last and the first, similar to those seen with original RAST test.

RESULTS: in the 20 meters test we found. Maximum speed: average 3.58 m/sec. Standard deviation: 0.37. Time to cover distance: average 6.05 sec. Standard deviation: 0.66. Losing speed in percentage average: 11.44% Standard deviation: 7.43. We also determined peak power and mean power taking in account power = mass distance

CONCLUSION: The advantage of using ARAST for measuring anaerobic power wheelchair patients is that it allows the execution of more specific movements, it is easily applied and low cost, and due to its simplicity can be incorporated into routine training. Future direction could be to test larger number of disable athletes, and also in different Sports. We concluded that this procedure is valid, and can be used to measure running anaerobic power and predict short-distance performances in wheelchair patients.

1780 Board #188 MAY 30 3:30 PM - 5:00 PM

Peak Power Output During A 15m Wheelchair Overground Sprint Can Be A Measure Of Anaerobic Capacity

Jan W. van der Scher1, Sonja de Groot1, Tom A. Gakes2, Marlies Bouma3, Dirk-Jan H.E.J. Veeger1, Lucas H.V. van der Woude1. 1University Medical Center Groningen, Groningen, Netherlands. 2VU University Amsterdam, Amsterdam, Netherlands. (Sponsor: Thomas W.J. Janssen, FACSM)

Wheelchair-specific anaerobic capacity can be assessed with a 30s Wingate-like sprint test in a handrim-propelled wheelchair ergometer (WC ergometer). Performance on this test has been found sensitive to change in high and low-intensity training programs. However, the ergometer test cannot easily be employed in a sports or rehabilitation setting. An alternative test might be a 15m overground sprint in a handrim-propelled wheelchair (15m WC sprint) equipped with torque sensors.

PURPOSE: To test the hypothesis that 1) peak power output and 2) time of a 15m WC overground sprint are valid alternatives for outcome measures of a 30s Wingate-like sprint test in a WC ergometer.

METHODS: Able-bodied men and women (age: 18-30y, height: 163-195 cm, weight: 50-94 kg) performed a 30s Wingate-like sprint test in a WC ergometer (start velocity = 0 m/s). Torque around the right wheel axle was measured, enabling determination of 1) peak power output, 2) mean power output over the full 30s-test, and 3) mean power over a 5s-interval after the first start-up strokes. Resistance was individualized to ensure a velocity < 2 m/s. On another day, subjects performed a 15m WC overground sprint. As in the ergometer sprint, unilateral peak power output was determined from torque around the right wheel axle (measured with a commercially available torque sensor-equipped wheel). In addition, similar to current use of 15m WC sprint tests in rehabilitation settings, performance time was manually recorded. Descriptive statistics and correlation coefficients (Pearson’s r) were calculated to test the hypothesis.

RESULTS: Unilateral peak power in the 15m WC sprint was 228 (±72) W, and 250 (±85) W in the WC ergometer test. Ergometer-30s power was 44 (±17) W, and ergometer-5s power was 54 (±21) W. Time over 15m was 7.2 (±1.0) seconds. Unilateral peak power in the 15m overground test was strongly correlated to ergometer peak power (r = 0.765), 30s-power (r = 0.836), and 5s-power (r = 0.716) at P < 0.001. Pearson’s r between 15m time and ergometer peak, 30s-, and 5s-power ranged between -0.479 and -0.612 (P < 0.05).”

CONCLUSION: Peak power output in a 15m WC overground sprint seems to be a valid alternative for mean power output measured in a 30s Wingate-like sprint test in a WC ergometer. Performance time on the 15m sprint seems less suitable for this purpose.

1802 Board #190 MAY 30 3:30 PM - 5:00 PM

Bilateral Strength Assymetry During The Vertical Jump In Professional Soccer Goalkeepers

Frantisek Zahalka, Tomas Maly, Lucia Mala, Jaroslav Teplan. Charles University, FFES, Prague, Czech Republic.

(No relationships reported)

Explosive power depends on the height of the jump and monitored parameters was determined by Pearson’s correlation coefficient.

RESULTS: The physiological different between level were found in the explosive power and anaerobic power of lower limbs and the agility ability. As the result, the elite level demonstrated better explosive power, anaerobic power, lower power decrement, and better agility ability.

Key words: Leg explosive Power, Intermittent anaerobic power, Speed, Agility, cardiovascular endurance.

1802 Board #190 MAY 30 3:30 PM - 5:00 PM

Bilateral Strength Assymetry During The Vertical Jump In Professional Soccer Goalkeepers

Frantisek Zahalka, Tomas Maly, Lucia Mala, Jaroslav Teplan. Charles University, FFES, Prague, Czech Republic.

(No relationships reported)

Explosive power is a fundamental skill that is important for soccer goalkeepers. Powerful legs enable them to leap up and over their teammates and opponents to collect balls kicked into the goal area. For soccer goalkeepers, functional strength is more important than absolute strength.

PURPOSE: The aim of the study is to assess the level of explosive strength and asymmetry of biomechanical parameters during the bilateral jump (counter movement jump with free arms - CMJ2A) in professional goalkeepers.

METHODS: The monitored group was composed of elite soccer goalkeepers (n = 25, age = 26.5±9.1 years, body height = 186.1±7.8 cm, body weight = 86.7±14.8 kg). Strength indicators during CMJ2A were observed by means of force platform Kistler 9861A. For statistical processing, methods from descriptive statistics were used; a bilateral difference between parameters was assessed by dependent t-test and relation between the height of the jump and monitored parameters determined by Pearson’s correlation coefficient.

RESULTS: The jump height of players was 45.26±3.36 cm. Total bilateral force produced at take-off was 2260.6±353.8 N. Take-off force produced by the dominant leg (DL) was
significant change was observed between the non-dominate leg (ND) (FND = 1174.6±167.5 N vs. FND =1086.0±202.8 N, \( p<0.01 \)). The mean difference in generated force was 101.0±103.5 N, which indicates high heterogeneity in the symmetry of jump implementation in the monitored group of professional players. The smallest difference was 4 N (0.4\%) and the greatest 373 N (34.7\%). The jump height did not correlate significantly with the size of the bilateral difference in force generated during the jump (r = -0.11, p<0.01).

CONCLUSIONS: Results showed a lower jump height in our players compared to the values of elite players stated in literature. A significant difference between strength generated in DL and NL, as well as differences on the basis of inter-individual comparison, are the evidence of strength asymmetries in the jump implementation. However, jump height is not dependent on the symmetric implementation of both legs in terms of maximum strength production. Supported by MSM 0021620864 and GACR P407/11/P784

1783 Board #191 MAY 30 3:30 PM - 5:00 PM
Estimated Times To Exhaustion And Power Outputs At Four Fatigue Thresholds
Haley C. Bergstrom1, Terry J. Housh, FACSM1, Jorge M. Zuniga2, Clayton L. Camic1, Daniel A. Traylor1, Glen O. Johnson, FACSM1, Richard J. Schmidt1.
1University of Nebraska-Lincoln, Lincoln, NE. 2Western New Mexico University, Silver City, NM. 3University of Wisconsin-Platteville, Platteville, WI.

(No relationships reported)

PURPOSE: The purposes of this study were to compare the power outputs and estimated times to exhaustion (T_{exh}) at the gas exchange threshold (GET), physical working capacity at the rating of perceived exertion threshold (PWCP_{RPE}), critical power (CP), and respiratory compensation point (RCP).

METHODS: Three male and five female subjects (mean ± SD: age 22.4 ± 2.8 yr) performed an incremental test to exhaustion on an electronically braked cycle ergometer to determine (dot above) V_{O2max}, peak, GET, and RCP. The two-parameter, linear, W_{max} versus time T_{max} model was used to estimate CP from four rides to exhaustion and four separate power outputs. Ratings of perceived exertion (RPE) were recorded during the rides to exhaustion. The PWCP_{RPE} was determined from the slope coefficients for the RPE versus time relationships calculated for three rides to exhaustion and plotted as a function of the corresponding power outputs to estimate the PWCP_{RPE}. The estimated T_{max} values for each subject at GET, CP, PWCP_{RPE}, and RCP were determined from power curve analyses (T_{max} = ax^b).

RESULTS: The results indicated that GET (154 42 W) was significantly (p < 0.05) less than RCP (181 54 W). There were no significant differences, however, among the CP (167 46 W), PWCP_{RPE} (176 55 W) or RCP. The estimated T_{max} for the GET (26.1 9.8 min) was significantly (p < 0.05) greater than PWCP_{RPE} (14.6 5.6 min) and RCP (11.2 3.1 min). The CP (16.0 1.6 min), however, was not significantly different from GET.

CONCLUSION: The results indicated that the PWCP_{RPE} occurred at a mean power output that was 12.5% greater than the GET and, therefore, it is likely that the PWCP_{RPE} occurred within the heavy exercise intensity domain. Furthermore, the RCP was 8% greater than CP and, therefore, these thresholds may be associated with different mechanisms of fatigue.

1784 Board #192 MAY 30 3:30 PM - 5:00 PM
Ground Reaction Force Analysis of the Anterior and Crossover Single Leg Hop Tests
Michael Nelson, Brent Sloss, Bryan L. Riemann. Armstrong Atlantic State University, Savannah, GA. (Sponsor: T. Jeff Chandler, FACSM)

(No relationships reported)

In contrast to the landing phase, less research has examined the propulsion phase of the single leg anterior (AHT) and cross over (COHT) hop tests. Additionally, there appears to be a void to exhaustion and plotted as a function of the corresponding power outputs to estimate the PWCP_{RPE}. The estimated T_{max} values for each subject at GET, CP, PWCP_{RPE}, and RCP were determined from power curve analyses (T_{max} = ax^b).

RESULTS: The results indicated that GET (154 42 W) was significantly (p < 0.05) less than RCP (181 54 W). There were no significant differences, however, among the CP (167 46 W), PWCP_{RPE} (176 55 W) or RCP. The estimated T_{max} for the GET (26.1 9.8 min) was significantly (p < 0.05) greater than PWCP_{RPE} (14.6 5.6 min) and RCP (11.2 3.1 min). The CP (16.0 1.6 min), however, was not significantly different from GET.

CONCLUSION: The results indicated that the PWCP_{RPE} occurred at a mean power output that was 12.5% greater than the GET and, therefore, it is likely that the PWCP_{RPE} occurred within the heavy exercise intensity domain. Furthermore, the RCP was 8% greater than CP and, therefore, these thresholds may be associated with different mechanisms of fatigue.

1785 Board #193 MAY 30 3:30 PM - 5:00 PM
Critical Power and Body Composition during Preparation for a Bodybuilding Competition: A Case Study
David H. Fikuda1, Lindy M. Rosswow1, Jeremy P. Loenneke1, Christopher A. Fahn1, Kristina L. Kendall1, Abbie E. Smith1, Jordan R. Moon1, Jeffrey R. Stout1, Michael G. Bemben, FACSM1, University of Oklahoma, Norman, OK. 2University of North Carolina, Chapel Hill, NC. 3United States Sports Academy, Daphne, AL.

(No relationships reported)

Critical power from an all-out cycling test reflects changes to physical training and may provide insight into the under-researched sport of natural bodybuilding.

METHODS: The subject was a 27 year old bodybuilder (height=186 cm; weight=88.9-102.9 kg) who performed four days of resistance training and two to three days of aerobic training of varying intensity per week. At baseline (M0) and alternating months during the six months of contest preparation (M2, M4, and M6), critical power (CP) and anaerobic working capacity (W') were calculated from a three-minute all-out cycling test, and muscle mass (MM) and body fat percentage (Fat%) were determined from bioelectrical impedance spectroscopy. Change scores between each time point were compared to minimal difference values (MD=standard error of the measure x 1.96 x n=10), W' (MD=3.8 kJ; n=10), MM (MD=0.3 kg; n=11), and Fat% (MD=2.5%; n=11).

RESULTS: The change in CP exceeded MD between each time point with an increase from M0 and M2 (43 watts), and decreases from M2 to M4 (37 watts) and M4 to M6 (30 watts). The change in W' exceeded MD between each time point with decreases ranging from 4.2 to 5.9 kJ. Fat% and MM decreased throughout the event preparation and changes were greater than MD for each time point, ranging from 3 to 6% and 0.4 to 1.8 kg, respectively.

Table 1

<table>
<thead>
<tr>
<th>Time</th>
<th>Weight (kg)</th>
<th>CP (watts)</th>
<th>W' (kJ)</th>
<th>MM (kg)</th>
<th>Fat%</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>102.9</td>
<td>223</td>
<td>25.0</td>
<td>40.3</td>
<td>6.8</td>
</tr>
<tr>
<td>M2</td>
<td>96.5</td>
<td>266</td>
<td>19.1</td>
<td>38.5</td>
<td>23.0</td>
</tr>
<tr>
<td>M4</td>
<td>90.8</td>
<td>229</td>
<td>14.9</td>
<td>38.1</td>
<td>6.0</td>
</tr>
<tr>
<td>M6</td>
<td>88.9</td>
<td>199</td>
<td>8.6</td>
<td>37.5</td>
<td>3.8</td>
</tr>
</tbody>
</table>

CONCLUSION: Preparatory training for a natural bodybuilding competition was associated with varying reductions in CP, W', Fat%, and MM.
1786  Board #194  MAY 30  2:00 PM - 3:30 PM
Asymmetrical Loading Affects Interssegmental Dynamics During The Swing Phase Of Walking
Jeremy D. Smith¹, Todd D. Royer², Philip E. Martin, FACSM². ¹University of Northern Colorado, Greeley, CO. ²University of Delaware, Newark, DE. ¹Iowa State University, Ames, IA.
(No relationships reported)

Much of the research related to lower extremity inertia manipulations has focused on temporal, kinematic and traditional inverse dynamics assessments during locomotion. Interssegmental dynamics is an analytical technique that provides further insights into mechanisms underlying linked-segment motion.

PURPOSE: To determine how interssegmental dynamics during the swing phase of walking are altered during asymmetrical lower extremity loading.

METHODS: Seven male and five female young healthy adults (Age = 26 ± 4 yrs.; Mass = 72.5 ± 10.6 kg; Height = 173.1 ± 6.2 cm), free of any notable gait or structural asymmetries, participated in the study. Participants walked overground at a speed of 1.57 m·s⁻¹ with 0.0, 0.5, 1.0, and 2.0 kg attached to one foot. A three segment lower extremity inverse dynamics model was used to determine net, interaction, gravitational, and muscle moments at the ankle, knee, and hip of each leg during each trial. Nine (3 moments x 3 joints) paired Hotellings T² tests (SAS 8.02, Cary, NC) were used to test whether asymmetrical lower extremity loading had an effect on the relative contributions of interaction, gravitational, and muscle moments to the absolute angular impulse at each joint.

RESULTS: Moment magnitudes at joints of the loaded leg increased systematically with increasing load, whereas unloaded leg moments were unaffected by loading. With increasing load, relative contributions of interaction moments about the knee and hip and gravitational moment about the ankle increased (i.e., 21%, 8%, and 44% increases, respectively for unloaded vs. 2.0 kg; all statistical comparisons had F > 65.0, p < 0.001), whereas the relative contributions of muscle moments about all three joints declined (i.e., -4%, -13%, and -8% decreases for the ankle, knee, and hip, respectively for unloaded vs. 2.0 kg; all statistical comparisons had F > 5.5, p < 0.019).

CONCLUSION: These results suggest that altered inertia properties of the limb not only affected the amount of muscular effort required to swing the leg, but also increased the influence of the interaction and gravitational moments on leg swing during effort.

1787  Board #195  MAY 30  2:00 PM - 3:30 PM
Effect Of Stride Frequency On Metabolic Costs And RPE During Walking In Water
Kenji Masumoto¹, Yoshiko Nishizaki², Ayako Hamada³. ¹Fukuoka Prefectural University, Tagawa, Japan. ²Kyushu University, Kasuga, Japan.
(No relationships reported)

Walking in water has been included in exercise and rehabilitation programs, however, no previous research has investigated the effect of stride frequency (SF) on metabolic costs and the rating of perceived exertion (RPE) during walking in water. Such information is important if gait mechanics in water is to be better understood.

PURPOSE: To investigate the effect of SF on metabolic costs and RPE during walking in water.

METHODS: Eleven male subjects (means ± SD: age = 23.8 ± 4.2 years, height = 175.7 ± 7.3 cm, body mass = 68.6 ± 7.0 kg) walked on a treadmill on dry land and on an underwater treadmill at their preferred stride frequency (PSF) and walked at an SF which was lower and higher than the PSF (i.e., SF ± 15, 10, and 15 strides·min⁻¹). Walking speed was kept constant at each subject’s preferred walking speed in water and on dry land. Oxygen consumption (VO₂), respiratory exchange ratio, heart rate, minute ventilation, RPE, PSF and preferred walking speeds were measured.

RESULTS: Metabolic costs and RPE were significantly higher when walking at low or high SF conditions than when walking at the PSF condition both in water and on dry land (e.g., 73% and 58% increases in VO₂ and RPE during walking in water at PSF+15 versus PSF conditions, respectively; p < 0.001). Additionally, the high SF condition produced significantly higher metabolic costs and RPE than the equivalent low SF condition during walking in water (e.g., 31% increase in VO₂ between PSF+15 versus PSF-15 conditions; p < 0.001)). Furthermore, metabolic costs (e.g., 12.3 ± 2.4 and 15.3 ± 2.2 ml·kg⁻¹ for VO₂ for water and dry land conditions, respectively; p < 0.005), RPE (i.e., 7.2 ± 1.2 and 9.5 ± 1.4 for water and dry land conditions, respectively; p < 0.001), and the preferred walking speed (1.5 ± 0.3 and 4.7 ± 0.6 km·h⁻¹ for water and dry land conditions, respectively; p < 0.001) were significantly lower in water than on dry land when walking at the PSF.

CONCLUSION: These observations suggest that a change in SF may influence metabolic costs and RPE during walking in water.

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1788  Board #196  MAY 30  2:00 PM - 3:30 PM
Influence Of Physical Activity History On Ground Reaction Force During Walking
Henry Wang, Jeff Frame, Clark Dickin. Ball State University, Muncie, IN.
(No relationships reported)

Military recruits are commonly afflicted by lower-extremity overuse injuries such as tibial stress fracture (TSF). In particular, recruits with low levels of fitness are at a higher risk. Thus, it is advisable to precondition recruits before basic training. Running and basketball are common exercises to improve physical condition. However, patterns of ground impact loading are different between running and playing basketball. Multi-directional loading in basketball may lead to bone adaptation and reduce the risk of TSF. As loaded walking, a major task in basic training exposes recruits to high ground impact forces leading to increased risk of injury, it is important to examine if and how physical activity history (PAH) of running or basketball influences ground impact forces during loaded walking.

PURPOSE: To determine differences in vertical ground reaction force (VGRF) and loading rate (VLR) during loaded walking between runners and basketball players.

METHODS: Forty recreational runners (n=20, 21±2 yr.) and basketball players (n=20, 21±2 yr.) participated in this study. Participants completed four walking tasks in the following order: walking with 0kg (W00), 13kg (W15), 25kg (W25), and 35kg (W35) loads. Each task was performed for 5 min on a force instrumented treadmill (AMTI) at 1.67 m/s. Peak VGRF and VLR at weight acceptance were normalized to body weight (BW). Two-way repeated measures ANOVAs were performed. α = 0.05.

RESULTS: No statistical differences in VGRF and VLR were found between the two groups (P>0.05). Increasing load carried had a significant effect on VGRF and VLR (P<0.001). As load carried increased, linear increases of VGRF(1.29±0.06, 1.57±0.11, 1.77±0.22, and 1.99±0.19 BW for W00, W15, W25, and W35, respectively) and VLR (17.92±3.72, 22.51±5.02, 27.01±8.33, and 31.56±7.18 BWs for W00, W15, W25, and W35, respectively) were observed (P<0.001).

CONCLUSION: The significant increases of mechanical loading and loading rate are proportional to the increment of load carried. Despite differences in activity loading patterns between runners and basketball players, there were no differences in mechanical loading. Future studies should examine aspects of how PAH influences mechanical responses of tibia during loaded walking to improve the understanding of TSF.

Supported by US Army W81XWH-08-1-0587.

1789  Board #197  MAY 30  2:00 PM - 3:30 PM
Metabolic Demands Of Split Belt Treadmill Walking
(No relationships reported)

Split belt treadmill walking (SBTW) is a novel intervention shown to improve gait asymmetry and locomotor function in neurologic populations. SBTW is thought to provide an advantage.
over traditional treadmill walking (TW) due to its increased reliance on motor learning. To better understand the mechanisms underlying these improvements, it is important to determine whether or not the metabolic costs associated with SBTW are different than TW.

**PURPOSE:** Evaluate effects of SBTW on VO\textsubscript{2}, heart rate (HR), and rating of perceived exertion (RPE, 16 point).

**METHODS:** Ten healthy young adults (G1: 21.9±2.1 yrs; 175±10.5 cm; 70.3±11.5 kg) and 10 healthy, non-faller older adults (G2: 69.8±7.7 yrs; 168±11.8 cm; 70.7±15.2 kg) performed self-selected speed forward and backward walking over a 10 m calibrated space during which time three-dimensional lower extremity kinematic parameters were measured with a 12-camera motion capture system (120Hz). Prior to the first walking trial, following the fifth trial and after the last (10th) walking trial, a series of static balance measures were completed. The balance tests consisted of four quiet stance conditions: 1) firm surface, eyes open, 2) firm surface, eyes closed, 3) soft surface, eyes open, and 4) soft surface, eyes closed. The intervention consisted of 10-15 min of backward walking, three days/week, for four weeks. Post-intervention testing (week four) replicated the pretest procedures while mid-intervention (week 2) testing evaluated balance only. Kinematic gait descriptors (stride length, cadence, walking velocity, range of motion) during forward walking were evaluated with correlated t-tests for G2. Balance scores and anterior-posterior sway range were assessed with a (2 x 3) mixed model ANOVA (P<0.05).

**RESULTS:** SBTW exhibited significantly faster self-selected forward walking velocity post-intervention (1.10±0.17 vs 1.22±0.12 m/s; P=0.048). Balance scores were significantly different between groups (G1: 90.4±2.0; G2: 85.5±13. p=0.005) and across time (G1: Pre: 89.8±1.7; Mid: 90.8±2.0; Post: 90.4±2.3; G2: Pre: 83.4±5.9; Mid: 87.3±3.7; Post: 85.9±5.8; p<0.012) for the most challenging balance test. Anterior-posterior sway range (cm) was also significantly different between groups (0.97±0.10 vs 1.42±0.13; p=0.014) and across time (Pre: 1.04±0.15 vs 1.60±0.66; Mid: 0.91±0.20 vs 1.27±0.38; Post: 0.96±0.23 vs 1.37±0.58 for G1 vs G2 respectively; p=0.028).

**CONCLUSION:** Older adults demonstrated improved balance and increased walking velocity after 2-4 weeks of backward walking. Consideration should be given to including backward walking as part of a regular exercise program for older adults.
CONCLUSIONS:

Bag (2) compared to no bag (1) and decreased 7.8% under load condition (3) compared to no bag (1). Also, CCC for the hip joints in the frontal plane decreased 8% and 10% under load indicative of an adaptive strategy (e.g. lateral bending) that could result in changes in joint forces and moments.

RESULTS:

This may indicate that forced cadence load carriage at fast speeds and cadences is a contributing factor to the higher incidence of lower extremity injuries seen in female BCT recruits.

were assessed in frontal and sagittal planes via Cross Correlation Coefficients (CCC). Each gait cycle was divided into swing and stance phases.

METHODS:

As expected, K

CONCLUSION:

support and unilateral stance variables. Over the 6-minute walk, both maximum and end gait velocities increased post-program, but subjects continued to show an inability to sustain a consistent speed compared to the end.

CONCLUSION:

The intervention was successful at improving balance, which likely led to improved gait parameters and a faster functional gait speed. Further development and testing of a yoga based balance exercise program to address both bilateral and unilateral activities is warranted.

PURPOSE:

To evaluate gait kinematics and co-ordinative patterns for lower extremity joints during asymmetrical load carrying.

METHODS:

Six university students (22.6±3.72yrs, 172.6±7.5 cm, 69.2±8.2kg) walked on a treadmill under three different load conditions: (1) no bag, (2) carrying a messenger bag on one shoulder hanging vertically down to the hip, and (3) carrying a messenger bag on one shoulder draped across the trunk to opposite hip. All participants walked at their preferred pace for one minute in each condition. Kinematic data were acquired using a Vicon motion analysis system with 7 digital cameras (120Hz). Changes in hip, knee, and ankle joint angles across the gait cycle were assessed in frontal and sagittal planes via Cross Correlation Coefficients (CCC). Each gait cycle was divided into swing and stance phases.

RESULTS:

As expected, K

CONCLUSIONS:

During the stance phase of walking on a treadmill while carrying an asymmetric load, the hip and knee joints follow different movement patterns when comparing right and left. Thus, the bilateral joint movements are less symmetrical. There was no effect on the ankle joints during the gait cycle. The frontal plane differences observed at the hip and knee may be indicative of an adaptive strategy (e.g. lateral bending) that could result in changes in joint forces and moments.

1793 Board #201 MAY 30 2:00 PM - 3:30 PM

Effect Of Balance Exercise Therapy On Gait Parameters In Individuals With Chronic Stroke

Tracy A. Dietsk1, Peter A. Altenburger1, Kristine K. Miller1, Arlene A. Schmid1. Indiana University, Indianapolis, IN. 2Roudebush VA Medical Center, Indianapolis, IN. (Sponsor: Stuart J. Warden, FACSM)

(No relationships reported)

Balance and gait deficits frequently impact those with chronic stroke. While therapy often aims at improving balance and walking speed for independent community ambulation, improvements remain ambiguous, and little is known regarding the sustainability of such a gait speed once achieved.

PURPOSE:

To investigate the effect of a balance exercise therapy program on balance and gait speed parameters in those with chronic stroke.

METHODS:

This is an ongoing study with 29 subjects with chronic stroke to date. Subjects completed an 8-week group exercise program (1-hour twice a week) that incorporated components of yoga. Pre-intervention, balance was assessed with the Berg Balance Scale (BBS). Subjects completed a 10-meter walk, with a gait paten positioned in the middle, and were instructed to walk at the fastest pace possible that felt safe. Lastly, subjects performed a 6-minute walk at their preferred pace while traversing a 30-meter walkway with the gait mat positioned in the middle, allowing for multiple passes to measure change in gait parameters over the 6-minutes.

RESULTS:

Post-program, subjects showed improved balance and faster gait speeds with longer steps/strodes and less time in double support (Table 1). No changes were noted for base of support and unilateral stance variables. Over the 6-minute walk, both maximum and end gait velocities increased post-program, but subjects continued to show an inability to sustain a consistent speed compared to the end.

CONCLUSION:

This is an ongoing study with 29 subjects with chronic stroke to date. Subjects completed an 8-week group exercise program (1-hour twice a week) that incorporated components of yoga. Pre-intervention, balance was assessed with the Berg Balance Scale (BBS). Subjects completed a 10-meter walk, with a gait mat positioned in the middle, and were instructed to walk at the fastest pace possible that felt safe. Lastly, subjects performed a 6-minute walk at their preferred pace while traversing a 30-meter walkway with the gait mat positioned in the middle, allowing for multiple passes to measure change in gait parameters over the 6-minutes.

RESULTS:

As expected, K

PURPOSE:

Detecting Gait Kinematic Patterns associated with Knee Osteoarthritis using a Support Vector Machine Algorithm

Kelsey H. Collins, Reginaldo K. Fukuchi, Blayne A. Hettinga, Reed Ferber. University of Calgary, Calgary, AB, Canada. (Sponsor: Louis Osternig, FACSM)

(No relationships reported)

Knee osteoarthritis (KOA) is a degenerative disease known to alter gait kinematics as compared with healthy individuals. It is necessary to understand which factors best describe the kinematic differences between healthy and KOA individuals to gain insight into KOA aetiology. To our knowledge, this research is the first to use a Support Vector Machine (SVM) and feature selection algorithm to objectively rank the most important kinematic variables when discriminating between KOA and control subjects.

METHODS:

38 KOA subjects (27 F, 11 M age 54 ± 8 yrs; 169 ± 11 cm; 73 ± 12 kg) and 30 healthy controls (21 F, 9 M age 53 ± 12 yrs; 168 ± 10 cm; 69 ± 13 kg) were included. Kinematic data were collected using an 8-camera 3D motion capture system. Sixteen discrete kinematic gait variables were chosen to train the SVM algorithm. A 10-fold cross-validation was implemented to assess the SVM recognition rate.

RESULTS:

The overall classification accuracy rate achieved 66.2% when all input variables were considered. This rate improved to 75% when the first 5 selected variables, determined by the feature selection algorithm, were considered. The combination of variables that achieved the best recognition rate were: knee flexion at heel strike (KOA -6.1° ± 4.9°, CON -3.6° ± 5.0°), peak knee abduction (KOA 3.9° ± 5.6°, CON 1.8° ± 3.4°), knee abduction excursion (KOA 3.7° ± 1.7°, CON 4.1° ± 1.4°), peak pelvic drop (KOA 0.3° ± 3.6°, CON -0.4° ± 3.9°), and peak knee abduction (KOA -0.5° ± 4.8°, CON -2.7° ± 3.4°).

CONCLUSIONS:

The SVM was able to classify KOA subjects accurately when using 5 selected variables combined. We expect that the classification accuracy would increase in future studies with more kinematic variables. This methodology identified important variables to consider in future KOA research.

1795 Board #203 MAY 30 2:00 PM - 3:30 PM

Detected Gait Kinematic Patterns associated with Knee Osteoarthritis using a Support Vector Machine Algorithm

Kelsey H. Collins, Reginaldo K. Fukuchi, Blayne A. Hettinga, Reed Ferber. University of Calgary, Calgary, AB, Canada. (Sponsor: Louis Osternig, FACSM)

(No relationships reported)

Knee osteoarthritis (KOA) is a degenerative disease known to alter gait kinematics as compared with healthy individuals. It is necessary to understand which factors best describe the kinematic differences between healthy and KOA individuals to gain insight into KOA aetiology. To our knowledge, this research is the first to use a Support Vector Machine (SVM) and feature selection algorithm to objectively rank the most important kinematic variables when discriminating between KOA and control subjects.

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CONCLUSIONS:

The SVM was able to classify KOA subjects accurately when using 5 selected variables combined. We expect that the classification accuracy would increase in future studies with more kinematic variables. This methodology identified important variables to consider in future KOA research.
A Pilot Study: Acute Effects of Doxorubicin on Hind-limb Gait Kinematics in Rats

John M. Yager, Jeremy D. Smith, Abigail L. Carpenter, Noah M. Gibson, David S. Hydock. University of Northern Colorado, Greeley, CO. (No relationships reported)

Doxorubicin (DOX) is an effective chemotherapy drug, but it also has detrimental effects on healthy tissues, such as skeletal muscle. For example, in vivo DOX treatment in the rat has been shown to decrease hind-limb muscle force production. DOX-induced lower extremity muscle dysfunction and is likely to alter the ability of the muscle to accelerate the limb during the recovery phase of locomotion, but this effect has yet to be determined.

PURPOSE: To determine the effects of DOX treatment on hind-limb gait mechanics, with specific focus on the acceleration of the limb and spatiotemporal characteristics of gait.

METHODS: Fifteen adult male Sprague-Dawley rats were randomly assigned and injected with saline, 10 mg/kg DOX, 12.5 mg/kg DOX, or 15 mg/kg DOX delivered as a bolus i.p. injection. Retro-reflective markers were positioned on the left hind-limb at the knee, ankle, and foot. Sagittal plane video were collected while rats walked on a treadmill at 27 cm/sec prior to injection and 72 hours post-injection (or as many days as possible). Videos were digitized, and individual stride cycles were identified based on foot contact events. Custom written software was used to filter marker position data (cut-off = 5 Hz), compute ankle angles, and compute accelerations. Two MANOVAS with Helmert contrasts were used to determine effects of DOX on kinematic and spatiotemporal measures.

RESULTS: Spatiotemporal measures were not significantly altered by DOX injections ($\Lambda^2=0.59$, $F_{10,30}=2.31$, $p=0.14$). However, DOX injections did affect limb accelerations ($\Lambda^2=0.08$, $F_{10,30}=6.96$, $p=0.02$). Follow-up Helmert contrasts revealed decreased accelerations in ankle vertical motion ($-13\%$, $p=0.002$, ES=0.07), and foot vertical motion ($-14\%$, $p=0.001$, ES=0.97) for all dose groups compared to the saline group. However, dose magnitude had no effect beyond the baseline comparison ($p > 0.25$ for all contrasts).

CONCLUSION: Regardless of cumulative DOX dosage, reductions in limb accelerations occurred during swing when compared to a saline treated group. These reduced limb accelerations were consistent with reductions in isolated muscle force production previously reported suggesting muscle dysfunction due to DOX treatments may transfer to activities of daily living.

Effects of Walking Speed on Net Muscle Moments and Contact Forces at the Knee

Derek J. Haight, Michelle M. Reynolds, Wayne J. Board, Trevor Connor, Melissa Holte, Raymond C. Browning, FACSM. Colorado State University, Fort Collins, CO. (No relationships reported)

Lower extremity net muscle moments (NMM) are used as a proxy measure of joint loading, particularly at the knee. However, there is little information regarding the relationship between knee NMM and joint contact forces (JCF) across a range of walking speeds.

PURPOSE: To quantify the magnitudes and changes in NMM and JCF during slow and fast walking.

METHODS: We collected kinematic and kinetic data as ten subjects (mass = 63.5 (11.0) kg, mean (SD)) walked on a dual-belt force measuring treadmill at 0.75 m/s to 1.50 m/s. An OpenSim three-dimensional musculoskeletal model with 23 degrees of freedom and 92 muscles was scaled to each subject. We used OpenSim to calculate NMMs and muscle forces via inverse dynamics and static optimization, respectively, for 5 gait cycles for each subject. We determined JCFs from the vector sum of the joint reaction force and individual muscle forces crossing the knee joint, reported in the tibial reference frame.

RESULTS: The peak extensor NMM at the knee increased $+40\%$ from 0.30 (0.23) Nm/kg to 0.7 (0.21) Nm/kg and the peak flexor NMM increased $+50\%$ from 0.38 (0.14) Nm/kg to 0.58 (0.07) Nm/kg as walking speed was increased from 0.75 m/s to 1.50 m/s, ($p<0.01$, Figure 1a). Peak axial JCF increased $-15\%$ from 3.65 (0.44) BW to 4.18 (0.54) BW at 0.75 m/s and 1.50 m/s respectively, ($p<0.01$, Figure 1b).

CONCLUSIONS: While NMMs increased considerably with gait speed, the increase in axial knee joint force was modest, suggesting that slower walking speeds may not substantially reduce joint loading. These results also suggest that NMM may not be a good proxy measure of joint loading and that musculoskeletal models should be used to quantify joint loads.

Supported by NIH Grant R03AR059264

Biomechanical Characteristics of Stairway Walking between Able-bodies and Those Wearing Lower Limb Prosthetics

Yugang Li, Haozhe Ma. Wuhan Institute of Physical Education, Wuhan, China. (Sponsor: Yong Tai Wang, FACSM)

(No relationships reported)

This study was to compare the biomechanical characteristics of stairway walking between the able-bodies and those wearing lower limb prosthetics while negotiating the different stairway slopes.

METHODS: Six male able-bodies and six males who wearing lower limb prosthetics (one side) participated in this study. The participants were able to perform stairway walking using the rail with the stairways slopes of 15° and 30°. A three-dimensional motion analysis system was used to record the kinematics and the hand and foot pressure sensors were used to record the hand and foot reaction forces when the participants walked upstairs with the stairways slopes of 15° and 30°. Three trials of walking on each stairway slope were recorded and the trials were averaged. The selected biomechanical variables included the knee flexion angle, speed of the center of mass (COM), peak hand and foot reaction forces. The independent t-test was employed to determine the differences between the able-body group (ABG) and the lower limb prosthetic group (LLPG).

RESULTS: For the 15° stairway walking, the knee flexion angles were 73.5°±2.1 for the ABG and 77.7°±4.9 for the LLPG; and the speeds of COM were 0.9±0.05 m/s for the ABG and 0.7±0.17 m/s for the LLPG, respectively. For the 30° stairway walking, the knee flexion angles were 82.5°±3.7 for the ABG and 86.4°±5.3 for the LLPG; and the speeds of COM were 0.8±0.09 m/s for the ABG and 0.66 m/s±0.11 for the LLPG, respectively. For the 15° stairway walking, the hand peak reaction force (46.2%±19.0% of the body weight) in the LLPG is significantly greater ($p < 0.05$) than that (22.9%±17.7%) in the ABG. However, the foot reaction forces were 131%±25.0% for the LLPG and 136%±20.0 for the ABG ($p > 0.05$). For the 30° stairway walking, the hand and foot reactions forces showed the patterns similar to the 15° stairway walking condition, but no significant difference was observed. During the knee extension phase, the ABG showed the area of center of pressure (COP) around the five toes and front foot, and the LLPG showed the area of the COP around the front and middle foot.

CONCLUSIONS: The lower limb prosthetics has a good substitute function for stairway walking. However, attention should be paid to the training of standing/swing phases of the prosthetic leg, and the stairway slopes may affect the stairway walking speed and stability.

Do Old Adults Modulate Walking Velocity Differently Than Young Adults?

Paul DeVita, FACSM, 1 Alexis Sidiropoulos, 1 Patrick Rider, 1 Aubrey Taylor, 1 Tibor Hortobagyi, FACSM. 1 East Carolina University, Greenville, NC. 2University of Groningen, Groningen, Netherlands. (No relationships reported)

Young and old adults walk with stereotypically yet distinctly different lower extremity joint power patterns. Old vs. young adults use greater power at the proximal hip and lower power at the more distal knee and ankle when walking at the same velocity. We now ask, does this distal to proximal mechanical plasticity with age also govern the modulation of walking velocity in old vs. young adults? Hypothesis was: old adults have a stronger relationship between hip power and weaker relationships between knee and ankle powers with walking velocity compared to young adults.

PURPOSE: Identify the relationships among hip, knee and ankle joint powers and walking velocity in young and old adults.
1800  Board #208  MAY 30  2:00 PM - 3:30 PM  
Multiscale Entropy Analysis of Gait Control in Health Subjects  
Kuo-Wei Tseng, Hung-Wen Cheng, Hui-mei Lin, Yu-Hua Tseng. Taipei Physical Education College, Taipei City, Taiwan.  
(No relationships reported)

Traditional approaches to measuring the complexity of biological signals fail to account for the multiple time scales inherent in such time series. The multiscale entropy (MSE) method is notable to studying a wide variety of other physiologic and physical time series data.

PURPOSE: To analyze the multiscale entropy of stride interval time series for normal gait group and two unstable gait groups of eyes-closed and dizziness in health subjects.

METHODS: We apply the MSE method to the gait cycle interval time derived from acceleration. The accelerometer recordings strides interval time series of 15 health subjects (age: 21.26±0.85 yrs) who walked for 2000 strides at normal gait pattern (N), eyes-closed gait (E) and dizziness gait (D). The subjects performed normal gait with normal spontaneous walking, eyes-closed gait with closed eyes, and dizziness gait with 20 standing spins in each 200 strides.

RESULTS: The stride interval in D and E group are shorter than N group (520.33±86.72, 557.31±64.53 vs. 574.07±63.60 ms, p<0.05). In all cases, D and E groups are assigned higher entropy values than N group at larger scales, such as scale factor 18(0.96±0.08, 0.92±0.12 vs. 0.62±0.23, p<0.05), scale factor 19(1.11±0.07, 0.94±0.12 vs. 0.61±0.19, p<0.05) and scale factor 21(0.94±0.13, 0.88±0.09 vs. 0.61±0.13, p<0.05). The results indicate that time series of D and E groups are more complex than N group.(Fig.1)

CONCLUSION: The motor control of human locomotor system during unstable walking is more complex than normal walking. The results obtained increasing complexity is one of the strategies when the ambulation be disturbed.

1801  Board #209  MAY 30  2:00 PM - 3:30 PM  
Sex Differences in the Stride Frequency of Walking while Carrying a Toddler Manikin  
Marcella J. Myers1, Alice A. Fasnacht2, Cara M. Wall-Scheffler1. 1St. Catherine University, St. Paul, MN. 2Seattle Pacific University, Seattle, WA. (Sponsor: Mark Blegen, FACSM)

(No relationships reported)

Despite the frequency and necessity of infant/toddler-carrying by parents and other caregivers, very little research has focused on the energetic and behavioral consequences of this activity in adults. In particular, sex differences in carrying behavior and biomechanics has been virtually ignored.

PURPOSE: Our specific goal was to determine whether women and men carrying a toddler-sized manikin on their hip or their shoulders choose different stride frequencies at a given speed when asked to walk around the perimeter of a gym at moderate to brisk walking speeds.

METHODS: To determine how child-carrying affects the free walking gait choices of adults as a function of sex and task, we calculated the walking speed of 6 females and 6 males as they walked around the perimeter of a gym while performing 6 tasks in a randomized order. Tasks consisted of all combinations of 3 loading conditions - carrying a 10kg toddler-proportioned manikin on the shoulders or hip, or a comparable mass around the waist - and 2 walking speed directives (“walk-all-day” or “brisk” walks). Stride frequency and walking speed were determined from videotape using a stopwatch. Speed was calculated from the time required to walk between two markers 3.7 meters apart, stride frequency was determined over 4 consecutive strides.

RESULTS: When speed directive was accounted for, females walked faster than males (p=0.001), and this effect was only enhanced by including body mass in the regression model (i.e. body mass differences could not explain the sex difference in walking speed). At a given walking speed, females used higher stride frequencies than males (p=0.001) and stride frequency increased as the load position changed from belt, to shoulder, to hip (p=0.006). Adding body mass to the model removed the sex effect.

CONCLUSIONS: Although the carrying task was a larger burden for the females due to their smaller body mass, females consistently chose faster walking speeds than males for a given speed directive, and higher stride frequencies for a given walking speed. Sex differences appeared to be the result of differences in body mass and the relative size of the toddler load. Supported by 3M Faculty/Student Collaborative Grant #212607 and the Endowed Professor in the Sciences at St. Catherine University, St. Paul, Minnesota.

1802  Board #210  MAY 30  2:00 PM - 3:30 PM  
Effectiveness of a Novel Therapeutic Technique on Improving Gait Characteristics among Children with Cerebral Palsy  
Jeffrey R. McClellan, Janet S. Dufek, FACSM, Robin Hickman. University of Nevada, Las Vegas, Las Vegas, NV.

(No relationships reported)

Large amplitude, high-intensity movement therapy has led to gait improvements in individuals with Parkinson’s Disease. Children with Cerebral Palsy (CP) typically demonstrate gait characteristics such as scissoring of the legs during gait and toe walking, with greater unilateral dysfunction being common.

PURPOSE: Test the concept of adapting large movements, whole body movements, similar to those used in Lee Silverman Voice Training BIG® in order to improve gait characteristics among children with CP.

METHODS: After receiving institutionally approved informed consent from a parent and child assent, five children diagnosed with CP (7.0±1.0yrs; 125.7±7.3cm; 26.0±5.1kg) walked twice across an instrumented electronic walkway (CIR Systems, Inc.; 120Hz) at a preferred speed, before and after a 15 minute intervention session focused on large amplitude, whole body movements. Foot pressure data were extracted and analyzed by right and left footfalls, for the heel, midfoot, and forefoot area of the foot. Two dependent variables, pressure-time (P*t) detailing the percent of total pressure distributed across time, and Area (A) detailing the percent of total foot area, in a given foot segment during stance were used to analyze the data. Data were compared pre-post intervention using a single-subject Model Statistic procedure (α = 0.01).

RESULTS: Results trended towards improvement, but were generally non-significant. S3 improved gait by walking with a more standard heel-toe gait pattern and significantly increased P*t (0.0% vs. 3.4±4.3%) and Area (0.0% vs. 13.6±7.1%) in the right foot heel segment. S5 improved gait by decreasing pressure from the right heel for P*t (44.4±7.3% vs. 32.7±8.4%) and transitioning more to the midfoot as shown by an increase in A (27.6±1.7% vs. 30.2±2.0%) for this segment. Results for other subjects showed no significant results (S1) or displayed mixed results (S2, S4).

CONCLUSION: While results remain inconclusive the general effectiveness of large amplitude exercise appears to be strengthened. Future testing and comparison of children with CP to typically developing children is recommended, while continued exploration regarding the effectiveness of clinical doses of large-amplitude movement interventions for this population should be determined.
Beta-1 adrenergic receptors (ADRB1) and Gs proteins (GNAS) polymorphisms have an impact on diastolic function and exercise tolerance measured before and after exercise training in patients with heart failure.

**PURPOSE:** The aim of the present study was to investigate whether ADRB1 Arg389Gly (rs1801253), GNAS -1211 G/A (rs6123837) and GNAS 2291 C/T (rs6026584) functional polymorphisms have an impact on diastolic function and exercise tolerance attenuated by treatment with Metoprolol and Atenolol.

**RESULTS:** A total of 61 patients with heart failure completed a 6-month exercise-training program. Mitral inflow velocities (deceleration time of early mitral flow and E/A ratio) and exercise tolerance (METs) were assessed before and after exercise training. Polymorphisms were detected through restriction fragment length polymorphism analysis.

**CONCLUSIONS:** Our data show that the functional GNAS -1211 G/A polymorphism influences diastolic function measured before and after exercise training in heart failure patients. Furthermore, our data suggest that there is an association between the ADRB1 Arg389Gly polymorphism and the exercise training response in heart failure patients. However, this association seems to be attenuated by treatment with Metoprolol and Atenolol.

Acknowledgements: This study was supported by the grant SFRH/BD/33122/2007 from the Fundação para a Ciência e a Tecnologia (FCT), Portugal.
RESULTS: After correction for multiple testing, 32 genes were identified for sympathetic nervous system function (39 variants, 20 genes) and nitric oxide synthase pathway (14 variants, 4 genes). 2) 60 variants from GWAS meeting pre-established statistical criteria; 3) 68 variants on 25 candidate genes associated with energy metabolism and body composition; 4) 102 variants on 27 candidate genes associated with other CVD risk factors including lipids.

PURPOSE: To develop a prioritized panel of candidate genetic variants that may have increased likelihood of associating with the BP response to exercise to be used in conjunction with genome-wide association studies (GWAS).

METHODS: We measured peak oxygen uptake (VO2peak) during an incremental cycle ergometer exercise test, and then the study subjects were divided into high-cardiorespiratory fitness (High-Fit) and low-cardiorespiratory fitness (Low-Fit) groups based on the median value of VO2peak in each sex and decade. FABP2 Ala54Thr polymorphism was determined by real-time PCR with Taqman probe.

RESULTS: There were no significant effect of FABP2 Ala54Thr polymorphism on carotid beta-stiffness and blood pressure. Carotid beta-stiffness, systolic blood pressure, and diastolic blood pressure in the Low-Fit subjects increased in Ala/Ala genotype individuals compared with Ala/Thr and Thr/Thr genotype of FABP2 Ala54Thr, however, no effect on FABP2 polymorphisms in High-Fit subjects. Additionally, serum triglyceride and plasma glucose levels were lower and serum HDL cholesterol levels was higher in High-Fit subjects compared with Low-Fit subjects, but there were no significant effect of FABP2 polymorphism.

CONCLUSION: These results suggest that the higher cardiorespiratory fitness may be associated with attenuated central arterial stiffness and blood pressure related to FABP2 Ala54Thr polymorphism, regardless of increase in conventional metabolic risk factors, such as hyperglycemia and dyslipidemia.
METHODS: The C79G SNP genotype (CC: n=14; CG: n=19; GG: n=7; unidentified: n=2) was determined in competitive 19–40 year old male cyclists with EIB (EIB+, n=10) and without EIB (EIB-, n=32). Athletes performed two 10-km time trials (TTs) on a cycle ergometer 60-min after the inhalation of either 400 μg SAL or placebo. Forced expiratory volume in 1 second (FEV₁) was assessed immediately before and 30-min after inhalation of SAL. Performance was measured by mean power output relative to body weight.

RESULTS: There was no association between the C79G SNP and EIB prevalence (p ≥ 0.05). The significant increase in FEV₁ after the inhalation of SAL (p ≤ 0.001) was independent of the genotypes at the C79G SNP: GG (GM (SD) = 4.70 (2.51) %), CG (7.88 (8.23) %); and CC (5.94 (2.31) %); (p ≥ 0.05). The C79G SNP did not affect average power output after the inhalation of SAL: GG (1.4 (0.4) W/kg); CG (3.9 (0.3) W/kg); and CC (4.0 (0.2) W/kg); p ≥ 0.05. Nevertheless, the C79G SNP was associated with the change in ventilation during the TT after SAL inhalation: Athletes with the GG genotype presented with an increased minute ventilation (1.82 (0.35) L/kg·min⁻¹) compared to placebo (1.64 (0.38) L/kg·min⁻¹; p = 0.03), but athletes with the GG genotype maintained ventilation after the inhalation of SAL (1.82 (0.27) L/kg·min⁻¹), compared to placebo (1.83 (0.32) L/kg·min⁻¹).

CONCLUSIONS: In competitive male cyclists, FEV₁ is improved after the inhalation of 400 μg SAL. Despite this improvement in lung function, mean power output during a 10-km TT was not altered regardless of the athletes’ susceptibility to EIB and genetic variation at the ADPR2 C79G SNP.

1810  Board #218  MAY 30  3:30 PM - 5:00 PM

The Association Between An Indel Polymorphism In The Alp Gene And Athletic Performance

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(No relationships reported)

the presence of alpha-actinin-3 in type-II fibres is known to affect skeletal muscle function and metabolism. The R-allele of the gene ACTN3 (polymorphism R577X) is associated with sprint/power performance, whilst the X-allele (alpha-actinin-3 absent) is associated with endurance performance. ALP is a muscle protein that interacts with alpha-actins, possibly affecting its expression/function. The human ALP gene displays a large Indel polymorphism (~2.6 kb) whose function remains poorly understood. Here, we explored the possibility of this polymorphism being associated with athletic performance.

PURPOSE: to compare the frequency of the polymorphic allele (I-allele) of the gene ALP between two distinct cohorts (athletes vs. non-athletes).

METHODS: DNA from 307 Australian athletes and 160 Australian Caucasian controls were submitted to a PCR reaction designed to amplify a fragment of the ALP gene with (I-allele) and without the ~2.6 kb insertion (D-allele). Allele’s frequencies were compared by means of the x² test.

RESULTS: although no differences were found between athletes and controls, the I-allele was slightly more frequent in power/sprint athletes as compared to endurance and controls. The frequency of the I-allele was twice as high in specific sports (i.e., T&F and cycling) and three times lower in rowing when compared to the control group (Table 1).

CONCLUSIONS: the frequency of the I-allele may help to explain the success in specific sports, especially T&F, cycling and rowing.

<table>
<thead>
<tr>
<th>Allele frequencies among athletes and controls.</th>
<th>D-allele</th>
<th>I-allele</th>
<th>chi-square (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls (n=160)</td>
<td>92%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Power/sprint athletes (n=112)</td>
<td>87%</td>
<td>13%</td>
<td>2.85 (0.06)</td>
</tr>
<tr>
<td>Endurance athletes (n=195)</td>
<td>91%</td>
<td>9%</td>
<td>0.14 (0.99)</td>
</tr>
<tr>
<td>Specific sports T&amp;F (n=65)</td>
<td>83%</td>
<td>17%</td>
<td>6.06 (0.008)</td>
</tr>
<tr>
<td>Cycling (n=64)</td>
<td>96%</td>
<td>4%</td>
<td>4.01 (0.027)</td>
</tr>
<tr>
<td>Rowing (n=83)</td>
<td>97%</td>
<td>3%</td>
<td>4.48 (0.02)</td>
</tr>
<tr>
<td>Swimming (n=59)</td>
<td>93%</td>
<td>6.6%</td>
<td>0.34 (0.58)</td>
</tr>
</tbody>
</table>

1811  Board #219  MAY 30  3:30 PM - 5:00 PM

Genome-wide Association Study On Physical Performance Among Children: Panic Study

Anni Haukosen, Tuomo Tompuri, Virpi Lindi, Mustafa Atalay, Timo Lakka. University of Eastern Finland, Kuopio. Finland.

Low physical performance increases the risk of many chronic diseases and mortality. In past decades physical performance among children has decreased mainly due to sedentary lifestyle. However, genetic factors associated with physical performance in children are unclear. Genome-wide association studies (GWAS) provide an efficient strategy to investigate the associations of large numbers of common gene variants with many health-related phenotypes in large human data sets.

PURPOSE: To identify new gene variants associated with physical performance in children.

METHODS: We studied the associations of 194 729 single nucleotide polymorphisms (SNPs), analyzed by MetaboChip array, with maximal work load in Watts divided by lean body mass in kilograms (Wmax/LBM, in W/kg), assessed by bicycle ergometer exercise test, in a representative population sample of 512 Caucasian girls and boys 6–8 years of age. The genome-wide associations with Wmax/LBM were analyzed with unadjusted dominant linear regression models. Altogether 17 SNPs with genome-wide significance (p<9.99x10⁻⁸) were further analyzed with multiple linear regression models adjusted for gender and age.

RESULTS: After adjustment for gender and age, 2 SNPs were associated with Wmax/LBM. Rs212593 near CBLN4 explained 1.2% of variance in Wmax/LBM (p=0.008 for linear regression model), and carriers of minor T allele had a 0.7 W/kg higher Wmax/LBM than major C allele homozygotes (p=0.006 for difference between 2 genotype groups). There were no minor T allele homozygotes in the cohort. Rs11596811 near PRKCE explained 0.6% of variance in Wmax/LBM (p=0.042 for linear regression model), and homozygotes for minor A allele had a 0.3 W/kg lower Wmax/LBM than heterozygotes and a 0.5 W/kg lower Wmax/LBM than major C allele homozygotes (p=0.162 for difference across 3 genotypes).

CONCLUSIONS: These preliminary data suggest that SNPs near CBLN4 and PRKCE genes are associated with physical performance among children. These findings should be replicated in other populations.


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Leisure time physical activity (LTPA) habits are the results of a complex interplay of both genetic and environmental influences. Large epidemiological cross-sectional studies have evidenced that the heritability of physical activity behavior ranges between 30% and 70%. However, at present little is known about the factors mediating change in physical activity behavior across the critical periods of life.

PURPOSE: The aim of this study was to estimate genetic and environmental influences on the longitudinal evolution of LTPA habits from adolescence to young adulthood.

METHODS: The research is part of the FinnTwin16 Cohort study and the sample consisted of 4,915 monzygotic and dizygotic twins, born between the years 1975 and 1979. The LTPA volume was assessed as frequency of physical activity and participants were classified in three groups: inactive, moderately active and active. Data was gathered at four time points; mean ages 16.1, 17.1, 18.6 and 24.4. Genetic and environmental influences on change in LTPA were estimated using linear growth modeling with a multiple threshold approach and sex-limitation effects. Analyses were developed in R-CRAN software utilizing the OpenMX package.

RESULTS: For both boys and girls the heritability of LTPA remained moderate (25%–40%) during the 8-year follow-up. The main results suggested important sex-differences in the estimates for additive genetic (A), common environmental (C), and specific environmental (E) influences on this behavior. The overall level of LTPA during the follow-up was moderately accounted for by A in boys (A=36.6%, C=56.2%, E=7.2%), while the corresponding percentage was lower in girls (A=17.3%, C=77.3%, E=5.4%). More noticeably, longitudinal changes in LTPA were largely accounted for by C in boys (A=1.0%, C=96.5%, E=2.4%) and by A in girls (A=62.5%, C=17.5%, E=20.0%).

CONCLUSIONS: The study evidenced relevant sex-differences in genetic and environmental influences in the evolution of LTPA habits from adolescence to young adulthood. Environmental factors showed critical to explain longitudinal changes in LTPA in boys, while girls’ variations were mostly accounted for by additive genetic influences. These outcomes emphasize the need of specific actions to each sex in order to promote physical activity habits during this period of life.

Androgen receptor (AR) CAGn (polyglutamine) repeat polymorphism determines part of the androgenic effect and may influence body composition and physical performance.

PURPOSE: To determine if androgen receptor polymorphism (CAGn) may influence body composition and the physical fitness in children.

METHODS: The association between body fat mass and physical fitness with the AR CAG, polymorphism was studied in 250 physically active children, 145 boys and 105 girls (mean±SD: 11.7±2.6 and 10.2±3.4 years old, respectively). The vertical jumping height (and power), running speed, and VO$_{2\text{max}}$ was determined in all subjects. CAG repeat number was determined by PCR and fragment analysis, and confirmed by DNA sequencing of selected samples. Boys were grouped as CAG short (CAG$_L$) if harboring repeat lengths ≤21; the rest as CAG long (CAG$_L$). The corresponding cut-off CAG number for girls was 22.

RESULTS: The boys harboring CAG$_L$ achieved better running performance in the 300 m running test than their CAG$_S$ counterparts (71.0±12.3 vs 74.2±13.0, respectively; P=0.018). This difference remained statistically significant after accounting for height and age covariates. No statistically significant differences between CAG$_S$ and CAG$_L$ groups were found either in boys or in girls for the rest of the physical fitness variables.

CONCLUSION: Androgen receptor (AR) CAGn (polyglutamine) repeat polymorphism has no influence on children physical fitness. However, a short CAG repeat number may favor performance in the 300 m running speed test in boys.

Androgens play an important role in the regulation of lipolysis and fat tissue mass. The cellular sensitivity to androgens varies depending on polymorphic variations of androgen receptors (AR).

PURPOSE: The aim of this longitudinal study was to evaluate if extreme CAG and GGN repeat polymorphisms of the AR may influence body fat mass, its regional distribution, fat accumulation, basal metabolic rate, and basal and maximal fat oxidation (MFO), maximal oxygen uptake (VO$_{2\text{max}}$), as well as the serum concentration of hormones implicated in the regulation of fat mass like leptin, testosterone and osteocalcin.

METHODS: CAG and GGN repeats length were measured in 319 young and physically active men (mean±SD: 28.3±7.6 years old). From these we selected the subjects with short (CAG$_S$ ≤ 19) and long (CAG$_L$ ≥ 24) CAG repeats, and the subjects with short (GGN$_S$ ≤ 22) and long (GGN$_L$ ≥ 25) GGN repeats, using the median CAG and GGN value as a cut off value.

RESULTS: CAG repeat polymorphism was not associated to fat mass. CAG$_S$ and CAG$_L$ subjects had similar basal metabolic rate and maximal fat oxidation capacity and accumulated comparable amounts of fat tissue over 6.4 ± 1.0 years of follow up. Men with GGN$_{22}$ had greater whole body and trunk fat mass than men with GGN$_{25}$. This concurs with a trend for a greater maximal fat oxidation capacity in the GGN$_S$ group (P=0.06), who accumulated less fat mass, particularly in the trunk region seven years later. In the whole group of subjects the VO$_{2\text{max}}$ (per kg of lower extremity lean mass) explained 53% of the variance in MFO, whilst age explained and additional 5%.

CONCLUSION: The CAG repeat polymorphism has little, if any, influence in fat mass deposition in young adults whilst a long GGN polymorphic variant may protect from fat mass accumulation.
METHODS: 257 elite Japanese track and field athletes (93 sprint/power athletes: SPA [sprinters, jumpers and throwers]; 164 middle-power/endurance athletes; MEA [middle- and long-distance runners]) and 649 Japanese population controls (CON) were genotyped for ACTN3 R577X and ACE I/D polymorphisms using TaqMan Genotyping Assay, and allele and genotype frequencies were compared between groups using a Chi-square test. All athletes were national or international level, and the group included medalists at the Olympic games.

RESULTS: For ACTN3 R577X polymorphism, the frequency of the R allele was significantly higher in spa than in CON (0.55 vs. 0.47, P=0.032); there was no significant difference between MEA and CON (0.49 vs. 0.47, P=0.438) and between spa and EMPA (0.55 vs. 0.49, P=0.191). When the three genetic models were tested, spa showed a higher frequency of RR+RX genotype than CON (40/93 [86.0%] vs. 47/8649 [7.3%], P=0.010 under the R dominant model). There was also a significant difference between spa and CON when using the additive genetic model (P=0.025). Further subgroup analysis dividing the SPA into sprinters (n=61) and field athletes (n=32) revealed a higher RR+RX genotype frequency in sprinters than in CON (56/61 [91.8%] vs. 47/8649 [73.7%], P=0.002 under the R dominant model) and than in EMPA (56/61 [91.8%] vs. 125/1064 [76.3%], P=0.009 under the R dominant model). No association was found for ACE I/D polymorphism in elite Japanese track and field athletes.

CONCLUSIONS: The ACTN3 R577X polymorphism-and not the ACE I/D polymorphism-was associated with elite Japanese track and field athlete status and only in sprint/power performance (not endurance).

1818 Board #226 MAY 30 3:30 PM - 5:00 PM
Thhr Single Nucleotide Polymorphisms And Sarcopenia
Ricardo J. Oliveira1, Claudia C. Lunardi2, Ana Bárbara M. Siqueira2, Tailce K.M. Leite2, Rinaldo W. Pereira1, Ricardo Moreno Lima1. 1Universidade de Brasília, Brasília, Brazil. 2Universidade Católica de Brasília, Brasília, Brazil. Supported by FAPDF Grant #1933000555/2009

Sarcopenia is described as a substantial loss of skeletal muscle mass and is related to important changes in body composition and related functions. Its etiology is not fully known, however, there is controversy in the literature regarding the contribution of genetic variability in fat-free mass.

PURPOSE: This study aims to examine the association of single nucleotide polymorphisms TRHR (Thyrotropin-releasing Hormone Receptor) and sarcopenia.

METHODS: Blood samples and total fat-free mass (TFFM) were collected of 241 elderly in the Federal District - Brazil. Were selected for this study the SNPs rs16892496 (alleles G and T) and rs7832552 (alleles A and G). Were classified as sarcopenia the elderly women who had values of relative TFFM (TFMF/ body weight) below 5.45 kg/m2.

RESULTS: The sample showed the following average values for age, body mass, height, years of menopause, fat-free mass: 66.65 ± 5.5 years, 65.81 ± 11.9 kg, 1.53 ± 0.1 cm, 17.96 ± 7.5 years, 37.95 ± 4.9 kg, respectively. The prevalence of sarcopenia was 17.4%. There was no significant association (p>0.05) between the SNPs and the values of TFFM relative and sarcopenia.

CONCLUSIONS: Although current studies have found significant association between the TRHR’s polymorphisms and phenotype of sarcopenia, this study found no association. Thus, we can conclude that in our sample, the SNPs rs16892496 and rs7832552 were not associated with sarcopenia.

Supported by FAPDF Grant #1933000555/2009

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Some authors have quantified an "optimal" polygenic profile by means of an algorithm resulting from the best accumulation of the polymorphisms candidate to explain individual variations in sport performance.

**PURPOSE:** Constructing a new model aimed to quantify the weightings attributable to genotypes in explaining the individual variations of explosive leg strength among elite soccer players.

**METHODS:** Using the model originally developed by Williams and Folland (2008) we determined the “Total Genotype Score” (TGS, from the accumulated combination of ACE, ACTN3, BDKRB2, VDR-ApaI, VDR-BsmI genes, associated with muscle performance) in a groups of 84 top-level soccer players and 102 sedentary healthy males (controls). Successively, we determined the “Total Weighting Genotype Score” (TWGS) computed on the basis of the proportion of the variance of muscle strength significantly predicted by the accumulated combined genotypes. Forward stepwise multiple regression models were used to explore the predictive role of each genotypic variables for muscle phenotypes, measured by means of Squat Jump (SJ) and Counter Movement Jump (CMJ). Finally, correlation between TWGS and explosive leg strength was tested by means of linear regression analysis.

**RESULTS:** There were no significant differences (F=0.076, p=0.782) in the TGS between athletes and controls. The soccer players with higher TGS score have performed a significantly better performance in SJ (R²=0.0902, F=6.550, p=0.012). The number of polymorphisms which significantly enter in the regression equation were only three (ACTN3, ACE and BDKRB2) for both tests. Among all polymorphisms, the ACTN3 was the most important. Finally, the soccer players with higher TWGS have performed a better performance in both SJ (R²=0.1546, F=12.075, p<0.001) and CMJ (F=10.12, p=7.438, p<0.001) tests.

**CONCLUSIONS:** Our results showed that giving the respective weighting to each predictor genotypes and by means of the new TWGS model, it could identify a polygenic profile that allows, at least partly, to predict the levels of explosive muscle strength in professional soccer players. Nevertheless, other genetic variants that we did not include in our model could also contribute to better explain the individual variations for attaining a high level of explosive strength in soccer.

**REFERENCES:**

Ghrelin (GHRL) acts on the central nervous system to regulate energy homeostasis. Ghrelin (GHRL) single nucleotide polymorphisms (SNPs) associate with obesity, the metabolic syndrome, and habitual physical activity (PA).

**PURPOSE:** To investigate whether ACTN3 R577X polymorphism would be relevant to muscular power in Japanese collegiate athletes.

**METHODS:** 105 male athletes and 243 controls (94 male and 149 female) were recruited in this study. Athletes performed 30s Wingate Anaerobic Test (WAnT) with a load equal to 7.5% of body weight. Genotyping was executed by using TaqMan approach for the ACTN3 (rs1815739) polymorphism.

**RESULTS:** ACTN3 polymorphism of athletes and controls was in Hardy-Weinberg Equilibrium. The distribution of ACTN3 XX genotype was significantly lower in athletes than controls (16% vs. 29%; P<0.001 under the R allele dominant model). There was no significant difference in 30s WnAT mean power among each genotype. However, WnAT peak power was significantly higher in RR or R allele dominant model groups than XX group.

**CONCLUSIONS:** The above data suggested that the ACTN3 RR and R allele would influence peak power of Wingate Anaerobic Test in Japanese collegiate athletes.
across 100% of the 50-mile TT, except for VO2_max which was not significantly higher (40.4 ± 1.8 vs. 45.9 ± 2.9 %, p<0.05). La_peak during the 30-s Wingate test was not significantly different between the two groups (361 ± 69 vs. 254 ± 57 Nm*s*kg^−1^, p<0.05). b) During the prolonged endurance events or if dietary nitrate supplementation can enhance performance to the same extent in highly trained individuals was significantly higher (361 ± 69 vs. 254 ± 57 Nm*s*kg^−1^, p<0.05); total muscle work, estimated as the sum of impulses generated during the fatiguing sub-maximal contractions, was significantly lower (40.4 ± 1.8 vs. 45.9 ± 2.9 %, p<0.05). La_peak was not significantly different. As for RSA, peak power was significantly higher during the 3rd, 4th and 5th repetition.

CONCLUSIONS: A moderate dietary dose of nitrates significantly enhanced variables of anaerobic performance in humans. These effects could be due both to a reduction of ATP cost and to an increase of ATP oxidative production. Although Popeye didn’t know about anything that can nitrate, we can hypothesize that he could be the “force” of Popeye’s spinach.

**824 Board #232 MAY 30 2:00 PM - 3:30 PM**

**Acute Dietary Nitrate Supplementation Does Not Improve 50-mile Time Trial Performance In Highly Trained Cyclists**

Daryl P. Wilkerson, Giles Hayward, Bailey J. Stephen, Vanhatalo Anni, Blackwell R. Jamie, Jones M. Andrew, FACSM. *Exeter University, Exeter, United Kingdom*. (No relationships reported)

Dietary nitrate supplementation has been shown to improve 4 and 16.1 km time trial (TT) performance by ~2.7% in sub-elite cyclists. However, it is not known if these ergogenic effects persist in longer endurance events or if dietary nitrate supplementation can enhance performance to the same extent in highly trained cyclists.

PURPOSE: To determine the effect of acute dietary nitrate supplementation on 50-mile TT performance in trained cyclists.

METHODS: After familiarization, 8 trained male cyclists performed 50-mile TTs under two experimental conditions: i) 2.5 h after consuming 0.5 L of beetroot juice (BR; containing ~6.2 mmol of nitrate) and ii) 2.5 h after consuming 0.5 L of nitrate-depleted BR (placebo; containing ~0.005 mmol of nitrate). The two conditions were administered using a counter-balanced, single-blind, crossover design. A minimum of 7 days separated visits to allow recovery and washout.

RESULTS: BR significantly elevated plasma [nitrite] (BR: 500 ± 59 vs. placebo: 411 ± 22 nM; P<0.05) and resulted in a group mean reduction in completion time for the 50-mile TT of 0.8% (BR: 136.7 ± 5.6 vs. placebo: 137.9 ± 6.4 min) which was not statistically significant (P>0.05). There was a significant correlation between the increased post-beverage plasma [nitrite] with BR and the reduction in TT completion times (r = 0.84; P<0.05). Power output (PO) was not different between the conditions at any point (P>0.05) but oxygen uptake (VO2) tended to be lower in BR (P=0.06), resulting in a significantly greater PO:VO2 ratio (BR: 67.4 ± 5.3 vs. placebo: 65.3 ± 4.8 W L^−1^min^−1^, P<0.05).

CONCLUSION: Acute dietary nitrate supplementation with nitrate-rich beetroot juice did not significantly improve 50-mile TT performance in trained cyclists despite the significantly greater PO:VO2. It appears that rather than attain a higher PO for a given VO2, the cyclists maintained a similar PO but at a lower VO2. It is noteworthy that although the reduction in 50-mile TT completion time of 0.8% did not attain statistical significance, an improvement in performance of this magnitude would likely be practically meaningful to an athlete.
1826 Board #234 MAY 30 2:00 PM - 3:30 PM Dietary Nitrate Supplementation Reduces The Oxygen Cost Of Exercise In Healthy Older Adults
James Kelly, Anni Vanhatalo, Jonathan Fulford, Olivia French, James R. Blackwell, Andrew M. Jones, FACSM. University of Exeter, Exeter, United Kingdom. (No relationships reported)

Dietary nitrate (NOx) supplementation, which might enhance nitric oxide bioavailability, has recently been shown to reduce resting blood pressure and the oxygen cost of exercise in healthy young adults.

PURPOSE: We investigated whether the beneficial effects of nitrate supplementation reported previously in young adults are also evident in healthy older adults.

METHODS: Twelve (6 males) healthy, older (60-70 yrs) adults volunteered to participate in this ethically-approved study which employed a double-blind, randomized, crossover design. The subjects supplemented their diet for 3 days with either nitrate-rich concentrated beetroot juice (BR: 2 x 70 ml d-1, each containing ~0.3 g NOx) or a nitrate-depleted beetroot juice placebo (PL: 2 x 70 ml d-1, containing ~0.74 mg NOx). Before and after the intervention periods, resting blood pressure was measured and venous blood samples were drawn for the determination of plasma nitrate concentration. The subjects also completed two 6-min bouts of moderate-intensity treadmill walking for the assessment of exercise economy by respiratory gas exchange. Differences between conditions were assessed by paired samples t-tests and statistical significance was accepted at P<0.05.

RESULTS: Dietary nitrate supplementation significantly increased plasma nitrate concentration (BR: 1037 ± 627 vs. PL: 286 ± 188 nM; P<0.01), while both systolic blood pressure (BR: 115 ± 9 vs. 120 ± 6 mmHg; P=0.05) and mean arterial pressure (BR: 85 ± 5 vs. PL: 88 ± 4 mmHg; P=0.05) were reduced. There was a reduction in the VO2 amplitude (BR: 373 ± 182 vs. PL: 457 ± 219 ml·min-1, P<0.05) and steady-state VO2 (BR: 901 ± 233 vs. PL: 955 ± 270 ml·min-1, P<0.05) during moderate-intensity treadmill walking.

CONCLUSIONS: In accordance with previous studies in young healthy adults, dietary nitrate supplementation elevated plasma nitrate concentrations and reduced both resting blood pressure and the oxygen cost of moderate-intensity treadmill exercise in healthy older adults. These results may have important implications for the enhancement of cardiovascular health, functional capacity and quality of life in senescence.

1827 Board #235 MAY 30 2:00 PM - 3:30 PM Effects Of Performance Supplements On Body Composition And Strength In Trained Men During 6 Weeks Of Resistance Training.
Michael J. Osmiebe, W. Kyle Mandler, D. David Thomas, Amber W. Kinsey, Colin J. Riley, Lynn B. Panton, FACSM, Jeong-Su Kim. Florida State University, Tallahassee, FL. (No relationships reported)

PURPOSE: Resistance training (RT) enhances muscle protein synthesis and increases muscle strength and hypertrophy. Performance supplements have been shown to augment the physiological improvements associated with RT. The purpose of this study was to investigate the impact of pre- and post-workout performance supplements on body composition, muscle strength, and power.

METHODS: Twenty-four (24.6 ± 4.9 yrs; 180.4 ± 5.5 cm; 80.7 ± 8.8 kg), resistance trained men completed 6 wks of periodized RT (3x/wk). They were assigned to one of two groups based upon maximal voluntary contraction of the quadriceps (Biodes) to lean mass (LM) ratio. Group 1 (n=13; Performance Supplement; PS) consumed NO-Shotgun® before each workout and NO-Synthesize® (Vital Pharmaceuticals, Inc., Davie, FL) immediately after each workout as well as on non-RT days, while Group 2 (n=11; Placebo; PL) consumed a flavor-matched isocaloric placebo. Body composition (DXA) and circumferences, 1-repetition maximal strength (1RM) of the upper (chest press; CP) and lower body (leg press; LP), anaerobic power (Wingate test) were assessed. A 2 x 2 (group x time) ANOVA with repeated measures was used. Tukey LSD post hoc tests were used to examine pairwise difference. Significance was set at p<0.05.

RESULTS: The PS group increased LM by 4.7% with no change for PL. PA 1RM increased in the PS group with training by 19.56% and the PL group increased by 25.94%. BI RM increased in the PS group by 8.4% and the PL group increased by 6.9%. There were no significant differences between groups for 1RM in either BP or LP. Circumferences increased for the arm in both groups (PS 2.2%, PL 2.6%), but only the PS group increased thigh masses by 2.5%. The PS group significantly increased relative anaerobic power by 9.38%, while PLA remained unchanged.

CONCLUSIONS: Pre- and post-exercise consumption of NO-Shotgun® and NO-Synthesize® during 6 wk-periodized RT facilitated RT-induced improvements in LM and anaerobic power in trained males. These supplements do not alter 1RM muscle strength or reduce body fat mass. This project was supported by supplement donation by Vital Pharmaceuticals.

1828 Board #236 MAY 30 2:00 PM - 3:30 PM Effects Of The Phosphodiesterase-5 Inhibitor Tadalafil On Parameters Of Aerobic Fitness In Healthy Men.
Cosme Franklin Buzzachera, Gian Pietro Emerenziani, Emanuele Franciosi, Maria Chiara Gallotta, Luigi Di Luigi, Laura Guidetti, Carlo Baldari, FACSM. University of Rome Foro Balsico, Rome, Italy. (No relationships reported)

The stimulation of nitric oxide (NO)-3'5' cyclic guanosine monophosphate (cGMP) signaling pathway results in vasorelaxation and increased muscle blood flow during rest and exercise. Tadalafil, a phosphodiesterase-5 inhibitor used for therapeutic and nontherapeutic purposes, reduces cGMP hydrolysis inducing vasodilation and increases exercise capacity in healthy men in hypoxia.

PURPOSE: To examine whether 48 h exposure to Tadalafil influences aerobic fitness parameters during graded exercise test (GXT) in healthy men in normoxia.

METHODS: Twelve subjects were randomly assigned to receive either a 2 consecutive days administration of placebo or Tadalafil (e.g. 20 mg with 36 hours of interval) in a double-blind crossover design, with a 14-days wash-out period between conditions. About 12 hours after the second administration of either placebo or Tadalafil, the subjects performed GXT on a cycle ergometer. Gas exchange measures and heart rate (HR) were recorded throughout GXT and blood lactate concentrations (La) were measured every 3-min stage of the test. Lactate threshold (LT), maximal oxygen uptake (VO2max), maximal power output (MPO), time to fatigue (TTF), time to achieve VO2max, and time at VO2max were assessed. Differences in aerobic fitness parameters between Tadalafil and placebo conditions were compared by paired t-tests (P<0.05).

RESULTS: Compared to placebo, the Tadalafil condition did not influence LT (3.75 ± 0.41 vs. 3.88 ± 0.44 mmol/L) and VO2max (3.46 ± 0.33 vs. 3.31 ± 0.28 L/min, respectively for placebo and Tadalafil conditions). Similarly, MPO (285.2 ± 27.0 vs. 275.0 ± 25.0 Watts) and TTF (1306.2 ± 101.8 vs. 1340.0 ± 146.5 s, respectively for placebo and Tadalafil conditions) did not differ between the two conditions. However, time to achieve VO2max was significantly faster in Tadalafil (1228.7 ± 91.4 s) compared with placebo (1288.7 ± 132.2 s), whereas the time at VO2max was longer in Tadalafil (77.5 ± 32.5 s) than in placebo condition (51.2 ± 26.7 s) (P<0.05).

CONCLUSION: In healthy men, the 48 hours exposure to Tadalafil did not substantially influence parameters of aerobic exercise during normoxia. However, Tadalafil significantly affected temporal responses during GXT by shortening the time to achieve VO2max and delaying the exhaustion at VO2max.

1829 Board #237 MAY 30 2:00 PM - 3:30 PM Dietary Nitrate Supplementation Improves Rowing Performance In Highly Trained Rowers
Andrea J. Braakhuis1, Hannah Bond2, Lillian Morton1. 1United States Olympic Committee, Chula Vista, CA. 2Waikato Institute of Technology, Hamilton, New Zealand. (No relationships reported)

Increased plasma nitrate concentrations from dietary sources of nitrate have proven to benefit exercise performance. Beetroot contains relatively high levels of sodium nitrate which increases nitric oxide production.

PURPOSE: This study investigated whether dietary nitrate supplementation, in the form of a beetroot beverage, improved rowing performance during ergometer repetitions.

METHODS: In a randomised crossover design, fourteen elite male rowers consumed either beetroot containing ~5mmol day-1 NO3 (BR) or placebo (PL) isocaloric drinks daily, for six days. Following supplementation, rowers completed six maximal 500m ergometer repetitions and times were recorded. A seven day washout period separated the two trials. Blood pressure, oxygen
saturation, maximum heart rate, urine (specific gravity, pH and nitrites) and lactates were collected for analysis at baseline (one-month testing prior to experiment), once, 30-min pre and then immediately, 1- and 2-min post-performance testing.

**RESULTS:** Changes in the mean with 95% confidence limits were calculated. There was a likely benefit to average repetition time in the BR condition, compared to PL (-0.4%, 95% confidence limits, ±1.0%). In particular, repetitions 4-6 showed an almost certain benefit in rowing time on BR (1.7%, 95% CL, ±1.0%). The underlying mechanisms for the observed results remain unknown as differences observed in rowers’ physiological measures between the two conditions were generally unclear.

**CONCLUSIONS:** Nitrate supplementation in the form of beetroot juice resulted in improved maximal rowing ergometer repetitions, particularly in the later stages of exercise.

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**Board #238**

**May 30 3:30 PM - 5:00 PM**

**Effects of Branched-chain Amino Acids Supplementation on Glucose Homeostasis and Lipid Profile in Humans**


(No relationships reported)

Branched-chain amino acids (BCAA), particularly leucine, play an important role on glucose homeostasis through insulin secretagogue action. Some studies have also demonstrated that BCAA may modulate the immune response on inflammatory conditions. However, it is unknown if BCAA may affect the glucose homeostasis kinetics at rest and if the inflammatory response can modulate such response.

**PURPOSE:** To evaluate the effects of BCAA and leucine supplementation on glucose homeostasis, lipid profile, and the possible interaction with inflammatory response in healthy humans.

**METHODS:** In a double-blind, randomized, and crossover design 08 healthy male adults (24.4 ± 1.2 years; 79.1 ± 3.5 kg; 179.5 ± 2.5 cm; BMI 24.55 ± 1.0 kg·m⁻²) ingested either BCAA (2.4 g of leucine, 1.6 g of isoleucine, and 1.6 g of valine), leucine (LEU) (2.4 g of leucine + 3.2 g of alanine) or isonitrogenous supplement (PLA; 5.6 g of alanine). Experimental sessions were conducted on different days (7 d apart). After an overnight fast, participants ingested a single dose of the supplement and blood samples were collected before, and after 15, 30, 60, 90, and 120 min to determine serum glucose and insulin concentrations, lipid profile, and interleukin (IL)-6 concentration. Data were analyzed using repeated measures ANOVA (p<0.05) one-way or two-way as appropriated and are presented as mean ± SEM changes.

**RESULTS:** Serum glucose curve and AUC did not differ between treatments (p>0.05). BCAA and LEU increased serum insulin 60' after ingestion when compared to PLA (BCAA 75.1 ± 23.8 µM·L⁻¹; LEU 76.2 ± 12.3 µM·L⁻¹; PLA 25.3 ± 3.6 µM·L⁻¹; p<0.05). There was no difference on serum lipid profile curve and AUC in all time points between treatments (p>0.05). LEU decreased serum IL-6 concentration 60' after ingestion when compared to BCAA and PLA (LEU -1.7 ± 0.3 pg·mL⁻¹; BCAA 1.1 ± 1.5 pg·mL⁻¹; PLA 2.3 ± 0.4 pg·mL⁻¹; p<0.05).

**CONCLUSION:** BCAA and leucine supplementation had no effects on serum glucose and lipid profile kinetics but increased serum insulin concentration 60' after ingestion. This effect may be related to insulin secretagogue role of BCAA and/or the possible role of leucine on IL-6 secretion.

Supported by FAPESP (2011/04690-6)

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**Board #239**

**May 30 3:30 PM - 5:00 PM**

**Effect of an Amino Acid Beverage on Exercise Recovery and Subsequent Anaerobic Exercise Performance**

Bei Wang, Zhengping Ding, Wanji Wang, Jungyun Hwang, Yi-Hung Liao, John L. Ivy, FACSM. *University of Texas at Austin, Austin, TX.*

(No relationships reported)

An amino acid mixture, composed of 5 amino acids, has been reported to lower glucose response to an oral glucose challenge in healthy overweight adults. Glucose uptake by skeletal muscle may be the major mechanism responsible for the hypoglycemic effect of the mixture.

**PURPOSE:** To investigate the effect of two different doses of an amino acid mixture on exercise recovery and subsequent anaerobic exercise performance in healthy active individuals.

**METHODS:** After a 2 h intense cycling bout, ten subjects (27.5±2 yrs) received a CHO/HAA (1.2g/kg bw CHO, 13g amino acid mixture), CHO/LAA (1.2g/kg bw CHO, 6g amino acid mixture), or CHO (1.2g/kg bw CHO) supplement immediately and 2 h post exercise. Muscle biopsies were performed immediately and 4 h post exercise. After the second biopsy, a Wingate Anaerobic Test (WAnT) was performed.

**RESULTS:** The CHO/HAA and CHO/LAA treatments significantly decreased glucose response compared with CHO, which was supported by the finding that the glucose AUC for the CHO/HAA and CHO/LAA treatments was significantly lower than that for the CHO treatment (CHO/HAA 1259.9±27.7, CHO/LAA 1251.5±47.7, CHO 1376.8±52.9 mmol/L·4h; p<0.05). However, glycogen storage rate was significantly lower in the CHO/HAA compared with CHO, while it did not differ significantly between the CHO/LAA and CHO treatments (CHO/HAA 15.4±2.0, CHO/LAA 18.1±2.0, CHO 21.5±1.4 mmol/kg wet wt·4h⁻¹). Phosphorylation of AS160 and glycogen synthase did not differ across treatments. Likewise, there were no differences in blood lactate, creatine kinase, or myoglobin responses or WAnT performance across treatments.

**CONCLUSION:** An amino acid mixture lowers the glucose response to a carbohydrate supplement after strenuous exercise. However, it was not effective in facilitating subsequent muscle glycogen storage or anaerobic performance.

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**Board #240**

**May 30 3:30 PM - 5:00 PM**

**Acute and Long-term Branched Chain Amino Acid Changes With Gastric Bypass Surgery**

Monica J. Hubal, Lynn Yieh, John Pender, William Chapman, Walter Pories, G. Lynis Dohm. *Children’s National Medical Center, Washington, DC.*

(No relationships reported)

Gastric bypass surgery (RYGB) often initiates a weight loss independent resolution of Type 2 diabetes, though the underlying mechanism(s) driving this effect are unknown. One possible mechanism involves amino acid metabolism changes with surgery that can affect glucose homeostasis. Studies have reported branched chain amino acid (BCAA) correlations to obesity and changes in BCAAs during the months following RYGB, but fasting glucose levels often drop more acutely (within days following surgery), necessitating earlier inquiry.

**PURPOSE:** To define acute and chronic changes in amino acids and clinical correlates in diabetic versus non-diabetic obese women following RYGB. Baseline differences between these groups and lean controls were also defined.

**METHODS:** Fasting plasma samples were obtained from the following groups of Caucasian females: Lean controls (N=7; L; baseline only), obese diabetics (D; N=9 and obese non-diabetic (Ob; N=8) subjects at baseline, 7d and 3mo after RYGB. Metabolite profiling was completed on a combination of mass spectroscopy platforms (Metanomics Health GmbH). Other clinical values obtained included anthropomorphic measures and insulin/glucose-related values from IVGTT. Statistical tests included RM ANCOVA and Pearson correlations with alpha set at <0.05.

**RESULTS:** RYGB caused similar reductions in BMI over time between groups, with greater reduction in fasting plasma glucose (FG; 2 fold; p<0.04) in the D group. Baseline differences were found for all BCAAs (Leu, Ile and Val), such that D=Ob=L, but no BCAA differences were seen between groups following surgery. Val levels in the D group dropped 20% acutely, while Leu and Ile did not significantly change. Acute elevations were seen in Leu (20%) and Ile (17%) in Ob, with no change in Val. All BCAAs dropped at 3 mo post-surgery in both groups (-35 to -46% for D; -23 to -57% for Ob), to lean control levels. While BCAA levels at baseline and across all time points correlated well with BMI (r<0.06), FG (r<0.7) and HOMA (r<0.6), changes in BCAAs at either time point did not significantly correlate to changes in clinical values.
CONCLUSIONS: While BCAAs decrease to lean control levels over 3 months following RYG, these changes do not occur as rapidly as improvements in glucose homeostasis.

ACKNOWLEDGEMENT: Supported by Johnson & Johnson.

1833 Board #241 MAY 30 3:30 PM - 5:00 PM The Effects of Endurance Training and Different Methionine-contained Diets on Insulin/IGF-1 System in Skeletal Muscle Young-Yu Liang1, Hsin-wen Chang1, Liang-Tong Kuo2, Sandy S. Hsieh1, Ming-Shin Chang1, Tsang-Hai Huang1, National Cheng Kung University, Tainan, Taiwan, Taiwan, Taiwan. 1National Taiwan Normal University, Taipei, Taiwan, Taiwan.

No relationships reported

PURPOSE: To investigate the effects of different methionine (M)-contained diets combined with endurance exercise (E) training on insulin/IGF-1 system in skeletal muscles.

METHODS: Male Sprague Dawley rats (7 weeks old, n=72) were randomly assigned to six groups, which were the 0.86%M, 0.52%M, 0.17%M, 0.86%M+E, 0.52%M+E, and 0.17%M+E groups (n=12 for each group). After 8-week diets and exercise training interventions, animals were sacrificed, and skeletal muscle and blood samples were collected and stored for further analysis. Two-way ANOVA (M×E) was used for statistical analysis (α=0.05).

RESULTS: Serum TBARS, insulin, insulin-like growth factor-binding protein-3(IGBP-3), IGF-1/IGFBP-3 ratio reached the significant level both in the main effects of diet and exercise. The results of post hoc comparisons were: 1) TBARS(pg/ml) (E: 20.2±0.6 < non-E: 33.9±2.0; 0.86%M: 3.0±2.4 × 0.17%M: 2.1; 0.86%M+E: 3.0±0.4 < non-E: 0.34±0.02; 0.52%M: 0.38±0.02 × 0.17%M: 0.3; 1.09±0.4). Significant interaction was shown in serum IGF-1(ng/ml) (0.17%M: 212.4±39.3; 0.52%M+E: 347.1±50.1 × 0.17%M+E: 219.9±33.7; 0.52%M+E: 38.6±15.1). Skeletal muscle markers, IGF-1 receptor (IGF-1R), insulin receptor (IR) all reached the significant level in the main effect of exercise. The results of supplementation with AA and RE on AAT mRNA expression and whether greater leucine intake alters the response is unknown.

CONCLUSIONS: Compared to 0.86%M and 0.52%M diets, 0.17%M diet showed better effects on the longevity index. The endurance exercise mainly improved the sensitivity of insulin/IGF-1 system.

1834 Board #242 MAY 30 3:30 PM - 5:00 PM The Importance Of Leucine In Stimulating Protein Signaling After Resistance Exercise In Young Females Marcus Borgenvik, William Aprø, MarJan Pontén, Björn Ekblom, Eva Blomstrand. Astrand Laboratory, Swedish School of Sport & Health Sciences, Stockholm, Sweden.

No relationships reported

Essential amino acids (EAA) and resistance exercise are well-documented in their capacity to stimulate human muscle protein. Out of the EAA, leucine has been proposed to have a unique role in promoting protein synthesis through activation of the mammalian target of rapamycin (mTOR) pathway.

PURPOSE: To evaluate the role of leucine with regard to mTOR signaling and mRNA expression of possible regulators of mTOR in young females following resistance exercise.

METHODS: Eight healthy females performed two sessions of leg press exercise and were randomly supplied a mixture of EAA with or without leucine (EAA-Leu). Blood samples were taken repeatedly throughout the experiment and muscle biopsy samples were collected before, 1h, and 3h after resistance exercise and analyzed for phosphorylation status of proteins in the mTOR pathway and mRNA expression of mTOR-associated genes. In addition, levels of free amino acids were determined plasma and muscle samples.

RESULTS: The phosphorylation of mTOR at Ser1312 was 30-fold higher than at baseline and 5-fold higher than EAA-Leu (P<0.05) pre-exercise. The mRNA expression of Rheb increased ~1.7 fold and that of Redd1 decreased ~60 % 3h post exercise (P<0.05), with no differences between supplements. The plasma levels of isoleucine, valine, methionine, tryptophan and tyrosine were all 16 to 58 % lower after EAA-Leu vs. EAA-pretreatment 2h and 3h of recovery (P<0.05). At 3h after exercise muscle levels of these amino acids were 28 to 59 % lower when leucine was present in the drink (P<0.05). In addition, the EAA trial muscle levels of leucine increased 64 and 32 % while in the EAA-Leu trial a 44 and 39 % reduction was observed 1 and 3h post exercise, respectively.

CONCLUSION: The significantly higher response with regard to p70S6K phosphorylation in the presence of leucine emphasizes its importance in the activation of enzymes in the mTOR pathway. In addition, the larger reduction of essential amino acids in plasma and muscle provide further support for a specific role of leucine in stimulating protein synthesis. Supported by Swedish National Center for Research in Sports

1835 Board #243 MAY 30 3:30 PM - 5:00 PM Role of Dietary Leucine on Amino Acid Transporter mRNA Expression Following Resistance Exercise Tyler A. Churchward-Venne1, Andrew Philp2, George R. Marcotte3, Cameron J. Mitchell1, Daniel W.D. West1, Leigh Breen1, Steven K. Baker1, Keith Baar, FACSM2, Stuart M. Phillips, FACSM1.1McMaster University, Hamilton, ON, Canada. 2University of California, Davis, CA. 3National Taiwan Normal University, Taipei, Taiwan, Taipei, Taiwan.

No relationships reported

Skeletal muscle amino acid transporters (AAT) may play a key role in the regulation of muscle protein metabolism via their ability to transport amino acids (AA) across the sarcolemma and relay signals to downstream protein targets. The mRNA expression of some AAT is increased after essential amino acid (EAA) intake and exercise resistance (RE); however, the combined effect of AA and RE on AAT mRNA expression and whether greater leucine intake alters this response is unknown.

PURPOSE: To examine the effect of AA/whey protein intake (with high and low leucine content) after RE on the mRNA expression of select AAT in human skeletal muscle.

METHODS: 24 adult men (22±1 y) completed unilateral knee-extensor RE before consuming one of the following: WHEY (25 g whey protein); LEU (6.25 g whey protein supplemented with leucine to be iso-leucine with WHEY); and EAA-LEU (6.25 g whey protein supplemented with EAA except leucine to be iso-EAA with WHEY for each EAA except for leucine). Muscle biopsies were obtained before RE and 1, 3, and 5h after from rested-fed (FED) and exercise-fed legs (EX-FED), qRT-PCR was used to determine changes in mRNA expression of LAT-1, CD-98, and PAT-1 AAT and members of the general AA control pathway GCN-2 and ATF-4.

RESULTS: mRNA expression of CD-98 and LAT-1 (fold-change from baseline) increased in FED and EX-FED, however the response at 5h was higher in EX-FED vs. FED. During EAA supplementation the phosphorylation of p70S6K at Thr389 was 30-fold higher than at baseline and 5-fold higher than EAA-Leu (P<0.05) 1h post exercise. The mRNA expression of Rheb increased ~1.7 fold and that of Redd1 decreased ~60 % 3h post exercise (P<0.05), with no differences between supplements. The plasma levels of isoleucine, valine, methionine, tryptophan and tyrosine were all 16 to 58 % lower after EAA-Leu vs. EAA-Leu following 2h and 3h of recovery (P<0.05). At 3h after exercise muscle levels of these amino acids were 28 to 59 % lower when leucine was present in the drink (P<0.05). In addition, the EAA trial muscle levels of leucine increased 64 and 32 % while in the EAA-Leu trial a 44 and 39 % reduction was observed 1 and 3h post exercise, respectively.

CONCLUSION: The significantly higher response with regard to p70S6K phosphorylation in the presence of leucine emphasizes its importance in the activation of enzymes in the mTOR pathway. In addition, the larger reduction of essential amino acids in plasma and muscle provide further support for a specific role of leucine in stimulating protein synthesis. Supported by Swedish National Center for Research in Sports

1836 Board #244 MAY 30 3:30 PM - 5:00 PM Effect Of β-Alanine And Sodium Bicarbonate Supplementation On High Intensity Performance Anu Koivisto1, Ida Svendsen1, Erlend J. Hem1, Truls Råstad1. 1Olympiatoppen, The Norwegian Olympic and Paralympic Committee and Confederation of Sports, Oslo, Norway. 2Norwegian School of Sport Sciences, Oslo, Norway.

No relationships reported

Supplementation with β-alanine can increase the level of intracellular buffer carnosine in skeletal muscle. Studies have shown that increased carnosine concentration can limit metabolic
acidity and enhance high-intensity exercise performance. Supplementation with sodium bicarbonate can increase buffer capacity in blood and enhance maximal exercise capacity in sports lasting 1-5 minutes.

PURPOSE: To determine the effect of β-alanine and sodium bicarbonate supplementation, separately and in combination, on high-intensity cycling capacity.

METHODS: Fourteen physically active students were block randomised to either a placebo or β-alanine group (4g/day for 5 weeks) based on VO2max. Before and after the 5-week loading phase with either β-alanine or placebo, two 5-minute cycling tests (test 1, test 2, with a 20-minute break between tests) were conducted. Performance was measured as average power in 5 minutes (Wmax). The repeated performance tests were conducted twice, before and after the loading phase, with either sodium bicarbonate (0.3g/kg body weight) or placebo (malodextrin) in a randomised cross-over design.

RESULTS: Bicarbonate supplementation alone did not have any effect on Wmax. As a result of 5-week loading phase there was a significant increase in Wmax in β-alanine (9 ± 7 W; 3.4%), (p=0.03) but not in placebo group. Wmax decrease between the repeated performance tests (test 1 and 2) was smaller when subjects received bicarbonate supplementation vs placebo (-5 ± 10 W, vs. -16 ± 19 W p = 0.04) after the β-alanine loading phase.

CONCLUSIONS: Supplementation with β-alanine enhanced performance in a 5-minute cycling capacity test. Supplementation with sodium bicarbonate alone did not have any performance enhancing effect, but when combined with β-alanine, the reduction in cycling capacity in the repeated performance test (after 20min) was reduced.

1837 Board #245 MAY 30 3:30 PM - 5:00 PM
Effects Of Beta-alanine Supplementation Combined Or Not With Sodium Bicarbonate On Anaerobic Performance

Methods: This was a randomized, double-blinded, placebo-controlled trial. Subjects were divided into 4 groups (BA + Placebo; Placebo + SB; Placebo+Placebo; and BA + SB). Thirty athletes (age=25±5 yrs; weight=78±49.9 kg; training experiences 6±4 yrs; training volume=6.8±2 h/wk) were assessed for intermittent anaerobic performance, through the use of 4 bouts of the Wingate Anaerobic Test for upper body, interspersed by 3 min recovery period. All athletes undertook the same experimental procedures twice (i.e. PRE and POST the supplementation period).

Results: We observed a significant main effect of time (F=38.81; p<0.0001) and a significant group*time interaction (F=6.7; p=0.001). BA, SB and BA+SB elicited significant improvement in performance (between subjects; p<0.05), whereas performance did not change in placebo group whatsoever. Moreover, the athletes from BA+SB group presented the highest improvement in performance as compared to BA or SB alone.

CONCLUSION: BA or SB alone improves intermittent anaerobic performance in a very similar fashion, and BA+SB combined showed additive ergogenic effects.

1838 Board #246 MAY 30 3:30 PM - 5:00 PM
Effects Of β-alanine Supplementation On Exercise Performance: A Meta-analysis
Ruth M. Hobson1, Bryan Saunders1, Graham Ball1, Roger Harris2, Craig Sale1, 1Nottingham Trent University, Nottingham, United Kingdom. 2Juniper Ltd, Newmarket, United Kingdom.

Methods: A comprehensive literature search identified all studies suitable for inclusion; strict exclusion criteria, generally relating to inappropriate methodological design, were applied. Exercise tests were analysed as a complete group for the overall effect of β-alanine supplementation (BA) and Sodium Bicarbonate (SB) supplementation on Anaerobic Performance of Upper Limbs, Methods: This was a randomized, double-blinded, placebo-controlled trial. Subjects were divided into 4 groups (BA + Placebo; Placebo + SB; Placebo+Placebo; and BA + SB). Thirty athletes (age=25±5 yrs; weight=78±49.9 kg; training experiences 6±4 yrs; training volume=6.8±2 h/wk) were assessed for intermittent anaerobic performance, through the use of 4 bouts of the Wingate Anaerobic Test for upper body, interspersed by 3 min recovery period. All athletes undertook the same experimental procedures twice (i.e. PRE and POST the supplementation period).

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CONCLUSION: BA or SB alone improves intermittent anaerobic performance in a very similar fashion, and BA+SB combined showed additive ergogenic effects.

β-alanine is a substrate of carnosine (which contributes to H+ buffering during high-intensity exercise) and is a popular ergogenic aid to sports performance.

PURPOSE: There have been several recent qualitative reviews published on the topic; here we present a preliminary quantitative review of the literature through meta-analysis.

Methods: A comprehensive literature search identified all studies suitable for inclusion; strict exclusion criteria, generally relating to inappropriate methodological design, were applied. Exercise tests were analysed as a complete group for the overall effect of β-alanine supplementation (BA) and Sodium Bicarbonate (SB) supplementation on Anaerobic Performance of Upper Limbs.

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Conclusion: BA or SB alone improves intermittent anaerobic performance in a very similar fashion, and BA+SB combined showed additive ergogenic effects.

β-alanine is a substrate of carnosine (which contributes to H+ buffering during high-intensity exercise) and is a popular ergogenic aid to sports performance.
Board #248  MAY 30  3:30 PM - 5:00 PM  
**Beta-alanine Supplementation Increases Muscle Carnosine Content And Physical Capacity In Elderly Subjects**  
Serena del Faverro, Hamilton Roschel, Marina Y. Solís, Ana P. Hayashi, Guilherme G. Arito, Maria Concepción Ontañón, Fabiana B. Benatti, Roger C. Harris, John A. Wic, Cláudia C. Leite, Rosa M. Pereira, Ana L. de Sá-Pinto, Antonio Herbert Lancha-Junior, Bruno Guadano, School of Physical Education and Sport – University of Sao Paulo, Sao Paulo, Brazil. School of Medicine – Division of Radiology - University of Sao Paulo, Sao Paulo, Brazil.  
Supported by FAPESP Grant 2010/11221-0.

**PURPOSE:** To study the effects of beta-alanine supplementation on exercise performance capacity and on the muscle carnosine content in elderly subjects.

**METHODS:** Eighteen elderly subjects (65±4 yrs) were randomly assigned to receive either beta-alanine (BA, n=12) or placebo (PL, n=6) for 12 weeks. The BA group received 3.2 g of beta-alanine per day (2×800 mg, given 2 times per day). The PL group received the exact same amount of placebo. At baseline (PRE) and after 12 weeks (POST-12) of supplementation we assessed the muscle carnosine content and anaerobic exercise capacity. Food intake was monitored throughout the study.

**RESULTS:** A significant increase in the muscle carnosine content of the gastrocnemius muscle was found in the BA group (+ 85.4%) when compared with the PL group (+ 7.2%) (p=0.004; ES: 1.21). The time-to-exhaustion in the TLIM test was significantly improved (p=0.05; ES: 1.71) in the BA group (+30.5%) versus the PL group (+6.6%). Similarly, time-to-exhaustion in the incremental test was also significantly increased (p=0.04; ES: 1.03) following beta-alanine supplementation (+12.2%) when compared with placebo (+0.1%). We also observed significant positive correlations between the relative change in the muscle carnosine content and the relative change in the time-to-exhaustion in the TLIM test (r=0.62; p=0.01) and in the incremental test (r=0.48; p=0.02). Dietary intake was unchanged.

**CONCLUSION:** beta-alanine supplementation is effective in increasing the muscle carnosine content in elderly healthy subjects, with subsequent improvement in their exercise capacity. Supported by FAPESP Grant 2010/11221-0.

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Board #249  MAY 30  3:30 PM - 5:00 PM  
**L-Alanyl-L-Glutamine Ingestion Maintains Performance during a Competitive Basketball Game**  

(No relationships reported)

**PURPOSE:** Examine the efficacy of L-alanyl-L-glutamine (AG) ingestion on basketball performance, including jump power, reaction time, shooting accuracy and fatigue during a basketball game.

**METHODS:** Ten women (21.2 ± 1.6 years; height: 177.8 ± 8.7 cm; body mass: 73.5 ± 8.0 kg), all scholarship NCAA Division I basketball players, volunteered for this study. Subjects participated in four trials, each consisting of a 40-min basketball game with controlled time-outs for rehydration. During the first trial (DHY) subjects were not allowed to rehydrate, and the total weight lost during the contest was used to determine fluid replenishment during the subsequent three experimental trials. During one trial subjects consumed only water (W), while during the other two trials subjects consumed the AG supplement marketed as Sustamine™ mixed in water using either a low dose (1 g per 500 ml) (AG1) or high dose (2 g per 500 ml) (AG2) concentration.

**RESULTS:** During DHY subjects lost 1.7 ± 0.42 kg (2.3% loss of their body mass). No differences in fluid intake (1.55 ± 0.43 L) were seen between rehydration trials. A 12.5% (p = 0.016) difference in basketball shooting performance was noted between DHY and AG1 and an 11.1% (p = 0.029) difference was seen between AG1 and W. Visual reaction time was significantly greater following AG1 (p = 0.014) compared to DHY. Differences (p = 0.045) in fatigue, as determined by player loads, were seen only between AG2 and DHY. No significant differences were seen in the pre to post game differences in either peak or mean vertical jump power during any trial.

**CONCLUSIONS:** In conclusion, rehydration with AG appears to maintain basketball skill performance and visual reaction time to a greater extent than water only.

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Board #250  MAY 30  3:30 PM - 5:00 PM  
**The Impact Of Glycine Propionyl-L-Carnitine Supplementation On Power Production In Recreationally Active Women**  
Melanie C. Chun, Paul C. Miller, Patrick L. Jacobs, FACSM. Elon University, Elon, NC.

(No relationships reported)

Many people use dietary supplements to enhance the effects of exercise. This has led to the development of a $14 billion supplement industry (Sarubin, 2000). One such supplement, glycine propionyl-L-carnitine (GPLC), is marketed to non-athlete exercisers for the purpose of increasing work output while delaying fatigue. Such a supplement may assist individuals in establishing an effective exercise routine that meets health recommendations. GPLC has been shown to increase anaerobic power in resistance-trained men (Jacobs et al, 2009). Recognizing that women may respond differently to exercise and nutritional supplementation, a study focusing on women participants is warranted.

**PURPOSE:** To study the effects of GPLC supplementation on anaerobic power production in recreationally active women.

**METHODS:** A double-blind, repeated measures design was used in this investigation. Participants (n=8) completed four sessions. The first session served to familiarize the participants to the anaerobic power test. Subsequently, 3 testing sessions were performed separated by 1 week. Sessions were counterbalanced by supplement; 3.0 g GPLC, 1.5 g GPLC, or control (200 mg brown rice powder). Ninety minutes following supplement ingestion, participants completed a 5 minute warm-up and then a 5-stage anaerobic power test on a cycle ergometer. The ergometer was loaded with 5% of the individual's body weight. Each stage lasted 10 seconds and was separated by 1 min of active recovery. Active recovery was done by pedaling an unloaded cycle ergometer at 50 RPM. Peak power (PP) and mean power (MP) were measured and recorded.

**RESULTS:** A RM-GLM revealed a significant time effect for both PP (p=0.001) and MP (p=0.01). There was not a significant condition effect for either PP or MP (p>0.05). A non-significant time*condition interaction was seen for both PP (p=0.076) and MP (p=0.063). Higher initial power was seen for those consuming 3.0 g GPLC (313.0±16.0 W) than either 1.5 g GPLC (304.6±11.5 W) or control (306.0±15.1 W).

**CONCLUSIONS:** Consuming 3.0 g GPLC prior to exercise may result in an increase in power production among recreationally active women. This may enable individuals to exercise at intensities sufficient to derive health benefit.
1843  Board #251  MAY 30  3:30 PM - 5:00 PM
Effect of an L-Arginine/L-Citrulline Supplement on Muscle Oxygen Saturation and Maximal Exercise Performance
Greg Ehlers, Stephanie Boehm, Jennifer Brown, Rebecca Gadeken, Sara Keller, Megan Mueller, Sarah Schnerber, David Uffenbeck, Reid Nelson. Concordia University Wisconsin, Mequon, WI.

L-Arginine (LA) is a semi-essential amino acid that is commonly used as a supplement to enhance blood flow and improve performance in resistance and aerobic exercise. LA exerts its primary effect by conversion to nitric oxide (NO), increasing vasodilatation potential in the vasculature of the body. The addition of L-citrulline (LC) to LA has been shown to enhance the potential ergogenic effects of LA.

PURPOSE: To examine the effects of an acute dose of LA/LC supplementation on skeletal muscle oxygen saturation (StO₂) and maximal cycle exercise performance.

METHODS: Twelve healthy, college-aged participants (9 M, 3 F; 20.69 ± 0.95 yr) completed two maximal cycle ergometer exercise tests after ingesting either LA/LC (LA 5000mg, LC 1500mg) in 0.5 L water or placebo approximately 90 minutes prior to testing. Order of drink mixture was determined by randomized, blinded balance design. Respiratory gases were collected for the determination of maximal oxygen consumption (VO₂max) and ventilatory threshold (VT). Heart rate (HR), blood pressure (BP) and rating of perceived exertion (RPE) were measured throughout exercise. Near infrared spectroscopy (NIR) was used to assess StO₂ in the vastus lateralis muscle by analyzing the StO₂ slope measured from the first significant reduction during exercise to the point of the VT.

RESULTS: No significant difference was found between supplement and placebo for time to exhaustion (13.50 ± 0.56 min vs 13.64 ± 0.57 min; P = 0.279), maximal workload (315.8 ± 18.3 vs 317.6 ± 18.2 watts; P = 0.653), VO₂max (47.97 ± 3.07 vs 47.69 ± 2.68 ml·kg⁻¹·min⁻¹; P = 0.731), StO₂ slope (+0.0418 ± 0.0033 vs -0.0384 ± 0.0043; P = 0.448), and time to VT (10.55 ± 0.492 vs 10.55 ± 0.494 min; P = 0.999), respectively. All participants showed consistency in maximal effort based on an RER of greater than 1.10 for all tests for both supplement and placebo trials.

CONCLUSION: The results of this study suggest that acute LA/LC supplementation does not significantly affect maximal exercise test results or the onset of the VT. In addition, skeletal muscle oxygen utilization from the beginning of exercise up to the VT was not affected by the LA/LC supplement when compared to placebo.

1844  Board #252  MAY 30  3:30 PM - 5:00 PM
L-arginine Combined With Resistance Exercise on Maximal Oxygen Uptake, Growth Hormone Secretagogues, And Insulin-like Growth Factor-1
Scott C. Forbes, Vicki Harber, Gordon Bell. University of Alberta, Edmonton, AB, Canada. (Sponsor: Dr. Darren Delorey, FACSM)

Acute resistance exercise and L-arginine independently have both been shown to elevate plasma growth hormone (GH) concentrations; however, their combined effect in strength trained participants is controversial.

PURPOSE: To investigate the combined effects of resistance exercise and L-arginine supplementation on plasma L-arginine, GH, GH secretagogues, and IGF-1 in strength trained males.

METHODS: Fourteen strength trained males (age: 25±4 yrs; weight: 81.4±9.0 kg; height: 179.4±6.9 cm; body fat: 11.5±3.8 %; training experience: 6.3±3.4 yrs; one repetition maximum (1RM) bench press relative to body mass ratio: 1.3±0.2) participated in a crossover study (separated by ~7 days) in which they were randomized to L-arginine supplementation (0.075 g·kg⁻¹·d⁻¹) or placebo. Subjects reported to the laboratory at 08:00 in a fasted state, consumed the supplement 60 min prior to performing a resistance training session (3 sets of 8 exercises, 10 repetitions at ~75% 1RM). Blood samples were collected at rest, before exercise, and 0, 15, 30, 60 minutes after exercise.

RESULTS: The L-arginine condition significantly increased plasma L-arginine concentrations (from 236 to 518 µmol·L⁻¹) while no change was detected in the placebo condition. There were no differences between conditions for GH, GH-releasing hormone, GH-inhibiting hormone, ghrelin, or IGF-1 at any time point. However; integrated area under the curve for GH was significantly blunted in the L-arginine condition (L-arginine = 288.4±368.7 vs. placebo = 487.9±482.0 min·ng·ml⁻¹; p<0.05).

CONCLUSION: Acute L-arginine supplementation when combined with exercise resistance blunted the GH response; however, this response was not due to changes in GH-releasing hormone, GH-inhibiting hormone, ghrelin, or IGF-1.

1845  Board #253  MAY 30  3:30 PM - 5:00 PM
Effects Of β-hydroxy-β-methylbutyrate (hmb) Supplementation On Exercise Performance, Body Composition And Hematological Response In Male Athletes
Minayuki Shirato1, Hirokazu Osana2, Kazuhiro Suzukiwa2, Hidenori Otsuna1, Naoto Kimura1,2. Meijiro University College, Tokyo, Japan. 1 nippon Sport Science University, Tokyo, Japan. 2 Himeji Dokkyo University, Hyogo, Japan.

(No relationships reported)

PURPOSE: Studies have shown that β-hydroxy-β-methylbutyrate (HMB) supplementation is able to increase muscle strength and lean-body mass and to prevent muscle damage with resistance training in untrained individuals. However, there have been less studies to examine the effects of HMB supplementation on these responses in trained individuals. The purpose of this study was therefore to examine the effects of HMB supplementation on exercise performance, body composition and hematological response over 4 weeks of resistance training in athletes.

METHODS: Fourteen male athletes were divided into two groups: HMB supplementation group (HMB, 3.0 g/day; n = 7) and placebo group (maltodextrin; n = 7). Resistance training consisted of 2 different exercises (bench press and leg press) at 75-80% of 1-repetition maximum (1-RM), performed 2-3 days/week for 4 weeks. 1-RM muscle strength, anaerobic power (Wingate test) and body composition were assessed before and after 4 weeks of resistance training. Blood samples were obtained before and at 2 and 4 weeks after starting HMB supplementation.

RESULTS: No significant differences were observed between the groups in 1-RM muscle strength, body composition, and hematopoietic enzyme activity. Anaerobic power at 5 sec during the Wingate test was significantly greater in the HMB group than in the placebo group (880±61 W vs. 804±40 W, P<0.05). The increase of in 1-RM leg press tended to be higher in the HMB group than in the placebo group (15±12% vs. 7±5%, P=0.15). High-density lipoprotein was significantly lower in the HMB group than in the placebo group after 4 weeks (46±5 mg/dl vs. 58±5 mg/dl, P<0.01). There were decreasing tendencies of creatine phosphokinase (p=0.11) and lactate dehydrogenase (p=0.07) in the HMB group compared with the placebo group.

CONCLUSION: These results suggest that HMB supplementation for 4 weeks is unable to increase muscle strength and lean body mass in athletes. However, it tends to reduce training-induced muscle damage by increasing cholesterol metabolism, and to maintain anaerobic performance.

1846  Board #254  MAY 30  3:30 PM - 5:00 PM
The Effect Of N-acetyllysine Supplementation On Recovery Of Strength Following Eccentric Muscle Injury
Ryan C. Luke1, Dan A. Benardot, FACSM2, Jeffrey L. Rupp, FACSM3, Christopher P. Ingalls, FACSM2, Benjamin T. Corona1, Michael S. Green1, J. Andrew Doyle4, FACSM. 1 California State University, Monterey Bay, Seaside, CA. 2Georgia State University, Atlanta, GA. 3US Army Institute of Surgical Research, San Antonio, TX. 4Troy University, Troy, AL.

(No relationships reported)

N-acetyllysine (NAC) supplementation has demonstrated pro- and anti-inflammatory effects in human subjects following exercise-induced muscle injury. However, there is limited data examining the effects of NAC on recovery of maximal isometric torque (MIT) following injurious exercise.

PURPOSE: The purpose of this study was to examine the effect of NAC supplementation on recovery of MIT following eccentric contraction-induced muscle injury.

METHODS: Non-resistance-trained female subjects (n = 21, age = 20.7 ± 1.3 yrs, weight = 68.1 ± 10 kg; height = 1.7 ± 0.07 m) performed one bout of eccentric exercise involving the non-dominant forearm flexor muscles. Subjects were given a placebo (P) (n = 10) or NAC supplement (10 mg·kg⁻¹·bw⁻¹; n = 11) for 7d prior to and 10d following the eccentric exercise bout. Maximal isometric torque, muscle soreness (SORE), range of motion (ROM), and arm circumference (CIRC) were measured at pre-exercise (PRE), immediately post-exercise (POST), and at 1d, 3d, 7d and 10d post-exercise. In addition, serum interleukin-6 (IL-6), serum creatine kinase (CK), and serum glutathione were measured. Subjects completed a food frequency questionnaire (FFQ) to determine the antioxidant content of their diet.
RESULTS: There was no difference in M1T values between the P and NAC group POST (26.93 ± 4.64 vs. 24.95 ± 4.94 Nm) or at 1d (27.83 ± 5.7 vs. 26.9 ± 8.5 Nm), 3d (38.35 ± 6.7 vs. 34.69 ± 10.2 Nm), 7d (46.9 ± 8.8 vs. 42.5 ± 11.8 Nm), or 10d (57.83 ± 11.7 vs. 52.92 ± 14.3 Nm) post-exercise. In addition, there was no difference in SORE (p = .752), CIRC (p = .533), ROM (p = .539), serum CK (p = .449), serum glutathione (p = .967), or serum IL-6 (p = .360) at any time point. FFQ scores demonstrated that dietary antioxidant intake was not significantly different between groups (p = .054).

CONCLUSION: A bout of eccentric forearm flexor exercise resulted in a significant decrease in M1T values (>50% PRE MIT at POST) in both groups. Supplementation with NAC had no effect on recovery of M1T, SORE, CIRC, ROM, serum CK, serum IL-6, or serum glutathione at any time point following the exercise bout when compared to a P group. These results suggest that oral ingestion of NAC, at a dosage of 10 mg·kg⁻¹·bw⁻¹·day⁻¹, has no effect on recovery of MIT following eccentric muscle injury. Supported by doctoral dissertation grant from Gatorade Sports Science Institute.

1847 Board #255 MAY 30 3:30 PM - 5:00 PM Muscle Protein Metabolism In Neonatal Alloxan-administered Rats: Effects Of Resistance Training Carla Ribeiro, Luciele Teresa Cambri, Fabrício de Azevedo Voltaralli, Rodrigo Augusto Dalia, Michel Barbosa de Araújo, José Diego Botteluzzi, Leandro Pereira de Almeida, Maria Alice Rostom de Mello. Sao Paulo State University, Rio Claro, Brazil.

(No relationships reported)

Currently, it has been observed that type 2 diabetes mellitus (T2DM) changes the serum levels of several amino acids that may contribute to disturbances in insulin secretion and action. However resistance training has the potential for increasing muscle strength and lean muscle mass which can enhance functional status on muscle protein metabolism in the T2DM.

PURPOSE: Thus, this study aimed to examine the effects of resistance training on muscle protein metabolism in neonatal alloxan-administered rats.

METHODS: Alloxan was injected in newborn rats at 6 days of age (250 mg/kg bw). At 28 days of age, the animals were divided into sedentary alloxan (SA), sedentary control (SC), resistance trained alloxan (TA), resistance trained control (TC) groups. The resistance training protocol (T) consisted of four series of 10 jumps in the water in individual cylinders (25 cm diameter x 50 cm height), one min interval between them, with an overload of 50% of b. w during 12 weeks, 5days a week. At 120 days the animals were subjected to glucose tolerance test (GTT), analyzed by the total area under the serum glucose curve (AUC mg/dLx120min). After 48hs of the last test, all animals were killed for analysis of protein synthesis (pmol/mg.h) and degradation (pmol/mg.h) in the soleus muscle; DNA concentrations (mg/g) and DNA/protein ratio in the gastrocnemius muscle. Data were analyzed by 2-way ANOVA (p<0.05), followed by Newman-Keuls post hoc.

RESULTS: The AUC was higher in the SA and TA when compared to corresponding controls SC and TC (SA=14140 ± 672 > SC=13064 ± 678 TA=15324 ± 657 > TC=14085 ± 392). No differences in protein synthesis (SC=12.77 ± 5.76 > SA=11.06 ± 2.17 TA=16.48 ± 3.03) and protein degradation (SC=287.93 ± 37.38 > SA=350.56 ± 90.71 TA=281.26 ± 127.88) were observed. The DNA concentrations were higher in the SC group than the TC group (SC=0.058 ± 0.010 SA=0.053 ± 0.013 TA=0.037 ± 0.013 SA=0.043 ± 0.016), whereas the DNA/protein ratio was observed to increase in the resistance training groups (SC=0.108 ± 0.020 SA=0.110 ± 0.035 TA=0.161 ± 0.026). Significant correlations were registered only for serum glucose and DNA/protein ratio (r=0.67, p<0.05).

CONCLUSION: It was concluded that resistance training sessions were effective in altering muscle growth by hyper trophy in alloxan-administered animals.


1848 Board #256 MAY 30 3:30 PM - 5:00 PM Routine Practice of Yoga Effects Whole Body Protein Utilization in Middle-Aged Women Megan Colletto, Jose Rodriguez, Jeffrey DellFavero, Nancy Rodriguez, FACSM. University of Connecticut, Storrs, CT.

(No relationships reported)

Whole body protein turnover (WBPTO) reflects the balance between protein flux (Q), protein breakdown (PB) and protein synthesis (PS). The influence of routine yoga practice on WBPTO in middle-aged men and women has not been characterized.

PURPOSE: To determine differences in WBPTO between middle-aged (50-70 y) men and women who practice yoga and healthy sedentary controls.

METHODS: WBPTO, protein (g/d) and energy intake (kcal/d) were determined in healthy middle-aged yoga practitioners (YOGA) and sedentary controls (CON). The 15N glycine method was used to measure WBPTO. Following the evening meal, subjects provided a spot urine sample for background enrichment of 15N glycine and then consumed the 2 mg/kg 15N glycine dose. Urine was collected overnight for 7-10 h and urinary 15N ammonia enrichment determined by IRMS at a commercial laboratory (Metabolic Solutions, Nashua, NH). Protein and energy intakes were estimated from 7 d diet records. Subjects estimated portion sizes with a food scale and visual guide. Records were verified by research assistants and analyzed using Nutritionist Pro software version 4.70 (Stafford, TX).

RESULTS: Data are presented as mean ± SE. Age, weight and BMI were similar for YOGA (n=8, 58.2 ± 1.5 y, 67.0 ± 4.2 kg, BMI = 24.7 ± 0.3) and CON (n=11, 55.4 ± 1.5, y, 73.7 ± 4.8 kg, BMI = 26.3 ± 0.8). Components of WBPTO did not differ between YOGA and CON (p = 0.089; Q: 0.74 ± 0.10 vs. 0.94 ± 0.098; p =0.26; PB: 3.43 ± 0.60 vs. 4.05 ± 0.66, p=0.12; PS: 3.97 ± 0.58 vs. 5 ± 0.58). For women only, Q and PS were lower for YOGA versus CON (p < 0.05; Q: 0.60 ± 0.06 vs. 0.75 ± 0.04, p < 0.05; PS: 3.22 ± 0.40 vs. 4.47 ± 0.52) while PB did not differ (p = 0.26; 3.43 ± 0.60 vs. 4.05 ± 0.66). No group or gender specific differences were found for protein (81 ± 6 vs. 91 ± 8) and calorie (1811 ± 120 vs. 2077 ± 626) intake.

CONCLUSIONS: Findings suggest that protein turnover may be down regulated in middle-aged women who routinely practice yoga. Given the increased popularity of yoga, further research is warranted to characterize the protein related metabolic response of this alternate mode of exercise in middle-aged men and women as a potential strategy for maintenance of muscle mass with aging.

Project funded by Daisy Research Institute.

1849 Board #257 MAY 30 3:30 PM - 5:00 PM Post-exercise Carbohydrate Plus Whey Protein Hydrolysates Supplementation Stimulates Muscle Protein Synthesis In Rats Atsushi Kanda,1 Kyotake Nakayama,1 Tomoyuki Fukasawa,1 Jinichiro Koga,1 Kentaro Kawanaka,2 Mitsuji Higuchi, FACSM1, 2Meiji Co., Ltd., Saitama, Japan. 1Niigata University of Health and Welfare, Niigata, Japan. 2Waseda University, Saitama, Japan.

(No relationships reported)

PURPOSE: Recent studies have shown that co-ingestion of carbohydrate and protein is more effective than ingestion of carbohydrate alone for stimulating muscle protein synthesis after exercise. However, it remains to be demonstrated which form of whey protein (intact protein, protein hydrolysates, or amino acids) is the most effective stimulator of protein synthesis and translation initiation in skeletal muscle. The aim of this study was to compare the effects of different forms of dietary whey protein on protein synthesis and translation initiation in skeletal muscle in the post-exercise phase.

METHODS: Male Sprague-Dawley rats, pre-trained for 3 days, trained for 2 hours. Immediately after the exercise, one of the following four isocaloric solutions was administered: carbohydrate (CHO); carbohydrate plus protein intake (whey protein [WPC], whey protein hydrolysates [WPH], or whey amino acid mixture [WAA]) (n = 8). A bolus dose (45 mg/kg BW, 22.5 mg/ml) of phenylalanine labeled with deuterium was injected via the tail vein 45 min after administration for the measurement of the protein fractional synthesis rate (FSR). One hour after administration, the triceps muscle was excised and quickly frozen. Subsequently, plasma insulin level, and protein synthesis and phosphorylated Akt/PKB in the triceps muscle were analyzed.

RESULTS: WPH caused significant increases (p < 0.05) in FSR (6.93±0.10%/day), compared with WPC (6.01±0.23%/day), WAA (5.83±0.30%/day), or CHO (4.56±0.22%/day). Post-exercise ingestion of WPH or WPC caused significant increases (p < 0.05) in plasma insulin (WPH, 0.86±0.12 ng/ml; WPC, 0.83±0.07 ng/ml) levels compared with CHO (0.44±0.06 ng/ml). In contrast, there were no significant differences in the plasma insulin increase after WAA ingestion (0.63±0.12 ng/ml) and CHO ingestion. Furthermore, the level of Akt/PKB phosphorylation was significantly higher (p < 0.05) after WPH ingestion (164%) than after CHO ingestion, but not significantly different after WPC (140%), WAA (127%), and CHO ingestion.

CONCLUSIONS: It is concluded that post-exercise supplementation with WPH increases skeletal muscle protein synthesis better than post-exercise supplementation with WPC or WAA by activating key enzymes such as Akt/PKB.
CONCLUSION: Supported by a grant from Solae LLC.

Effect Of Protein Intake On Muscle Strength And Muscle Mass According To Physical Activity Level

PURPOSE: To investigate the effects of HMB on signaling pathways regulating protein synthesis and degradation. METHOD: Female rats were orally administrated by vehicle, whey protein (187.5mg/kg), HMB (400mg/kg) or leucine (1.4g/kg). Blood was collected before, 45 min and 90 min after supplement administration. Gastrocnemius muscle was excised 90 min after exercise. Results showed that HMB increased Akt phosphorylation in RG (vehicle 0.18±0.03, protein 0.17±0.03, HMB 0.28±0.05 leucine 0.20±0.03 arbitrary units, p<0.05). Both HMB and leucine increased phosphorylation of mTOR in RG (vehicle 0.40±0.08, protein 0.39±0.04, HMB 0.65±0.06, leucine 1.06±0.10 arbitrary units, p<0.05) and WG (vehicle 0.34±0.06, protein 0.36±0.02, HMB 0.46±0.03, leucine 0.59±0.06 arbitrary units, p<0.05), but the effect of leucine was stronger. Leucine also increased the phosphorylation of p70S6K and 4E-BP1 in both RG and WG, whereas HMB did not. Conversely, phosphorylation of FOXO3A was stimulated only by HMB (vehicle 0.53±0.09, Protein 0.59±0.09, HMB 1.61±0.24 Leucine 0.81±0.08 arbitrary units, p<0.05).

CONCLUSION: Leucine appears to be an effective activator of signaling proteins involved in protein synthesis, whereas HMB appears to be involved in inhibiting protein related to protein degradation. These results suggest that supplementing with a combination of leucine and HMB could possibly increase protein synthesis and limit protein degradation thereby increasing protein accretion.

Whey Protein Supplementation Results in Greater Gains in Lean Body Mass Compared to Soy Protein during a Progressive 9-month Resistance Training Program

PURPOSE: Whey and soy are two quality protein sources used by athletes. Few studies have directly compared their ability to promote gains in lean body mass. We compared the effect of whey and casein with intermediate and slow rate, respectively (p>0.05). Protein breakdown across the leg was reduced post-exercise with no differences between Protein A and B, respectively (p>0.05). Also, net phenylalanine balance across the leg increased from baseline to a similar extent (7.4±1.8, 11.6±3.3 nmol/100g muscle/min) in both A and B, respectively (p<0.05). Protein breakdown across the leg was reduced post-exercise with no differences between Protein A and B.

CONCLUSION: We conclude, from these preliminary data, that the ingestion of a protein blend affects the overall muscle protein anabolic response following resistance exercise to a similar extent compared to whey protein. Supported by a grant from Solae LLC.
dual supplementation with whey protein (WP) or soy protein (SP) on lean body mass responses to a 9-month progressive resistance training program.

**METHODS:** Non-resistance trained men and women were randomized into a WP (n=19) or SP (n=22) group. The supplement provided -22 g carbohydrate plus 21 g of either whey protein concentrate or soy isolate. All subjects participated in a supervised, whole-body non-linear periodized resistance training program for 9 months (3x/wk). Body composition was assessed every 3 months via dual x-ray energy absorptiometry (DXA).

**RESULTS:** Average daily protein intake, including the supplement, was 1.4 g/kg body weight. Despite consuming similar calories and protein during the intervention, gains in lean body mass were significantly greater in the WP (3.3 ± 1.5 kg) than the SP (1.8 ± 1.6 kg) group. There were no significant differences in body mass and fat mass responses between groups.

**CONCLUSION:** Whey protein supplementation was more effective than soy protein in promoting gains in lean body mass in response to chronic resistance training.

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**1854**

**Board #262**

**MAY 30**

**3:30 PM - 5:00 PM**

**Effects Of Chocolate Milk And A Whey Protein Drink On Muscle Damage And Performance**

Jamie R. Fornal, Catherine G.R. Jackson, FACS, Timothy R. Anderson, Felicia A. Greer. *California State University, Fresno, Fresno, CA.*

(No relationships reported)

**PURPOSE:** To compare muscle recovery effects of fat-free chocolate milk (CHOCM) and a chocolate whey protein drink mixture (CWPM) on performance and measures of muscle damage.

**METHODS:** Eight male recreational athletes (age 24 ± 4y; body mass 80.1 ± 12.5 kg; height 17.87 ± 0.66 m) completed three testing sessions after muscle damage, measured by elevated serum creatine kinase (CK) levels, was induced by a sprint protocol. On day one of each testing session, a standardized warm-up was followed by 15 × 30 meter sprints with a 10 meter deceleration zone leading to a complete stop with 60 second rest periods. CK and performance assessments [peak quadriceps isometric force (MVC), vertical jump (VJ), pro agility (PA), muscle soreness (MS), and Mental and Physical State and Trait Energy and Fatigue Scales (MPSTEFS)] were measured immediately after and at 48 and 96 hours post. Testing session 1 established baseline measurements with no supplementation. In testing sessions 2 and 3, subjects received 2 cups of either CHOCM or CWPM post-exercise. Treatment beverages were isocaloric and given in a randomly counterbalanced double-blind protocol.

**RESULTS:** One-way ANOVA with repeated measures revealed no significant differences in sprint performances across tests, indicating no training effect over time (p>0.05). Individual univariate ANOVAs were used to analyze all other dependent variables. CK levels were clinically elevated (mean=517.13 U/L) above normal range (44-196 U/L) immediately following all sprint protocols indicating exercise-induced muscle damage. CK levels were 48 hours post (mean=603.92 U/L) and lowest 96 hours post (mean=444.61 U/L) exercise. When CK levels at 48 and 96 hours were compared, CHOCM (mean=400.94 U/L) levels were significantly lower (p<0.05) than CWPM (mean=448.93 U/L). There were no differences between CHOCM and CWPM for MVC, VJ, PA, MS, or MPSTEFS assessments (p>0.05).

**CONCLUSION:** These findings indicate that CHOCM attenuates elevated CK following exercise-induced muscle damage faster at 48 and 96 hours than CWPM. Although there were no significant differences found for performance variables, cellular level muscle recovery was enhanced. CHOCM may therefore lessen exercise-induced muscle damage if used chronically as a post-exercise drink.

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**1855**

**Board #263**

**MAY 30**

**3:30 PM - 5:00 PM**

**Whey Protein Supplementation Exhibits Limited Additional Benefit in Older Men Undergoing Resistance Training**

Alan Hayes, Graeme J. Smith. *Victoria University, Melbourne, Australia.*

(No relationships reported)

The loss of muscle mass that occurs with age can be at least partially reversed by resistance training (RT). While whey protein isolate (WPI) supplementation has proven effective in augmenting the effects of RT in younger individuals, few benefits in older individuals is less established, as is any effect of WPI on the redox status of the cell in older individuals.

**PURPOSE:** To assess the effect of WPI supplementation in addition to 12 weeks RT on body composition, strength, and cellular redox status in older males.

**METHODS:** Male participants (aged >55 years, n=16) gave written, informed consent to be randomized, double-blind, to undertake progressive overload RT (3 days/week for 12 weeks) either with (1.5 g/kg/day) or without WPI supplementation. Body composition, muscle strength and protein content, and redox status were measured before and after training. All procedures were approved by the Victoria University Human Research Ethics Committee.

**RESULTS:** No differences existed between the groups at baseline, with the exception that the group to be supplemented had a higher energy intake (2132 ± 239 vs 1728 ± 333 kcal/day, p<0.05) due to higher carbohydrate intake. As expected, 12 weeks RT significantly improved 1-repetition maximum muscle strength (129 ± 27 vs 186 ± 43 kg and 61 ± 25 vs 76 ± 22 kg in the leg press and bench press, respectively, p<0.001). Isometric and isokinetic knee extension and isokinetic knee flexion strength was similarly increased. In addition, highly significant (p<0.001) improvements in body composition (increased lean mass, decreased fat mass) were also observed. However, WPI supplementation demonstrated no incremental benefit in the above measures compared to RT alone. Total muscle protein content was not altered by RT, although there was a significant difference (p<0.05) in the change in the WPI group (+13.4 mg/g) compared to the non-supplemented group (-10.9 mg/g). Plasma and tissue thiols and disulfides were unaffected by RT, nor were they changed by WPI supplementation.

**CONCLUSION:** WPI supplementation offered no incremental benefit over RT in novice older male participants in terms of body composition or muscle strength. Neither a 12-week RT program on its own, nor in combination with WPI dietary supplementation, altered the plasma or tissue redox states.

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**1856**

**Board #264**

**MAY 30**

**3:30 PM - 5:00 PM**

**The Influence of Bovine Colostrum Combined with a Recovery Beverage During an 8-Week Resistance Training Program**

Fabrizio Gargiulo, Justin D. Roberts, Lindsy S. Kass, Michael G. Roberts. *University of Hertfordshire, Hatfield, United Kingdom.*

(No relationships reported)

Current research interest exists concerning the use of bovine colostrum (BC) supplementation to enhance strength and performance gains during high intensity training programmes. Furthermore, there is minimal information regarding the use of BC in combination with additional recovery formulas to enhance ergogenic benefits.

**PURPOSE:** To determine if combined supplementation of BC and a carbohydrate-protein recovery beverage (REC) enhances maximal strength performance and recovery during an 8-week resistance training programme.

**METHODS:** In a randomised, double blind, placebo controlled, repeated measures design, 24 healthy males volunteered for participation (Age: 26.8±7.4 years; Weight: 84.8±10.8 kg; Height: 179.9±4.8cm). Subjects were administered daily either 20g BC or a calorie matched placebo in the morning; additionally subjects consumed either a REC beverage or calorie matched placebo or soy isolate. All subjects participated in a supervised, whole-body non-linear periodized resistance training program for 9 months (3x/wk). Body composition was assessed every 3 months via dual x-ray energy absorptiometry (DXA).

**RESULTS:** Average daily protein intake, including the supplement, was 1.4 g/kg body weight. Despite consuming similar calories and protein during the intervention, gains in lean body mass were significantly greater in the WP (3.3 ± 1.5 kg) than the SP (1.8 ± 1.6 kg) group. There were no significant differences in body mass and fat mass responses between groups.

**CONCLUSION:** Whey protein supplementation was more effective than soy protein in promoting gains in lean body mass in response to chronic resistance training.

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**451**

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PURPOSE: Neurormuscular activation of the gluteal muscle group while executing the single-leg squat has been well studied. The electrical activity of other major muscle groups of the lower leg during single-leg squats is not as well known. The purpose of this study was to examine the electrical activity of the quadriceps, hamstrings, adductors, gastrocnemius, and tibialis anterior during a single-leg and double-leg squat.

METHODS: Eleven male intercollegiate athletes participated in the study. Electromyography (EMG) of the quadriceps, hamstrings, adductors, gastrocnemius, and tibialis anterior were recorded during 5 repetitions of dual-leg squats and single-leg squats. Participants performed the squat in time with a metronome such that each complete squat occurred in 2 seconds resulting in total of 10 seconds of activity for each trial. For the dual-leg movement, participants were instructed to squat until the thigh was parallel to the ground and then return to a standing position. Subjects then recovered for 3-5 minutes and performed five single-legged squats. These squats were completed while standing on a 17 inch high bench with the dominant leg only. Participants were instructed to lower themselves until their non-dominant leg touched the floor, then return to a standing position using only the dominant leg. This movement was repeated 5 times at a cadence of 2 seconds per single-leg squat. All EMG activity was recorded, transformed, and reported as root mean square (RMS) activity.

RESULTS: Mean RMS EMG activity for the hamstrings (.024 mV, 121% increase, p<0.01) and gastrocnemius (.022 mV, 108% increase, p<0.01) was significantly higher during the single leg squat compared to the dual-leg squat. There was also a trend for greater quadriceps activation (.013 mV, 29%, p=0.07) with the single-leg movement. No differences were detected in adductor activity (.009 mV, 25%, p=0.02) or tibialis anterior activity (.008 mV, 6%, p=0.04).

CONCLUSION: These results suggest that single-leg squats result in greater lower limb activation for the same number of repetitions. These findings may be useful for developing rehabilitation or training techniques that focus on lower limb activation.

PURPOSE: The purpose of this study was to determine whether a bilateral versus unilateral strength training program improved absolute and relative 1RM bilateral and unilateral squat performances in young adult males and females.

METHODS: Subjects were young adults ranging in age from 18-26. Subjects’ 1RM bilateral and unilateral (each leg) squat were measured both prior to and following an 8 week resistance training program. Subjects were randomly assigned to either a bilateral or unilateral, lower-body training program utilizing the back and front squat and Romanian deadlift. The resistance training consisted of a linear periodization program with intensity increasing weekly from 60-95% while decreasing the volume.

RESULTS: A trial-by-gender interaction was also observed for both left- and right-leg squat, both absolute and relative to lean body mass. For left-leg squat (p=0.002), males improved from 174.7 to 220.3 lbs, while females only improved from 95.8 to 113.3 lbs. For left-leg squat strength/lbm (p=0.01), males improved from 2.55 to 3.43 lbs/lbm, while females only improved from 2.02 to 2.35 lbs/lbm. For right-leg squat (p=0.002), males improved from 174.6 to 220.4 lbs, while females only improved from 95.0 to 113.7 lbs. For right-leg squat/lbm (p=0.01), males improved from 2.55 to 3.34 lbs/lbm, while females only improved from 2.00 to 2.30 lbs/lbm. For bilateral squat, no gender difference in improvement was observed (p=0.89). Males improved from 296.8 to 331.8 lbs, while females demonstrated similar improvement, from 142.3 to 175.8 lbs. For bilateral squat/lbm, a trial-by-group interaction was observed (p=0.04). The bilateral-training group improved from 3.81 to 4.76 lbs/lbm, while the unilateral-training group only improved from 3.82 to 4.23 lbs/lbm.

CONCLUSIONS: These data suggest that bilateral resistance training is more effective for improving bilateral 1RM squat relative to lean body mass than unilateral resistance training; however, for unilateral 1RM squat performances, males show greater improvement than females, and bilateral training is equally effective compared to unilateral training.
RESULTS:

Table1. Average muscular activation comparisons between conditions (n=18).

<table>
<thead>
<tr>
<th>Device/conditions</th>
<th>Mean</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable/bipodal</td>
<td>12.48</td>
<td>0.79</td>
</tr>
<tr>
<td>Soft Stability/bipodal</td>
<td>13.08</td>
<td>0.76</td>
</tr>
<tr>
<td>Racker Board/bipodal</td>
<td>14.02</td>
<td>0.87</td>
</tr>
<tr>
<td>Stable/unipodal</td>
<td>14.28</td>
<td>0.95</td>
</tr>
<tr>
<td>Soft Stability/unipodal</td>
<td>15.08</td>
<td>0.89</td>
</tr>
<tr>
<td>Racker Board/unipodal</td>
<td>15.15</td>
<td>0.93</td>
</tr>
<tr>
<td>Soft Stability/unipodal with elastic tubing</td>
<td>21.82*</td>
<td>1.30</td>
</tr>
<tr>
<td>Soft Stability/unipodal with elastic tubing</td>
<td>22.75*</td>
<td>1.40</td>
</tr>
<tr>
<td>Racker Board/unipodal with elastic tubing</td>
<td>23.38*</td>
<td>1.43</td>
</tr>
</tbody>
</table>

Data is expressed as a mean (SEM) in percentage of the MIVC. * indicates significant differences (p<0.05) related to unipodal and bipodal conditions without elastic tubings. † indicates significant differences (p<0.05) related to stable condition. †† indicates significant differences (p<0.05) related to bipodal condition.

CONCLUSION: In the evaluated exercises, the use of elastic tubings always provokes in a statistically significant way a higher level of muscular activation in the CORE independently of the unstable device used and/or of the modification of the support.

1860 Board #268 MAY 30 2:00 PM - 3:30 PM
Electromyographic Activation Of 3 Back Muscles During Pronated, Supinated, And Behind The Neck Pull-ups
Vincent C. Marsh, Kelly Kirby, Cameron Almandinger, Anthony Caterisano, FACSM, Furman University, Greenville, SC.

Hand placement during upper back exercises is often varied to target or enhance recruitment of specific muscles and or muscle groups. However, little research has been published regarding the validity of these practices and claims.

PURPOSE: To analyze and compare the activation of three back muscles while performing three sets of pull-ups in different variations.

METHODS: Eleven resistance-trained, college males performed randomized trials of three different varieties of pull-ups for five repetitions each: supinated (SP), pronated (PP), and behind the neck pull-ups (BNP). Electromyography (EMG) was used through the use of silver silver chloride surface electrodes positioned on the upper trapezius (TR), upper latissimus dorsi (UL), and lower latissimus dorsi (LL). EMG data were filtered, then quantified by integration, and expressed as a percentage of the total electrical activity of the three muscles.

RESULTS: A mixed design analysis of variance (ANOVA) and Tukey post hoc tests indicated no significant difference between total muscle activation and pull-up orientation (p = 0.992), the muscle activation consistently remained LL (45% MVC), UL (39%), and TR (16%MVC) throughout the trials.

CONCLUSION: While the results suggested that the latissimus dorsi provided a greater relative contribution than the trapezius throughout the three variations of pull-ups (p<0.05), there were no significant changes to that ratio when hand placement was altered (p=.396).

1861 Board #269 MAY 30 2:00 PM - 3:30 PM
Lumbopelvic Muscular Activation During Push-ups Performed Under Different Unstable Surfaces
Martin Fernando, Sebastien Borreani, Joao Alves, Juan Carlos Colado, David Gramage, Julio Martin. University of Valencia, Valencia, Spain.

Suspension devices for physical conditioning have increased the work possibilities of the professionals that use devices that generate instability. Suspension training devices seem to have the same possibilities as the rest of the unstable devices during the performance of global exercises, as for example the push-ups. However, there is no agreement in the current studies.

PURPOSE: To compare lumbopelvic muscular activation during push-ups performed in different unstable conditions.

METHODS: 30 physically fit and healthy subjects took part in a counterbalanced, within-subject design assessment. Muscular activation was evaluated in muscles Multifidus Lumbar (MFL), Erector Espinae Thoracic (EED), External Oblicue (OE), and Rectus Femoris (RF), during execution of 5 push-ups in different stability conditions: TRX Suspension Training (TRX), Fitness Dome (FD), Thera-Band® Stability Disc (SD), Thera-Band® Wobble board (WBR) and floor (CE). Surface electromyography was recorded and then the peak root mean square values were calculated for each condition and execution. The maximum isometric voluntary contraction (MVIC) was evaluated for the purpose of normalization. All values, expressed as the %MVIC, were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at p<0.05.

RESULTS: Table 1. Peak muscular activation between conditions (n=30).

<table>
<thead>
<tr>
<th>Device/conditions</th>
<th>OE</th>
<th>MFL</th>
<th>EED</th>
<th>RF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRX= TRX Suspension Training; FD= Fitness Dome; SD= Stability Disc; WBR= Wobble board; CE= floor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRX</td>
<td>151.56(26.59)</td>
<td>8.01(1.64)</td>
<td>79.11(26.61)</td>
<td>22.37(2.36)</td>
</tr>
<tr>
<td>FD</td>
<td>140.24(20.90)</td>
<td>8.78(2.73)</td>
<td>80.86(28.94)</td>
<td>21.49(1.89)</td>
</tr>
<tr>
<td>SD</td>
<td>212.19(56.98)</td>
<td>8.29(1.88)</td>
<td>64.99(20.86)</td>
<td>27.96(3.56)</td>
</tr>
<tr>
<td>CE</td>
<td>152.69(40.78)</td>
<td>8.64(2.28)</td>
<td>55.71(22.81)</td>
<td>25.75(3.16)</td>
</tr>
<tr>
<td>TRX with elastic tubing</td>
<td>131.56(40.10)</td>
<td>6.27(1.72)</td>
<td>85.91(11.64)</td>
<td>22.38(1.41)</td>
</tr>
</tbody>
</table>

* indicates significant differences (p<0.05) related to WBR. † indicates significant differences (p<0.05) related to CE, SD, FD.

CONCLUSION: Push-ups performed with TRX provoke more lumbopelvic muscular activation than employing other unstable devices and/or stable condition. There were no differences between the other conditions (unstable and stable) except in the OE and RF where the muscular activation was higher with the SD versus the WBR.
**Board #270**  MAY 30  2:00 PM - 3:30 PM  
**Effects of Stance Width on Hip Displacement during Parallel Squat in Women**  
Leacenna Woodworth, Kryu Marshall, George J. Davies, Bryan L. Riemann. Armstrong Atlantic State University, Savannah, GA. (Sponsor: T. Jeff Chandler, FACSM)  

While sagittal plane kinematics and kinetics have been compared between squats of varying stance widths, limited research has considered the frontal and transverse planes.

**PURPOSE:** To examine effects of stance width on frontal and transverse plane hip kinematics, total body center of mass (COM) vertical displacement and to examine the relationships between hip kinematics and hip abductor (AB)/external rotator (ER) isometric muscle strength (ISoM).

**METHODS:** 18 healthy, physically active young women (21.6±2.6 yrs) performed 8 repetitions of squats using both neutral stance (NS) and wide stance (WS) using a load equal to each subject’s 8 repetition maximum. Neutral stance was 1.5x anterior superior iliac spine (ASIS) distance and wide stance was 2.5x ASIS distance. Dominant limb frontal and transverse plane hip kinematic data was collected using an extended range electromagnetic motion analysis system (Motion Monitor, IST, Inc). Starting, peak and start to peak displacement abduction/adduction and internal/external rotation angles were computed. Dependent t-tests (α=0.05) were used to compare dependent variables between NS and WS. Hip AB and ER ISoM strength was evaluated using handheld dynamometry. Pearson correlation analyses were conducted between peak/displacement angles and AB/ER ISoM strength.

**RESULTS:** COM vertical displacement was significantly (P<0.01) greater for NS. During WS, both starting (P<0.01) and peak (P<0.01) AB angles were significantly greater, however, no difference for angular displacement (P=0.322). Additionally, during WS, the hip started with significantly greater ER (P=0.047). The peak internal rotation angle (P<0.01) and displacement (P<0.01) were also significantly greater for WS. No significant correlations (r=0.016 to 0.183) were noted between peak and displacement angles and ISoM strength.

**CONCLUSION:** Despite greater squat depth based on the COM displacement for NS, the hip joint experienced increased abduction/internal rotation during WS squats. Thus, NS squats should be considered when less abduction and internal rotation is warranted. As evidenced by no significant relationships, ISoM strength of hip AB and ER do not appear to be a contributing factor to frontal and transverse plane hip movement during squats.

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**Board #271**  MAY 30  2:00 PM - 3:30 PM  
**Isometric Rapid Torque Characteristics As Predictors Of Playing Status In Division I Collegiate Football Players**  
Brennan J. Thompson,1 Eric D. Ryan,2 Eric J. Sobolewski,2 Doug B. Smith,1 Eric C. Conchola,1 Kaz Akehi1, Tyler Buckminster1, Joel T. Cramer, FACSM.1  
1Oklahoma State University, Stillwater, OK. 2University of North Carolina - Chapel Hill, Chapel Hill, NC.  

**INTRODUCTION:** Rapid torque characteristics are an important measure of muscle performance and may provide a sensitive measure for talent identification in collegiate football players.

**PURPOSE:** To examine the effectiveness of maximal isometric torque and rapid torque characteristics to discriminate among football playing ability in elite Division I collegiate football players.

**METHODS:** Sixteen starters (age=20.81±1.28 yr) and 15 non-starters (20.40±1.68) volunteered to participate in the study. Participants performed two isometric maximal voluntary contractions (MVCs) with the leg flexor and extensor muscle groups with one minute of recovery between each contraction and three minutes of recovery between muscle groups. Peak torque (PT; Nm) was calculated as the highest 0.5 s epoch of the torque - time curve. Rate of torque development (RTD; N·s⁻¹) and contractile impulse (MI; N·m·s⁻¹) were determined from the time intervals of 0-30, 0-50, 0-100, and 100-200ms of the torque - time curve. Peak rate of torque development (PRTD), time to PRTD (TTPRSD) and absolute torque (TORQUE) at 30,50,100 and 200ms were also calculated. 2-way mixed factorial ANOVAs were used to analyze all torque - time variables. Follow up analyses included independent samples t-tests and paired samples t-tests with Bonferroni corrected post-hoc comparisons.

**RESULTS:** For the leg flexors, RTD30, IM30, IM50 and TORQUE30 were greater (P<0.02-0.03) and TTPRSD was shorter (P<0.02) for the starters when compared to the non-starters. There were no significant differences between starters and non-starters for maximal isometric PT, RTDpeak, and later rapid torque characteristics (>100 ms from onset of contraction) of the leg flexors and all isometric torque and torque - time variables for the leg extensors (P>0.06-0.33). In addition, the leg extensors were greater (P<0.001) for all torque and rapid torque variables and less for TTPRSD when compared to the leg flexors for all players.

**CONCLUSIONS:** These findings showed that early rapid torque - time variables of the leg flexor muscle group may effectively discriminate among playing ability in Division I collegiate football players. Strength coaches may consider designing strength programs aimed at maximizing early rapid muscle contraction characteristics, specifically for the leg flexors.

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**Board #272**  MAY 30  2:00 PM - 3:30 PM  
**Neuromuscular and Metabolic Responses to Power Training: Effects of Different Rest Intervals**  
Saulo Martorelli1, Andre Martorelli1, Rafael Cunha1, Maria Cladia Pereira1, Diego Jesus1, Valdirn Rocha Júniour2, Lee E. Brown, FACSM1, Martim Bottaro1.  
1University of Brasilia, Brasilia, Brazil. 2National Academy of Police (Federal Police), Brasilia, Brazil. 3California State University, Fullerton, Fullerton, CA.  

The between-set rest interval (RI) is an important factor in the resistance training prescription. The American College of Sports Medicine (ACSM) recommends at least 2-3 min of RI for individuals who perform power training for core exercises. However, according to the ACSM (2009) this recommendation is based on poor scientific evidence (evidence category D).

**PURPOSE:** To compare the effects of three different RI on mean power output (PW), blood lactate concentration (BLA), and electromyography (EMG) in trained men.

**METHODS:** Fourteen healthy men (22.43 ± 3.01 years) performed 6 sets of 6 repetitions of squat exercise at 60% of 1RM on a Smith machine. Each volunteer performed three different RI protocols (1, 2 and 3 min) on three different days in counterbalanced order, separated by at least 72 h. PW was measured every set using a velocity transducer. BLA concentration and vastus medialis (VM) EMG (maximum isometric voluntary contractions) were measured before and after the 6 sets of each RI.

**RESULTS:** No significant differences were observed between RI protocols on PW. However, the 1min RI protocol showed a significant (p ≤ 0.05) reduction (9.90%; 488.05 ± 112.48 to 439.75 ± 91.60 W) in PW from 1st to 6th set. In contrast, no significant reduction was observed between the 1st and 6th sets for 2 min (0.04%; 477.83 ± 123.44 to 477.62 ± 97.60 W) or 3 min (4.32%; 488.89 ± 118.67 to 467.59 ± 98.32 W) RI protocols. BLA was significant greater (p < 0.05) after 1 min (5.67 ± 1.71 mmol/L) when compared to 2 min (4.59 ± 1.51 mmol/L) and 3 min (4.00 ± 2.47 mmol/L). Only the 3 min RI presented a significant reduction in root mean square (RMS) values of the VM EMG (27.10 ± 4.06 to 21.64 ± 3.31).

**CONCLUSION:** Our data suggest that 1 min RI showed greater decline in muscular performance and greater levels of fatigue metabolic by products. Also, after 3 min, muscle activation was less at the end of the training session. In summary, if an individual wants to maintain power output with less fatigue and greater muscle activation during power training, 2 min RI should be used. These results concur with ACSM (2009) recommendations that a RI of at least 2 min should be used when young individuals are training muscle power using multi-joint exercise.

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**Board #273**  MAY 30  2:00 PM - 3:30 PM  
**The Effect of Remote Voluntary Muscle Contractions on Strength and Power Performance**  
Daniel Haughney, Nabil Boutagy, Robert M. Otto, FACSM, John W. Wygand. Adelphi University, Garden City, NY.  

In an effort to maximize muscular performance from a specific muscle group, the simultaneous recruitment of ancillary muscle groups has been proposed. This theory of remote voluntary contractions (RVC) suggests that concurrent activation of remote muscle groups, in addition to the prime movers, may stimulate enhanced sympathetic drive in proximity to the control center of the brain and potentially improve performance. Several studies (Hiroshi, et al., Ebben et al. and Ebben) have demonstrated improvements in time to peak force and rate of force development when using jaw clenching to activate RVC.

**PURPOSE:** This study was designed to examine the effects of RVC by jaw clenching with a mouthpiece (MP) and with the jaw in a relaxed state without a mouthpiece (R-noMP) on acute muscular performance.
METHODS: Thirteen subjects (10 males and 3 females, age 22.9 ± 1.9 yrs, ht 174.2 ± 9.1 cm, body mass 77.3 ± 14.6 kg) volunteered to perform a grip dynamometer test with a Jamar Grip Dynamometer (Gr), a Vertical Jump Test (VJ), a 6 repetition maximum (RM) chest press (CP) and a 6 RM leg extension (LE) on Nautilus equipment. Subjects performed familiarization trials and the MP and R-noMP trials were conducted in a random design. A paired-samples t-test (p<.05) was applied to these data.

RESULTS: Statistical analysis revealed no significant difference between MP vs R-noMP for grip strength (35.6 vs 35.5 kg), vertical jump (40.6 vs 40.9 cm), 6 RM chest press (47.5 vs 47.4 kg) and 6RM leg extension (44.4 vs 44.1 kg), respectively.

CONCLUSION: The use of RVC by jaw clenching failed to amplify the outcome measures of four acute muscular strength and power measures. Therefore the use of RVC to enhance acute anaerobic performance is not supported.

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**1866 Board #274 MAY 30 2:00 PM - 3:30 PM**

Upper Extremity And Core Muscle Activation During An Aquatic Resistance Exercise Performed At Different Depths

Sebastien Borreani, Juan Carlos Colado, Josep Furio, Fernando Martin, Juan Benavent, Joaquin Madera. University of Valencia, Valencia, Spain. (No relationships reported)

It is positive to train the strength of the limb and core to improve the physical performance. The aquatic medium has been shown as an efficient tool, however nowadays there is a lack of knowledge about the influence of the level of immersion on muscle activation.

PURPOSE: To compare upper extremity and core muscle activation during a shoulder extension performed at maximal velocity at different depths (xiphoid vs clavicle).

METHODS: 24 physically fit and healthy subjects took part in a counterbalanced, within-subject design assessment. Maximum isometric voluntary contraction (MIVC) was evaluated for the normalization. Agonist: latissimus dorsi (LD); and core: rectus abdominis (RA) and lumbar erector spinae (LES) muscular activities were recorded, and then the peak root mean square values of all of them were calculated for each condition. Surface electromyography was isolated and the activity was analyzed during the shoulder extension of 3 repetitions performed with an aquatic device that increases drag force moved at maximal velocity. All values, expressed as the %MIVC, were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at p<0.05.

RESULTS:

| Table1. Peak muscular activation comparisons between conditions (n=24). |
|-----------------|-----------------|-----------------|
|                 | LD              | RA              | LES             |
| Xiphoid depth   | 73.0 (10.3)*    | 114.9 (30.3)*   | 60.0 (12.1)     |
| Clavicle depth  | 61.9 (9.9)*     | 92.8 (27.5)*    | 41.5 (11.6)     |

Data is expressed as a mean (SEM).

* indicates significant differences between conditions (p<0.05)

LD= Latissimus Dorsi, RA=Rectus abdominis, LES=Lumbar Erector Spinae

CONCLUSION: Xiphoid depth condition generates significantly a higher LD and RA activation than clavicle depth. This shows that a lower level of immersion provokes a higher muscular activation because the body stability is increased during the performance of the movement. However, this fact is not relevant for the LES due to the direction of the movement of the upper extremity. These results are similar to previous studies in dry land. Consequently, monitoring the level of immersion is very important during the aquatic resistance exercises.

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**1867 Board #275 MAY 30 2:00 PM - 3:30 PM**

Effects of Squat Flywheel Training on Strength, Muscle Structure and Performance.

Giuseppe Coratella1, Gianluca Giorgi2, Impellizzeri Franco2, Federico Schena1. 1University of Verona, Verona, Italy. 2Schultess Klinik, Zarigh, Switzerland. (No relationships reported)

PURPOSE: Inertial flywheel device (YoYo Technology) is well known to induce strength adaptations and increase muscle mass after short term training. (Norbrand 2011, Tesch 2004). Changes in muscle architectural parameters appropriate to improve peak torque has been described (Seynnes, 2007). However these adaptations were not directly related to specific performances like jump, velocity and change direction ability. Aim of the study is to evaluate quadriceps strength and architecture, lower limb fat free mass, and performance parameters after short term YoYo squat training.

METHODS: 31 healthy young males has been randomly assigned at training (TR) or control (CON) group. TR underwent 16 training sessions in 9 weeks each consisting in 60 maximal reps at YoYo squat. Maximal Voluntary Contraction (MVC), Fat Free Mass (FFM), Fascicle length and thickness, Squat Jump (SJ) and Countermovement Jump (CMJ) Height and time on 30m dash and 20m shuttle have been measured pre and post training. Analysis of covariate has been done after log transformation.

RESULTS: Compare to CON, TR showed higher MVC isometric (avg 25%, CI 95 13% to 38%), concentric (10%, 2% to 19%), eccentric (9%, 2% to 17%) extension (for each parameters, p<0.01). In TR, FFM (4%, 1% to 7%), fascicle length (8%, 1% to 16%), fascicle thickness (6%, 1% to 15%) increased compare to CON (p<0,01). SJ (9%, 2% to 16%), CMJ (8%, 1% to 14%), 20m shuttle (-4%, 7% to 1%) significantly improve (p<0.05) in TR compare to CON. 30m dash did not improve significantly compare to CON (-1%, -4% to 2%, p=0.445), indicating that 20m shuttle performance is specially due by an augmented control of decreasing and increasing speed.

CONCLUSION: Augmented strength and changed muscle structure are in agreement with previous study. Longer fascicle is correlated with higher velocity of sarcomere contraction (Blazevich 2006). Outcomes show positive transfers in sport performance tasks, like jumping or braking and change sprinting direction. Flywheel device can be successfully used to improve performance in sport in which jumping or speed are key factors.


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**1868 Board #276 MAY 30 2:00 PM - 3:30 PM**

Effect of Exercise with Blood Flow Restriction Depends on Total Work Regardless of Mechanical Intensity

Shingo Takada1, Koichi Okita, Masashi Omokawa2, Tadashi Suga2, Noriteru Morita1, Masahiro Horiiuchi1, Tomoyasu Kadoguchi1, Takashi Sato2, Masashige Takahashi2, Arata Fujushima1, Tsuneki Homma1, Yoshihiro Masaki2, Shintaro Kinugawa1, Hirokui Tsutsui1. 1Hokkaido University Graduate School of Medicine, Sapporo, Japan. 2Hokkaido University, Ebetsu, Japan. 3Hokkaido University of Education, Hamamatsuzawa, Japan. 4Northern Regions Lifelong Sports Research Center (SPOR), Ebetsu, Japan. (No relationships reported)

BACKGROUND: Resistance exercise with blood flow restriction (BFR) is a new training method providing significant training effects despite the use of low-intensity mechanical loads. We previously demonstrated that BFR remarkably enhances musculoskeletal metabolic stress in resistance exercise (J Appl Physiol 2009) and that the metabolic stress was effectively enhanced by increasing mechanical intensity but not BFR pressure (J Appl Physiol 2010). However, because of blocking the metabolic recovery by BFR, it is possible that even with low intensity, metabolic stress might gradually increase with respect to increased repetitions and reach sufficient level.

PURPOSE: Therefore, we compared musculoskeletal metabolic stress during multiple intensity resistance exercise with BFR adjusted by totally the same work volume (load × repetitions).

METHODS: Twenty-six young subjects (male/female, 13/13, 21±1 yrs, means±SE) were recruited and performed unilateral plantar-flexion at 30 repetitions/min in a whole body magnetic resonance system. The exercise protocols were as follows: (A) exercise with 10% of one repetition maximum (1-RM) for 6 min, (B) 15% 1-RM for 4 min, (C) 20% 1-RM for 3 min, (D) 30% 1-RM for 2 min.

CONCLUSION: The effect of BFR might be dependent on the total work regardless of the mechanical intensity.
1-RM for 2 min, and (E) 40% 1-RM for 1.5 min. All protocols were same in total work volume (load × repetitions=1800). Muscular metabolic stress in the calf muscle, defined as phosphocreatine depletion and intramuscular pH decrease were evaluated by 31P-magnetic resonance spectroscopy.

RESULTS: Phosphocreatine depletion (A: 15.6±0.7, B: 14.8±0.8, C: 15.2±0.6, D: 14.3±0.6, E: 10.9±0.5 mM, ns) and intramuscular pH decrease (A: 6.82±0.02, B: 6.84±0.01, C: 6.83±0.02, D: 6.83±0.02, E: 6.77±0.02, ns) at the end of each exercise protocol were statistically similar.

CONCLUSIONS: If the total exercise volume calculated as a product of mechanical load multiplied by repetitions were equal, metabolic stress in exercising muscle might achieve the similar level at the end of exercise with BFV and could provide similar training effects.

Supported by JSPS KAKENHI (23500784) and Hokkaido University Northern Regions Lifelong Sports Research Center (SPOR).

1869 Board #277 MAY 30 2:00 PM - 3:30 PM Optimizing Resistance During Multiple-set Weight Training to Increase Training Volume in Women
Young Sub Kwon1, Suzanne M. Schneider2, Washington University, Topeka, KS. 3University of New Mexico, Albuquerque, NM.

(No relationships reported)

We previously reported that a greater training volume is attained using descending resistance (DR) method than using a constant resistance (CR) method in men. 

PURPOSE: When a resistance-trained person performs multiple sets with short or incomplete rest periods between sets, the resistance must be reduced to maintain the same number of reps until fatigue or, the number of reps will be reduced if the same resistance is used. There is no benchmark method for optimizing resistance to maximize training volume in women when training with multiple sets with short rest periods. In this study we hypothesized that a greater training volume (sets × reps × resistance) would be produced using a training protocol where resistance is decreased with each training set (DR) based on the subject’s fatigue ratio (using an individualized regression equation) vs. during a training protocol where subjects use a constant resistance (CR), and the number of repetitions declines with each set in women.

METHODS: Ten female subjects (mean±SD, age = 26±6 yr, height = 164±7 cm, body mass = 59±7 kg, weight training experience = 6±2 yr) completed 4 sets of 65% 1RM leg press, 75% 1RM bench press and 85% 1RM seated row exercise to failure, with 30 second (for 65%), 90 second (for 75%) and 180 second (for 85%) rest intervals. Data were analyzed using paired sample t-tests.

RESULTS: There was a greater training volume (p < 0.01) when subjects exercised with decreased load sets compared to training with same load sets at all three exercises (table 1).

CONCLUSIONS: In women as previously shown in men, a greater training volume is also attained using this DR method based on subject’s fatigue ratio than when using a CR training method suggesting this may be a more effective training method.

Table 1. Training volumes (kg, sets × reps × resistance) completed during 4 set exercises.

<table>
<thead>
<tr>
<th>Training Method</th>
<th>65% Leg Press</th>
<th>75% Bench Press</th>
<th>85% Seated Row</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>11908 ± 1452</td>
<td>1330 ± 365</td>
<td>400 ± 79</td>
<td></td>
</tr>
<tr>
<td>DR</td>
<td>13754 ± 1403</td>
<td>1621 ± 376</td>
<td>472 ± 50</td>
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</tr>
</tbody>
</table>

1870 Board #278 MAY 30 2:00 PM - 3:30 PM The Influence of Body Weight and Strength Fitness Status on Markers of Cardiometabolic Health
Mary M. Lee, Christopher S. Oh, Michael Kiatirae, Christian K. Roberts, FACSM, UCLA, Los Angeles, CA.

(No relationships reported)

PURPOSE: We have previously demonstrated that overweight untrained (OU), overweight trained (OT) and lean trained (LT) young men with differing muscle strength levels exhibit differences in body composition and indices of vascular health, independent of body weight. We examined the influence of body weight vs. training status on blood markers of cardiometabolic health including blood lipids, steroid hormones, inflammation and adipokines in this cohort.

METHODS: 90 young adult males were categorized into 3 groups: OU (n=30, BMI 30±8.2 kg/m^2), OT (n=30, BMI 29.2±2.2, ≥4 d/wk resistance training (RT)) and LT (n=30, BMI 23.7±1.4, ≥4 d/wk RT). Subjects were assessed for serum glucose, lipids (including total-cholesterol, LDL, HDL, TG, oxLDL), hormones (testosterone, SHBG, free androgen index (FAI), cortisol), inflammation (CRP, TNF-α, IL-8, MCP-1), and adipokines (amylin, leptin, adiponectin).

RESULTS: BMI and body weight were similar in OT and OU and both higher than LT (all P≤0.001). Fasting glucose was lowest in LT and significantly different from OU and OT (all P≤0.007). LT and OT exhibited higher HDL, lower TG, and lower oxLDL than OU (all P≤0.001). LDL was significantly lower in LT vs. OU and OT showed a trend of lower LDL (P=0.08) vs. OU. Similarly, both trained groups had elevated SHBG (OT: 30.1±13.5, LT: 35.0±10.8 nmol/L and lower FAI (OT: 71.2±29.0, LT: 64.2±20.0) compared to OU (15.6±5.6 nmol/L; 116.0±45.6) (all P<0.001). Testosterone was highest in LT (622.8±194.9 ng/dL) and significantly different from OU (576.6±112.6, P<0.002) while values for OT (544.1±160.6) were nominally higher than OU (P=0.09). CRP (OT: 1.3±2.8, LT: 1.3±3.7 mg/L) was lower in the trained groups compared to OU (2.5±3.5, all P<0.02), while IL-8 was lower in LT (6.5±82.4 pg/mL) but not OT (49.5±46.3) compared to OU (67.7±173.7, P=0.02). Additionally, amylin (23.3±13.4 pM) and leptin (766.5±731.9 pM) were significantly higher in OU compared to OT (13.4±8.6; 311.0±406.1) and LT (9.7±3.4; 90.3±9.0, all P<0.004), while adiponectin was significantly lower in OU (3.2±1.4 ng/mL) compared to OT (5.7±3.4) and LT (6.0±3.3, all P<0.003).

CONCLUSION: These results provide further evidence that, in this study as assessed by muscular strength, is a better predictor of metabolic health compared with body weight per se in young men.

1871 Board #279 MAY 30 2:00 PM - 3:30 PM Acute Effects Of Lower Body Aerobic Exercise On Lower And Upper Body Resistance Exercise Workouts

(No relationships reported)

PURPOSE: It’s been suggested that performance of an acute lower body aerobic exercise bout negatively affects a subsequent lower body resistance exercise workout. The effects of lower body aerobic activity on an upper body resistance exercise workouts is unknown. Therefore, the purpose of this study was to compare lower and upper body resistance exercise workout responses following acute bouts of lower body aerobic exercise on an elliptical machine.

METHODS: Twelve men (mean ± SD age = 24.1±2.3 y, height = 180.8±6.9 cm, body mass = 91.9±16.4 kg) volunteered for this study and completed four trials in random order. Two trials consisted of thirty minutes on the elliptical machine at 70% of age-predicted maximum heart rate prior to either a back squat (BS) or bench press (BP) workout, consisting of three sets to failure performed at 75% 1RM. The other two trials consisted of only the back squat (SO) or bench press (BO) resistance workouts.

RESULTS: The results indicated that an acute bout of aerobic exercise on an elliptical machine significantly reduced the number of repetitions completed for the back squat (BS = 24.8±5.0 repetitions, but not bench press (BP = 25.6±5.2 repetitions, BO = 26.0±6.3 repetitions) exercise.

CONCLUSIONS: The performance of an acute bout of lower body aerobic exercise reduces the number of repetitions completed during a subsequent lower body, but not upper body, resistance training workout. These results suggest that in order to optimize the quality of a resistance training workout, the workout should not be preceded by an aerobic exercise bout using the same muscle groups.
Previous researchers have investigated the loads that maximize power output of the system (POmax) during jump squats (JS). However, it is unclear how different loads affect the power output at the lower-body joints (POJ) during JS.

**Purposes:**

The purpose of this study was to investigate the effects of different loads on POmax and lower-body POJ during JS.

**Methods:**

Sixteen healthy young men (mean age 24 ± 2 years) performed JS under seven different loading conditions: 0, 12, 27, 42, 56, 71, and 85% of body weight. JS were performed on two force platforms synchronized with a 3D motion analysis system, both sampling at 200 Hz. Instantaneous POmax was calculated as the product of the vertical component of the ground reaction force and the vertical velocity of the bar during its ascent. Instantaneous POJ was calculated as the product of the joint moment and joint angular velocity during bar ascent for the hip, knee, and ankle joints in the sagittal plane. Both POmax and POJ were averaged during bar ascent to provide average power output. The data were analyzed using a one-way ANOVA with repeated measures.

**Results:**

POmax was maximized at 0% MDS (p < 0.001) with polynomial contrasts showing a significant linear trend (p < 0.001) caused by POmax decreasing as the load increased. Similar findings were found for the knee and ankle joint POJ with POJ being maximized at 0% MDS (p < 0.001) and decreasing with increasing load producing a significant linear trend (p < 0.001). POJ at the hip was maximized at 42% MDS (p = 0.016), producing a significant quadratic trend (p = 0.030).

**Conclusions:**

POmax during JS reflects the POJ at both the knee and ankle joints, being maximized with loads equivalent to 0% MDS and decreasing with increasing load. However, POJ at the hip does not correspond to POmax during loaded JS. Practitioners may need to vary the loads used during phases of resistance training that focus on power output to ensure that POJ is maximized at the lower-body joints.
the maximum voluntary isometric contraction MVC (MVIC). The data normality was tested through the Shapiro-Wilk test. The normalized mean values of EMG, during the each exercise, were compared between muscles on each exercise and between exercises, using Anova for repeated measures. The significance level was set at p<0.05.

**RESULTS:** EMG activity was very similar among the 3 bar exercises. For those exercises, AD(33-36% MVC), SA(36-39% MVC) and RA(35-42% MVC) muscles registered significant less activation than the other muscles. Most requested muscles were IF(51-53% MVC) and PD(49-51% MVC). For the cable exercise, PC(47% MVC) and PD(49% MVC) were the muscles that registered less activation. The most requested muscles were IF(60% MVC) and TB(63% MVC). When comparing muscles between bar and cable exercises, AD(33-36% vs 57% MVC), PE(43-47% vs 52% MVC), SA(36-39% vs 57% MVC), RA(35-42% vs 53% MVC), QT(45-47% vs 57% MVC), IF(51-53% vs 60% MVC), TB(46-47% vs 63% MVC) and LD(44-46% vs 55% MVC) muscles registered significant superior activation in the cable exercise. For PD(46-47% vs 47% MVC) and PD(49-51% vs 49% MVC) muscles, there were no significant differences.

**CONCLUSION:** Pullover with cable stimulates higher muscle activation, compared to other types of pullover, for 60% MVC of 1RM.

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**TABLE 1**

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Peak Power (W)</th>
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</thead>
<tbody>
<tr>
<td>Power Clean</td>
<td>1814</td>
</tr>
<tr>
<td>Hang Clean</td>
<td>1766</td>
</tr>
<tr>
<td>Clean Pull</td>
<td>1831</td>
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<tr>
<td>Hang Clean Pull</td>
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**RESULTS:**

Repeated high-intensity contractions produce significant myofiber damage leading to a period of decreased force production, soreness, and edema. However, the repeated bout effect (RBE) indicates that if the same exercise is repeated within six months, the magnitude of muscle damage is attenuated compared to that ensuing the initial exercise bout. Myofiber damage has been previously considered a key stimulus for muscle hypertrophy. However, it has been recently shown that muscle growth may manifest independent of myofiber damage. Thus, invoking the RBE may be advantageous to minimize undue fatigue during muscle hypertrophy training. However, it remains undetermined if varying muscle-specific exercise selection between consecutive training bouts diminishes the RBE.

**PURPOSE:** To determine if muscle-specific exercise variation between consecutive training sessions alters the magnitude of the RBE.

**METHODS:** Twenty healthy, untrained males (ages=21 ± 2 yrs) were assigned to one of two groups: 1) two sessions of dumbbell incline curls (DIC, n=10) or 2) one session of dumbbell incline curls and one session of dumbbell preacher curls (DPC/DBC, n=10). The two training sessions for each group were separated by seven days. Both groups performed 5 sets of 6 repetitions of each exercise at ~50% of maximal isometric elbow flexor strength in both training sessions. Muscle damage indices, which included range of motion (ROM), muscle soreness, maximal voluntary isometric contraction (MVIC), and serum creatine kinase (CK) and lactate dehydrogenase (LDH), were measured at pre, and immediate post (IP), 24, 48, 72, and 96 hours after each training session.

**RESULTS:** Following the first session, ROM decreased and muscle soreness increased significantly up to 72 hours, while MVIC significantly declined by 15% IP. Serum CK was significantly elevated by 28% 48 hours post while LDH increased IP. There were no significant differences in these responses between groups. After the second session, both groups demonstrated similar damage responses (RBE) with MVIC declining only 7.5% IP.

**CONCLUSION:** Variation of muscle-specific exercise between consecutive training sessions does not alter the magnitude of the RBE. Further research is necessary to determine chronic adaptations to training implemented varying or repeated exercise selection.

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**RESULTS:**

It has been well established that in-season training is crucial for the maintenance of power and strength throughout a college football season. Strength and conditioning coaches typically prescribe variations of Olympic weightlifting exercises, such as the clean complex, to develop and maintain power. However, due to the physical toll of collisions in practice and games, the selection of in-season resistance training exercises that maintain explosiveness while minimizing additional orthopedic stress can be very challenging.

**PURPOSE:** To determine differences in power output of the clean complex.

**METHODS:** A total of 8 NCAA Division I collegiate football players were recruited for this study. A Tendo Weightlifting Analyzer unit was used to measure the average power generated during the power clean (PC), hang clean (HC), clean pull (CP) and hang clean pull (HCP) exercises. Load assignments for all varieties of the clean complex were based on each participant’s 1-repetition maximum (1RM) PC. After completing a 5-minute dynamic warm-up, participants performed a warm-up set at 50% of 1RM on the PC. The barbell was then loaded to 75% of 1RM, and the Tendo unit was attached to the barbell, and the PC was performed for 3 repetitions with the average power in watts (W) for each repetition recorded for data analysis. After a 3-minute rest period, the above procedure was performed for the HC, CP, and HCP. For the CP and HCP, 3 repetitions at 85% of 1RM were performed to adjust for the lack of the catch phase.

**RESULTS:** Repeated measures ANOVA indicated no significant difference in power output between PC, CP and HPC (1814, 1766, 1831, 1831 W, respectively; F = .042, p = .753).

**CONCLUSIONS:** No one exercise of the clean complex variations resulted in significantly greater power output. As such, exercises that produce less orthopedic stress on wrists, elbows, and shoulders such as the CP or HCP, may be beneficial to an athlete during in-season workouts.
Post-activation potentiation (PAP) is a phenomenon in which contractile performance improves following a conditioning stimulus. Maximal voluntary contractions (MVC) can be used as a conditioning stimulus to elicit PAP, which may increase speed of contraction. This phenomenon may result in increased power performance.

**PURPOSE:** To examine the effect of a maximal effort isometric deadlift exercise on vertical jump and 40 yard dash performance.

**METHODS:** Ten male collegiate varsity track athletes participated as subjects. A randomized crossover design was used where each subject served as his own control. The treatment consisted of a standardized warm-up followed by three, 3 second MVC of static deadlifts separated by one minute of rest. The control condition performed the warm-up but not the MVC’s. The dependent measures were two vertical jump height trials separated by 30 seconds and two 40 yard dash times separated by 1 minute.

**RESULTS:** The control group 40 yard dash time decreased 4.1% from attempt 1 to attempt 2 (5.152 ±0.197 to 5.131 ±0.173 seconds) while the treatment group decreased run time by 7.3% (5.189 ±0.197 to 5.151 ±0.179 seconds). The main effect for this result approached significance (p = .052) however the interaction between groups was not significantly different (p =.54) suggesting that the result was not due to the treatment. The control group vertical jump height increased 1.98% from attempt 1 to attempt 2 (64.07 ±5.17 to 65.34 ±5.17 cm) while the treatment group decreased jump height by .29% (64.96 ±5.12 to 64.77 ±5.13). The main effect for this result approached significance (p = .10). The interaction between the groups was significant (p = .02) suggesting that there was a significant increase in jump height for the control group compared to the treatment group.

**CONCLUSIONS:** The main trend identified in this data is an increase in performance for second attempts compared to first attempts for all 40 yard dash times and for the control condition in the vertical jump height. It may be that the first attempt for vertical jump and 40 yard dash time in the control condition acted as a conditioning stimulus to improve performance. The MVC’s treatment may have had a dampening effect on both run and jump performance, therefore isometric exercise should not be used prior to performance in this population.
1884

Board #292
MAY 30  2:00 PM - 3:30 PM

Contextual Interference Effects On The Acquisition Of Strength And Skill Of The Bench Press

Marshall Naimo1, David W. Eccles1, Jacob M. Wilson2, Michael C. Zourdos3, Jeong-Su Kim1, Lynn B. Panton, FACSM,1 The Florida State University, Tallahassee, FL.2 University of Tampa, Tampa, FL.

(No relationships reported)

PURPOSE: To test if HCI is superior to LCI for the acquisition of (a) movement skill and (b) strength of the bench press (BP).

METHODS: Twenty four healthy, college-aged males (n=15) and females (n=9) were randomly assigned to a control (C), LCI, or HCI group. LCI and HCI were shown proper BP form and performed this exercise for 4wks, 3 times/wk for 4 sets, separated by 90 s, 10-12 reps at 50-55% of one repetition maximum (1RM). Both groups also completed 4 damthrow sets (4 throws per set). HCI undertook one dart-throw set following each BP set. LCI simply stood between BP sets and carried out all 4 dart-throw sets after completing their 4 sets of BP. C only did testing. 1RM tests were filmed; using the film, BPMT scores were calculated using a 13-point movement checklist by a CSCS expert blinded to the groups. Measurements were taken at pre, 1wk, 2 wks, post, and at a retention test 9 days after post. Alpha was set at 0.05.

RESULTS: LCI had a significantly greater increase in %1RM than C at post (LCI: 23.5±2.9; C: 14.8±2.9, C: 10.2±2.9%). At retention, LCI and HCI had a greater increase in %1RM than C (LCI: 21.1±2.6; HCI: 17.9±2.6, C: 11.1±2.6%), but LCI and HCI were not different from each other. The %1RM increase from wks 1 and 2 to retention was significant for the HCI group only. In LCI and HCI, BPMT scores were significantly higher than C at 1 (LCI: 12±1; HCI: 11±2; C: 9±2) and 2 wks (LCI: 12±2; HCI: 12±1; C: 8±3). HCI had significantly greater BPMT scores than C at post (3.4±1 vs. 9±3) and retention (12±1 vs. 9±3); there were no differences between LCI and C at post or retention.

CONCLUSION: HCI led to better retention of the BP movement after training compared to the other conditions. Thus, HCI may augment strength and movement skill on the BP since proper technique is an important component of strength-based tasks.

1885

Board #293
MAY 30  2:00 PM - 3:30 PM

The Effect Of Stretching And Motor Imagery On Anaerobic Performance In Trained Cyclists

Hannah Chaeys1, Rebecca Zakrzewski2, Maria Martinson1, Kaci Smith3, Sara Hochgesang4, Andrea Brewer5, Michelle Ritchey6, Adam Edwards7, Tom Nesser8, Matt Gage9, J. Derek Kingsley6. 1Ball State University, Munice, IN. 2University of Tennessee, Knoxville, TN. 3Indiana State University, Terre Haute, IN. (Sponsor: Lynn Panton, FACSM)

(No relationships reported)

Purpos:E To examine the effects of stretching compared to MI and quiet rest (QR; sitting and reading the student newspaper) on anaerobic performance in trained cyclists.

Methods: Thirteen trained cyclists (9 males: 4 females; aged: 21±2 yrs) were assessed for height (1.76±0.07m), weight (73.4±13kg), % body fat (10±8.6%) and maximal oxygen consumption (VO2max: 42±5.6 ml/kg/min). Participants performed 3 randomized sessions, separated by at least 72 hours, consisting of cycling for 30 minutes at 65% of VO2max before undergoing 15 minutes of SS, MI or QR, followed by an anaerobic performance test. SS consisted of 3 sets of 30-second stretches for the knee flexors/extensors, hip flexors/extensors and the shoulders. VO2max was calculated using a modified TDE in combination with an 8.5% grade setting. Subjects were informed that their anaerobic performance test will be watched by a well-known tennis star (world rank: 30, 2007, silver medal in Australia Open). There were no significant results were found for MPWR or MHR. We further conclude that athletes tend to perform better with any feedback at all, whether positive or negative, than no feedback. The maximal nature of this task was such that the manipulation did not affect RPE, as might be expected (c.f. Tenenbaum, 2001). Such findings may have important implications for the role played by self-efficacy in enhancing physical activity participation.

This study examined the effect of self-efficacy (SE) on perceived effort (RPE) and performance using a maximal effort anaerobic task. A repeated measures experimental design was employed, with male and female collegiate athletes (N = 36) randomly assigned to one of three groups: (a) high-efficacy (HE); (b) low-efficacy (LE); or (c) control group. Efficacy expectations were manipulated via false performance feedback. A manipulation check confirmed that this method successfully impacted SE in the intended direction (p < .01). Before and after the SE condition, participants completed a 30-second Wingate bike test to fatigue. During the task participants provided differed ratings of perceived exertion at 15 s intervals. Effort tolerance was determined by the length of time the participant could maintain the task. Differences in peak power (PKPWR), mean power (MPWR), maximum heart rate (MHR), and RPE were analyzed using a RM MANOVA.

CONCLUSIONS: Results revealed that the HE participants found the task less strenuous and more enjoyable than the LE or control group following the manipulation. Furthermore, HE resulted in significantly greater tolerance of the task than either the LE or control conditions. Compared to the control group PKPWR increased significantly (p < .05) in both intervention groups.

CONCLUSIONS: Changes in SE, regardless of direction, appear to positively influence anaerobic performance. However, this positive impact appears to affect only the initial burst of anaerobic exercise. Therefore, no significant results were found for MPWR or MHR. We further conclude that athletes tend to perform better with any feedback at all, whether positive or negative, than no feedback. The maximal nature of this task was such that the manipulation did not affect RPE, as might be expected (c.f. Tenenbaum, 2001). Such findings may have important implications for the role played by self-efficacy in enhancing physical activity participation.
environment that the task was actually performed. Both relative and absolute powers, as well as peak rpm, were quantified using the 30-second Wingate anaerobic threshold test. Significance was set a priori at \( p \leq 0.05 \).

RESULTS: No significant interactions existed among SS, MI and QR for relative peak power, absolute peak power or peak rpm.

CONCLUSION: In disagreement with current literature, the present study suggests that neither SS nor MI affect anaerobic performance in trained cyclists. This may be explained by the influence of several variables such as the length of the exercise bout, the duration of the stretching and the participants’ experience with imagery and/or quality of imagery.

1886  Board #294  MAY 30  2:00 PM - 3:30 PM

Irritable Bowel Syndrome Disrupts Mental and Physical Function in Female Endurance Athletes

Emily Crohale, Samantha Rhodes, Trevor Gilbium, Matthew Kuennel. West Texas A&M University, Canyon, TX. California Baptist University, Riverside, CA. (No relationships reported)

Gastrointestinal distress is a common complaint among female endurance athletes. Irritable bowel syndrome (IBS), characterized by recurrent abdominal pain, inflammation and disturbed bowel function, is a common diagnosis. IBS also causes severe anxiety, depression and fatigue; the combination of these physical and psychological symptoms severely hinders athletic performance. While quercetin’s analgesic and anti-inflammatory properties have been extensively studied in healthy male athletes, the efficacy of this supplement in diseased female athletes is unknown.

PURPOSE: To determine whether quercetin improves the mental and physical health of female endurance athletes with IBS.

METHODS: 6 female endurance athletes (age: 21.2 ± 0.5yrs; weight: 54.8 ± 2.2kg; bodyfat: 18.1 ± 1.6%; VO2max: 49.9 ± 1.7 ml/kg/min) consumed 1g/d quercetin for 21 consecutive days. Saliva, collected before, immediately after and 1hr after exercise was assayed for cortisol using ELISA.

RESULTS: IBS-associated fatigue, anxiety, depression, symptom severity and quality of life was worse in athletes with IBS than those without (p<0.05); these issues did not improve with quercetin supplementation (p>0.05). Athletes with IBS exhibited an increase in salivary cortisol from pre to post-exercise on the 1st (13.5±4%; p<0.05) and 21st (38.3±4%; p<0.05) days of supplementation; each day cortisol values returned to baseline by 1hr after exercise. Surprisingly, control subjects did not exhibit an increase in salivary cortisol with exercise on either the 1st or 21st days of supplementation (p>0.05).

DISCUSSION: Our results suggest female endurance athletes with IBS suffer from greater fatigue, anxiety, depression, and gastrointestinal distress than their non-afflicted counterparts. This likely has a significant impact on athletic performance and warrants further investigation. Preliminary data do not support a role of quercetin in diminishing the stress response.

B-39  Free Communication/Poster - Sport Psychology

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

1887  Board #295  MAY 30  2:00 PM - 3:30 PM

Educational Achievement And Career Transition Among Chinese Elite Athletes After Retirement

Fan Zhang, Flavia Andrade, Weimo Zhu, FACSMS. Qinghua University, Beijing100084, China. University of Illinois at Urbana-Champaign, Champaign, IL. (No relationships reported)

This study investigated the factors associated with attending college and career transition among the Chinese elite athletes who have retired.

METHODS: The sample focused on retired elite athletes who had registered in the Beijing Sports Administration. These athletes (N=212, mean age=24.7, 55% female) had formally played professional sports on the national or provincial teams. Data were collected in 2010. Former athletes received the questionnaires through their former coaches. Descriptive statistics and logistic regressions were used to explore whether educational achievement and career transitions differed across sports. We also explored whether these associations varied by gender and social background.

RESULTS: In multivariate analyses, higher age of retirement was associated with a higher likelihood of getting a job versus going to college (OR=1.31, 95% CI 1.13-1.52). Other variables such as sex, parental background and type of sport in which they competed as athletes were not statistically significant. However, only 26% were satisfied with their jobs after the retirement. When athletes were asked about who have played a role in their decision to go to college, 56% highlighted the role of their parents as important (or very important). Most categorized the help such as sex, parental background and type of sport in which they competed as athletes were not statistically significant.

CONCLUSIONS: The retirement transition of Chinese elite athletes is affected by their retirement age. Those retiring at older ages were less likely to attend college which may reduce their career options in the future. Most retired athletes seem dissatisfied with their jobs. Further implications are discussed.

1888  Board #296  MAY 30  2:00 PM - 3:30 PM

Motivation In Soccer - A Comparison Between Professionals, Semi-professionals And Amateurs Soccer Players


In spite of the existence of a significant quantity of studies that examine motivation in context to physical and leisure activities, very few coincide in contexts of a natural competitiveness, especially in what concerns adult competition.

PURPOSE: To compare the achievement goal, self-determination and beliefs about the nature and determinants of sport competence according to the competitive level: Professionals (PF), Semi-Professionals (SP) and Amateurs (AM).

METHODS: 105 professional soccer players (I and II Professional Leagues), 156 semi-professionals (II and III National Leagues) and 78 amateurs (Regional Leagues), completed the following tools: Task and Ego Orientation in Sports Questionnaire; Self-Regulation Questionnaire; Questionnaire relative to Beliefs about the Nature and Determinants of Sports Competency. ANOVA was used to analyse the differences between the three groups, post hoc comparisons were done using the Tukey test (p<0.05).

RESULTS: The analysis of results shows that the three groups were predominantly task oriented and significant differences were not found between them The professionals, when compared with the amateurs, reported significant higher levels in respect to the introjected regulation (PF, 3.3±0.82; AM, 3.19±0.76; p=0.015), identified regulation (PF, 4.36±0.66; AM, 4.10±0.69; p=0.012) and for the beliefs that the sport competence was a result to learning (PF, 4.47±0.57; AM, 4.25±0.71; p=0.038) and subject to improvement (PF, 4.14±0.68; AM, 3.89±0.85; p=0.47).

The amateurs showed significant higher levels of amotivation (PF, 1.42±0.60; AM, 1.69±0.93; p=0.003) and believe more than the professionals that sport competence is stable (PF, 2.39±0.63; AM, 2.66±0.80; p=0.021). On the other hand, the semi-professionals, when compared with the amateurs, also tended to report significant higher levels of introjected regulation (SP, 3.52±0.85; AM, 3.19±0.76; p=0.015) and to believe that sport competence for playing football results from learning (SP, 4.56±0.42; AM, 4.25±0.71; p=0.000) and is subject to improvement (SP, 4.25±0.61; AM, 3.89±0.85; p=0.001).

CONCLUSION: The differences found concerning the several motivation determinants in function of the competitive level, underline the existence of a relation between the competitive level and motivation.
Big Five Inventory was used to assess five main dimensions of personality traits: Extraversion, Agreeableness, Openness, Conscientiousness and Neuroticism. This is a 44-item inventory that

PURPOSE: The aim of this study is to identify the soccer clubs model of organization, their culture, goals and answers to the demands of the surrounding environment.

METHOD: Three Portuguese soccer clubs from different contexts were analyzed. One professional club (PC) and two amateur (AC) of regional level, one of a rural area (RAC), other of an urban area (UAC). The criteria to select the clubs were: a) belong to the same district, b) experience in collaboration with research studies. Field observations and guide tour to club infrastructures were registered. And semi-structured interviews were recorded, followed by text transcription and respectively speech analysis.

RESULTS: Comparative to the AC’s the PC is more complex, formalized, specialized and is more oriented to performance goals. The volunteers in the PC that work with the youth athletes receive compensation (e.g., monetary, merchandising, tickets). The AC’s present a simple structure, lack of formal training and bureaucracy, suggesting high centralization. The goals declared are related to promotion of sport practice. Volunteers’ involvement is based on friendship and relationships. The protocols established with local authorities seem to be an important factor that helps UAC to have better capacity to obtain income than the RAC.

CONCLUSIONS: The PC is more prepared and capable to provide better conditions for soccer skills development, but the orientation to performance goals could promote anti-social and anti-ethical attitudes and values in the athletes. The AC’s are more dependent from the local authorities, but their function could be improve if they develop good partnerships with local authorities. These can see in the clubs an opportunity to promote social capital, provide informal education and promote active citizenship. It’s possible that these organizational differences promote different values and skills of youth athletes.

Cognitive Function of Retired Professional Football Athletes

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BACKGROUND: Exposure to repeated head injuries can alter the expected cognitive recovery course, increasing the risk of long-term neuropsychological problems over the lifespan. Due to age associated memory decline and the prevalence of multiple concussions in professional football players, clinicians are often concerned about the cognitive status of retired professional football athletes.

METHODS: Twenty-three retired professional football players (ranging in age from 32 to 70 years, with a mean age of 54 years) participated in a health screening event and reported multiple “bell ringers” during their athletic careers. All participants were independent with mobility and ambulation. The Montreal Cognitive Assessment (MoCA) and a self-report Likert scale of memory function were administered to 21 of the 23 participants. MoCA total scores, MoCA Memory subtest scores and self-reported total memory scores were calculated. Age comparisons of those fifty years of age or older versus those under the 50 years will be made using regression analysis.

RESULTS: Thirteen (62%) participants scored below 26 on the MoCA (mean score 23.62), 18 participants (86%) scored below 3.73 on the memory subtest (mean memory score 1.76) and 13 (62%) participants reported functional impairment in daily living activities associated with memory deficits.

CONCLUSION: Cognitive screenings should be routine for annual health examinations of retired professional football players. Future research is needed to examine additional factors contributing to cognitive decline among these individuals, including medical conditions and psychosocial factors.

The Mental Health Of Apprentice Horse Racing Jockeys: Is There A Need For Risk Assessment?

Justine Stynes. Australian Catholic University, Sydney, Australia. (Sponsor: Mike Climstein, FACSM)

The life of the apprentice horse racing jockey is grueling. There is no ‘off’ season. The 4-year apprenticeship involves early morning track work (3 to 4 hours a day, 5 to 6 days a week), daily stable work (e.g., feeding and grooming horses), weekly trial meetings, and at least one race meeting a week (up to 8 rides per meeting). Injuries can be debilitating and life threatening. Jockeys constantly battle with meeting weight for competition. Evidence in other sports suggests that meeting weight can be psychologically debilitating, impacting the performance, longevity and well-being of the athlete. Despite the physical and psychological demands of the sport, there is limited research on the mental health of the apprentice jockey.

PURPOSE: To determine whether apprentice jockeys experience distress. To identify potential risk and protective factors for mental health in apprentice jockeys.

METHODS: Male (n=13) and female (n=1) apprentice jockeys with a mean age of 20.00 (SD=3.01) and mean weight of 49.89 kg (SD=7.91) were assessed using structured questionnaires and open ended questions. Distress was assessed using the Depression, Anxiety and Stress Scale and the Athlete Burnout Questionnaire. The potential risk and protective factors for mental health assessed were: resiliency (Reisnity Scales for Children and Adolescents), coping strategies (Adolescent Coping Scale), social support, and stressors.

RESULTS: The jockeys reported levels of depression (range=0-36, M=11.14, SD=10.69), anxiety (range=0-34, M=7.43, SD=8.28) and stress (range=0-40, M=12.74, SD=10.45) in the normal to severe range. Levels of burnout were reported in the low to high range for reduced accomplishment (M=2.52, SD=0.74), emotional and physical exhaustion (M=2.43, SD=1.03), and sport devaluation (M=1.94, SD=0.81). Potential risk factors identified included: lack of social support, poor coping strategies (e.g., ignore the stressor, wishful thinking) and various sport related stressors (e.g., weight restrictions, getting rides). Potential protective factors identified included: social support (e.g., emotional) and constructive coping strategies (e.g., problem solve).

CONCLUSION: There is evidence of distress and burnout in apprentice jockeys. A risk assessment of mental health in apprentice jockeys is recommended.

Personality Variables And Barefoot Running

Janet Buckworth, FACSM, Nicholas Hanson, Heather Preston. The Ohio State University, Columbus, OH.

Interest in barefoot running has grown in recent years, although many runners have not attempted or implemented barefoot running into their training. It is hypothesized that personality characteristics may be a factor in this decision.

PURPOSE: To determine if there are differences in personality between barefoot and shod runners.

METHODS: An online survey was administered to both male and female runners who had completed a footrace of at least 13.1 miles in the last two years (Project ULTRA (Understanding Long-distance Training and Runners’ Affect)). The runners were asked, “Have you ever run barefoot?” and were classified as either barefoot (BF) or shod (SH) runners by their response. The Big Five Inventory was used to assess five main dimensions of personality traits: Extraversion, Agreeableness, Openness, Conscientiousness and Neuroticism. This is a 44-item inventory that utilizes a 5 point Likert-style scale for each question. The subjects were asked to answer from 1 “disagree strongly” to 5 “agree strongly” regarding statements about their personality. Independent samples t-tests were used to compare the means of the two groups on the five personality dimensions.

RESULTS: Runners from 46 of the 50 states were represented in the sample. The mean age of the respondents was 39.86 yrs (range 18-80, SD 10.99 yrs). Of the 601 runners who completed the survey, 217 reported they had run barefoot. The barefoot runners scored significantly higher on the personality trait Agreeableness (BF mean 3.90 ± 0.57 SD vs SH mean 3.86 ± 0.66 SD, p<0.01) and lower on Extraversion (BF mean 3.18 ± 0.85 SD vs SH mean 3.26 ± 0.85 SD, p<0.01). There were no significant differences on Openness, Conscientiousness or Neuroticism. Additionally, 45% of shod runners were women (n=174) while only 30% of barefoot runners were women (n=65).

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CONCLUSION: Our results show that runners who have at least attempted barefoot running tend to be more introverted (low-key, deliberate, quiet) and agreeable (sympathetic, cooperative, kind, affectionate). Very little is known about the participation of women in barefoot running, or personality factors that may distinguish them from shoed female runners or male runners; therefore, further research is warranted on the extent of barefoot running and psychological factors in men and women.

1893 Board #301  MAY 30  2:00 PM - 3:30 PM
Mood State And Pre-performance Anxiety In Cirque Du Soleil Artists: Similar Yet Different From Competitive Athletes
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(PURPOSE: To contrast mood state profiles and pre-performance anxiety trends between circus artists and competitive sport athletes. METHODS: In a pilot study on injury prediction, 33 (17F, 16M) modern circus artists performing acts related to sport or music completed the Profile of Mood States (POMS) and State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1993) under baseline and recalled best performance using methods based on Hanin’s Individual Zones of Optimal Functioning (IZOF) model. POMS results were compared to published values for athletes (Raglin et al., 1991; Terry, 2000) with independent t-tests and the distribution of IZOF values contrasted with compiled athlete values (Raglin & Hanin, 2000) via Z-score transformations. RESULTS: Mean POMS subscale values were: Tension: 14.7 (6.7), Depression: 8.0 (9.3), Anger: 8.9 (8.0), Vigor: 20.1 (5.4), Fatigue: 9.0 (5.8) and Confusion: 12.3 (4.4). Circus artists’ scores for Anger, Vigor, Fatigue were similar to athletes (p>0.05), whereas Tension and Confusion were similar to non-athletes (p<0.05, i.e. higher than athletes p<0.05). Baseline anxiety values did not differ from published norms for State: 37.2 (12.5) or Trait: 38.8 (10.8) anxiety. The mean score for optimal pre-performance anxiety was 31.9 (10.1). Compared to athletes, a greater proportion of circus artists (57.6% vs 21.6%) reported their optimal performance occurring at a lower anxiety range (T-score <35), but the proportions of artists with optimal performances at moderate (T-score 35-45) and high (T-score>45) anxiety levels were less than athletes (moderate: 27.3% vs 44.2%; high: 15.1% vs 34.2%). CONCLUSIONS: The mood state profiles of modern circus artists in this pilot study were similar to typical athlete profiles except for higher yet normal values for POMS tension and confusion, consistent with the tenets of Morgau’s (1980) mental health model of sport performance. As predicted by the IZOF model, we found considerable variation on self-reported optimal pre-performance anxiety level (R=20-55). Finally, a greater proportion of circus artists appear to perform optimally at a lower level of anxiety compared to athletes, perhaps because of differences in performance context (e.g., competitive vs. non-competitive) or scheduling (occasional competition vs. 10-12 shows weekly).

Email: raglinj@indiana.edu (FACSM sponsor)

1894 Board #302  MAY 30  2:00 PM - 3:30 PM
Motivations to Participate in Sport at the 2010 Pan Pacific Masters Games
Kent J. Adams, FACSM1, Joe Walsh1, Stephen Burck2, Ian T. Heazlewood1, Jyrki Kettunen3, Mark DeBello4, Mike Clemstein, FACSM5 1California State University Monterey Bay, Seaside, CA; 2Australian Catholic University, Sydney, Australia; 3Charles Darwin University, NT, Australia; 4Arcada University of Applied Sciences, Helsinki, Finland; 5Southern Utah University, Cedar City, UT. 6Bond University, Gold Coast, Australia.

(PURPOSE: To investigate athletes’ motivations for participation in their sport at the 2010 Pan Pacific Masters Games held in Gold Coast, Australia. METHODS: As part of an online survey, over 10,000 participants from 34 sports were asked to rate on a scale of 1 thru 7 the importance of 56 different reasons as to why they participate in their sport (1 = item is not a reason, 7 = item is a very important reason). RESULTS: A total of 1,824 participants responded (response rate = 18%) with a mean age of 49.1yrs (range 25 to 83yrs). Competitors from 14 countries completed the survey. On a scale of 1-7 the top three reasons to participate were (mean (SD)): to socialize with other participants = 5.91 (1.41); to become more physically fit = 5.25 (1.76); and to improve my health = 5.25 (1.82). CONCLUSIONS: Socialization with other participants was the most important personal motivation for sport participation in the 2010 Pan Pacific Masters games. Health and fitness were less important motivators than socializing to these masters level athletes, but still stronger than competition.

1895 Board #303  MAY 30  2:00 PM - 3:30 PM
Characteristics of Elite Table Tennis Athletes’ Brains Activity in Spin-Serve Judging Process
Anmin Li, Male, Yuhui Zhang, female. Shanghai University of Sport, Shanghai, China.

(PURPOSE: This study compared the brain activity of Chinese Olympic table tennis athletes and Chinese National League table tennis athletes when they executed a spin-serve judging tasks. The reactions of the cerebral areas involved with perception and response times were measured during the tasks. The purpose of the study was to examine differences in cognitive processing activities in the central nervous systems of athletes with different table tennis skill levels during the judging the spin of table tennis serves. METHODS: Six female athletes from the Chinese Olympic table tennis team and 12 female athletes from the Shanghai University of Sports with National League table tennis participated in the study. All the participants were instructed to watch a video in which four kinds of serve spins. The participants’ task was to identify the type of serve spin and to react by pressing one of four buttons to indicate which type of serve was. The participants’ event-related potentials, response times, and accuracy were recorded at the same time. RESULTS: The latency to the greatest activation in the occipital region of Olympic group was 200 ms earlier than the National League group. The ending of parietal cortex activation of the Olympic group was 270 ms earlier than the National League group. Positive waves were observed in the frontal lobes of the Olympic group, while negative ones appeared in the National League group at around the latency of 300 ms. CONCLUSIONS: (1) The transformation from occipital activation to parietal activation occurred more quickly in the Olympic group relative to the National League group. This faster transfer between the regions provided more time for making correct decisions. (2) The Olympic group showed hemispheric asymmetry in the processing of visual stimuli by utilizing primarily the right occipital resources, whereas the National League group showed bilateral occipital activation. (3) The Olympic Group showed a resource-saving mode with fewer occipital and parietal resources, allowing them to perform cognitive tasks more efficiently.

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Effects of Transcranial Direct Current Stimulation on Performance, Autonomic Nervous System, and Rating of Perceived Exertion during Incremental Exercise

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(Purpose) We investigated the effects of transcranial direct current stimulation (tDCS) on heart rate variability, rating of perceived exertion (RPE) and time to exhaustion (TE) during incremental exercise test to exhaustion in trained cyclists.

Methods: Ten male national-level road cyclists volunteered to participate in this study (32.9±8.5 years; 171.5±5.8 cm; 72.8±4.9 kg; 24±8.3±2.2 kg/m²; 10.2±10.7 training years). The cyclists performed two maximal incremental exercise test: (a) anodal tDCS; (2) or sham for 20 minutes. Heart rate (HR), R-R interval (HRV), and RPE were recorded continuously through all stages of the experiment. From the data collected during the incremental test, the peak power output (PPO), HRV determined every minute and estimated HRV threshold (HRVthr) were determined. The testers and the cyclists were blinded to the test condition.

Results: HRVthr, PPO and TE were all significantly higher for anodal tDCS than the SHAM condition (HRVthr anodal: 147.5 ± 53.3W vs sham: 125.0 ± 35.4, p=0.04; PPO anodal: 313.2 ± 29.9W vs sham: 301.0 ± 19.8, p=0.043; TE anodal: 751.4 ± 71.5 vs. sham: 723.7 ± 45.0s, p=0.05). RPE are significantly more slowly during the first six stages of the test in subjects received anodal tDCS.

Conclusion: We conclude that tDCS decreased RPE and improved performance and cardiac autonomic control.

Supported by FAPESP, CNPq, and CAPES.

The Influence of a Collegiate Soccer Season on Perceived Stress and Recovery Scores

Stephen J. Rossi, Jim McMillan, Thomas Buckley. Georgia Southern Univ, Statesboro, GA.

(Purpose) The intent of the present study was to examine the influence of a competitive collegiate men’s soccer season on perceived stress and recovery (RESTQ-Sport).

Methods: Nine male NCAA Division I soccer players filled out a RESTQ-Sport questionnaire before the start of the pre-season (T1), three times during the season (T2, T3, T4), and post-season (T5). Participants were given the same instructions at each time point on how to properly answer the questionnaire. Repeated Measures ANOVA was run on all general and sport specific stress and recovery scale means and significance was set at p<0.05,Copyright © 2012 by the American College of Sports Medicine. Unauthorized reproduction of this article is prohibited.
RESULTS: Repeated measures ANOVA revealed a significant time effect for the general stress scale (p = 0.015) and a simple contrast using T1 (0.94 ± 0.39) as a baseline revealed significant difference at T2 (1.92 ± 1.20; p = 0.017), T3 (1.56 ± 0.61; p = 0.009), T4 (1.31 ± 0.54; p = 0.038), and T5 (1.67 vs. 0.86; p=0.010). Social stress showed a significant time effect (p = 0.02) and a simple contrast using T1 (1.34 ± 0.65) as a baseline revealed significant difference at T2 (2.44 ± 0.92; p = 0.003), T3 (2.10 ± 0.98; p = 0.042), and T5 (2.10 ± 0.73; p=0.011). Fatigue showed a significant time effect (p = 0.001) and a simple contrast using T1 (1.34 ± 0.65) as a baseline revealed significant difference at T3 (3.11 ± 1.12; p = 0.001) and T5 (2.40 ± 0.94; p=0.008).

CONCLUSION: Theses data indicate general stress, social stress, and fatigue were negatively influenced by a collegiate soccer season. Higher scores on the three general stress scales have been associated with complaints of being stressed, depressed, having conflicts with others, and feeling over fatigued, and having problems sleeping. The RESTQ-Sport may provide useful information about an athlete’s recovery status and readiness to train and compete. This information could be beneficial when designing an athletes’ training program.

**Board #308**

**MAY 30  2:00 PM - 3:30 PM**

**Athletic Perseverance: Assessing Perseverance Attributes Of Athletes And Non-athletes**

Matthew C. Wagner1, Judy L. Sandlin2, Rosanne S. Keathley1. 1Sam Houston State University, Huntsville, TX. 2Texas A&M University, College Station, TX.

**Purposes:** The purpose of this study was to gather baseline data on athletic perseverance of college students and student-athletes. 

**Methods:** Participants (n=75) were selected university students and a matched sample of Division 1 student-athletes. Each was given the 30-item Mental Toughness Scale (Goldberg, 2006). The instrument contains five subscales - Reboundability, Ability to Handle Pressure, Concentration, Confidence, and Motivation - these are summed to yield an overall an Athletic Perseverance Score. The maximum score for each subscale is 6 thereby producing an over all maximum score of 30.

**Results:** A one-way MANOVA was utilized to determine if significant differences were observed between the athletes and non-athletes on the five subscales. Significant differences were found between athletes and non-athletes, Wilks lambda = .69, F(5, 68) = 6.09, p = .000. Analyses of variances were conducted as follow-up tests to the MANOVA. The ANOVA for Pressure, F(1, 72) = 13.21, p = .001, Concentration, F(1, 72) = 17.12, p = .000, Confidence, F(1, 72) = 11.49, p = .001, and Motivation, F(1, 72) = 10.57, p = .002 were each significant. For each significant subscale, the athletes scored higher when compared to students.

**Conclusions:** Athletes demonstrated higher levels of athletic perseverance than non-athletes. Further research could investigate the effectiveness of different aspects of mental training for both student-athletes and students.

**Board #309**

**MAY 30  2:00 PM - 3:30 PM**

**Psychological Determinants of Injury: Expanding the Mechanical Model**

Diane L. Elliot, FACSM, Esther L. Moe, Linn Goldberg, FACSM, Chondra M. Lockwood. Oregon Health & Science University, Portland, OR.

**Purpose:** Adolescent female athletes are at increased risk for sport injuries, especially knee trauma. To date, the focus of understanding knee injuries’ pathophysiology and prevention has been on anatomy and neuromuscular control. Identifying other determinants of injury might allow for a more comprehensive prevention paradigm.

**Methods:** Define an injury model for female high school athletes that uses psychological dimensions as predictors of sport trauma.

**Results:** A 45-minute anonymous survey using validated indices of psychological traits/states was administered to female athletes from a range of sports and a spectrum of high schools. Reliable constructs were assessed as predictors in both an ‘any injury’ and ‘knee injury’ model.

**Conclusions:** Expanding injury prevention models to include psychological determinants might better prevent injury and provide young female athletes with mental resilience that would benefit them on and off the playing field.

**Board #310**

**MAY 30  2:00 PM - 3:30 PM**

**Independent And Interactive Effects Of Mother, Father, And Coach Autonomy Support On Athletes’ Self-determined Motivation**

Anthony J. Amorose1, Lindley McDavid2, Allison Riley3, Aidyn Iachini2. 1Illinois State University, Normal, IL. 2Purdue University, West Lafayette, IN. 3Ohio State University, Columbus, OH. 4University of South Carolina, Columbia, SC. (Sponsor: Kristen M. Lagally, FACSM)

**Purpose:** The purpose of this study was to examine the independent and interactive influences of athletes’ perceptions of autonomy support from their mothers, fathers, and coaches on athletes’ self-determined motivation.

**Methods:** Athletes (N=335; M age=15.75 years; 62.4% female; 84.2% Caucasian) from a variety of school-sponsored sport teams completed survey measures near the end of their competitive season assessing their level of self-determined motivation and their perception of autonomy support provided by their coach, mother, and father.

**Results:** Hierarchical regression analysis results showed that autonomy support from all three social agents significantly and positively predicted the athletes’ self-determined motivation (No relationships reported)

**Conclusions:** The findings of this study demonstrate how the combination of perceived autonomy support from these three influential social agents (i.e. coaches, mothers, fathers) can add to the understanding of athletes’ sport motivation.

**Board #311**

**MAY 30  2:00 PM - 3:30 PM**

**The Effect Of Growth And Maturation On Mental Skills Of Junior Elite African Soccer Players**

Linda Van den Berg1, Julius Jooste2. 1Tshwane University of Technology, Eloffordge, South Africa. 2Tshwane University of Technology, Pretoria, South Africa.

**Purpose:** The Purpose of this study was to examine the psychological impact of material growth and maturation on the psychological development of young athletes.

**Methods:** A total of 155 male soccer players with an average age of 16.3 years, representing 11 countries in Africa formed part of this study. A Biological Maturatation questionnaire was compiled to ascertain biological maturation, and accordingly classified the group into early (ED, n = 29), average (AD, n = 77) and late developers (LD, n = 46). Sport psychological skills (Coping with adversity, Peaking under pressure, goal-setting and mental preparation, concentration, freedom from worry) as determined by the Athletic coping Skills inventory-28 and
Numerous studies have been conducted on eating disorders (ED) in collegiate athletes. Many studies conclude that collegiate athletes are more at risk of developing an ED compared to non-athletes, while some report the opposite.

**Purpose:** To determine if collegiate athletes are more likely to exhibit ED characteristics compared to those who only participated in high school sports. **Method:** Each participant completed The Eating Attitude Test-26 (EAT), The Eating Disorder Inventory subscales Body Dissatisfaction (EDIDBF), Drive for Thinness (EDIDTF), and Bulimia (EDIBUL) and The Body Shape Questionnaire-34 (BSQ).

Group differences were examined for males (N=101), females (N=189), collegiate athletes (N=107), non-athletes who played sports in high school (high school athletes) (N=183), and those who did not play sports in high school (non-athletes) (N=31).

**Results:** Two-tailed independent T tests for equality of means were computed to examine group differences. In comparison to males, females scored significantly higher on the EAT (t=−3.186, p<0.002), the EDIDBF (t=4.897, p<0.000), EDIDTF (t=4.075, p<0.000), and BSQ (t=6.618, p<0.000). No significant differences were found regarding EDIBUL. Combined collegiate athletes and high school athletes (N=259), showed no significant differences in comparison to non-athletes in EAT, EDIDFT, and EDIBUL. However, non-athletes scored significantly higher on the EDIDBF (t=2.629, p=0.013) and BSQ (t=2.617, p=0.013) compared to collegiate athletes. Compared to collegiate athletes, high school athletes scored significantly higher on the EAT (t=3.770, p<0.000) EDIDBF (t=2.983, p<0.003), EDIDTF (t=4.750, p<0.000), and BSQ (t=4.308, p<0.000). No significant differences were found between these two groups regarding EDIBUL.

**Discussion:** Compared to collegiate athletes, high school athletes scored significantly higher on the EAT, EDIDFT, EDIDBF, and BSQ, indicating they are at a greater risk of an ED. The mixed results found when combining collegiate athletes and high school athletes in comparison to non-athletes suggest that more research is needed to determine if one group is at a greater risk than the other. Overall, this study suggests high school only athletes are more at risk of developing an eating disorder compared to collegiate athletes.

**Conclusions:** Although we were unable to identify strong correlations between dependent measures, our results may indicate alcohol consumption has an impact on hydration status and ultimately performance. Although other factors may have influenced hydration, we did identify significant dehydration following alcohol consumption.

**Methods:** We used a correlational design to determine the relationship between self-reported alcohol consumption and fatigue. We acquired IRB approval to evaluate 5 Division I athletic teams from one educational institution (ages of 18–26, football=15, basketball=25, softball=11, soccer=25, volleyball=15; men=40, women=51). We measured hydration status using a clinical refractometer, self-reported alcohol consumption using the alcohol use disorders identification test (AUDIT) questionnaire, and fatigue using the visual analog scale for fatigue (VAS-F). During the initial team meeting we acquired informed consent and measured baseline fatigue. Athletic Training Services performed baseline hydration status testing during pre-participation physicals (PPPs). Each team participated separately on an “off day” post competition and again 3 days following. During the follow-up data collection sessions, we assessed hydration status, VAS-F, and AUDIT.

**Results:** We identified no significant or strong relationships between our dependent variables (Spearman’s ρ correlation range=0.003–0.079, p ranges=0.192–0.973). We identified significant differences in hydration status over time (F2,269=5.226, p<0.006, η²=0.037) between baseline hydration status (1.017±0.001) and follow-up day 1 (1.021±0.001) as well as follow-up day 3 (1.024±0.001). We also identified a significant difference between sports on the AUDIT score (F4,86=4.279, p<0.003 η²=0.166) with significant differences between the highest risk athletes from softball (9.3±1.22) and baseball (4.36±0.81) and the lower risk athletes in soccer (4.36±0.81) and basketball (3.46±0.81). We identified no significant or strong relationships between our independent variables (Spearman’s ρ correlation range=0.003–0.079, p ranges=0.192–0.973). No relationships reported

**Conclusions:** The present study found that collegiate athletes are at an increased risk for binge drinking behaviors. Alcohol has numerous negative physiological effects. For collegiate athletes these effects may have contributed to decreased performance. **Purpose:** The purpose was to identify the relationship between self reported alcohol consumption and fatigue and hydration existed. **Methods:** We used a correlational design to determine the relationship between the dependent measures. We acquired IRB approval to evaluate 5 Division I athletic teams from one educational institution (ages of 18–26, football=15, basketball=25, softball=11, soccer=25, volleyball=15; men=40, women=51). We measured hydration status using a clinical refractometer, self-reported alcohol consumption using the alcohol use disorders identification test (AUDIT) questionnaire, and fatigue using the visual analog scale for fatigue (VAS-F). During the initial team meeting we acquired informed consent and measured baseline fatigue. Athletic Training Services performed baseline hydration status testing during pre-participation physicals (PPPs). Each team participated separately on an “off day” post competition and again 3 days following. During the follow-up data collection sessions, we assessed hydration status, VAS-F, and AUDIT.

**Results:** We identified no significant or strong relationships between our dependent variables (Spearman’s ρ correlation range=0.003–0.079, p ranges=0.192–0.973). We identified significant differences in hydration status over time (F2,269=5.226, p<0.006, η²=0.037) between baseline hydration status (1.017±0.001) and follow-up day 1 (1.021±0.001) as well as follow-up day 3 (1.024±0.001). We also identified a significant difference between sports on the AUDIT score (F4,86=4.279, p<0.003 η²=0.166) with significant differences between the highest risk athletes from softball (9.3±1.22) and baseball (4.36±0.81) and the lower risk athletes in soccer (4.36±0.81) and basketball (3.46±0.81). We identified no significant or strong relationships between our independent variables (Spearman’s ρ correlation range=0.003–0.079, p ranges=0.192–0.973). No relationships reported

**Conclusions:** Although we were unable to identify strong correlations between dependent measures, our results may indicate alcohol consumption has an impact on hydration status and ultimately performance. Although other factors may have influenced hydration, we did identify significant dehydration following alcohol consumption.
CONCLUSIONS: The knee joint ROM and peak angles were different between groups. Moreover, knee joint internal-external rotation was correlated with VL activity among the AL group whereas with VM among the BL group. Further investigation should focus on the differential effect of knee rotation on different muscle groups among different TC practice levels.

Supported by Shanghai Key Discipline Construction: S30803

1907  Board #315  MAY 30  3:30 PM - 5:00 PM
The Evaluation Of Active Drag: A New Proposal
Bruno Mezźncio1, João G O Claudino1, Polyyana P. Takao1, Rafael Soncin2, Jacielle C. Ferreira1, Leszek A. Szmaczkowski2, Rudolf Huebner2, Alberto C. Amadio1, Julio C. Serollo1, USP, São Paulo, Brazil. 1UMG, Belo Horizonte, Brazil. 2Endomar, Sobral, Brazil. (No relationships reported)

The active drag has a strong influence on swimmers performance, but it is a controversial issue because of complexity of the flow around the swimmer. Used methods for estimating this variable need greater specificity or accuracy.

PURPOSE: Measure the mean drag active of swimmers through the difference between the net force in dynamometry testing with (WD) and without displacement (ND).

METHODS: In a ND test the active drag is approximately zero due to drag-speed relationship. Thus, the strength difference between ND and WD tests is the drag active experienced by the swimmer on test speed with displacement. Twelve tests were conducted to measure the propulsive force ND and WD, the minimum time of rest between attempts was five minutes. A unidirectional load cell, with sampling rate of 1000Hz, measured net force in both situations. The sequence of tests was randomized and balanced. The study included eight swimmers with performance equivalent to 81.9 ± 6.4% of the world record of 50 meters freestyle and height of 1.74 ± 0.06 m. The stroke rate and kick count, per cycle, was used to evaluate the technical differences between the tests. A camcorder with 1000 fps was used to record the underwater motion of swimmer. The measurement errors were calculated by the method of propagation of uncertainties considering the individual variability and characteristics of the measuring equipment.

RESULTS: There was no significant difference between the technique evaluated from the stroke rate (ND = 1.083 ± 0.069 and WD = 1.088 ± 0.075 s, p>0.05), and kick count (ND = 6 ± 0 and WD = 6 ± 0, p>0.05) of the different tests. The mean drag active was evaluated 153.74 ± 9.75 N with associated error estimated at 12.44%.

CONCLUSION: The estimated active drag values are within the range of values previously reported for swimmers of similar performance (42 to 167 N). However, the associated error of estimate was lower than was showed in other methods (30%). Thus, the proposed method is a practicable alternative to assess the active drag of swimmers.

1908  Board #316  MAY 30  3:30 PM - 5:00 PM
Kinematic Comparison Of Different Step Lengths In A Swimming Incremental Protocol
Ricardo J. Fernandes1, João Ribeiro1, Ana Sousa1, Maria Sousa1, Arturo Abraldes2, Carmen Ferragut1, Pedro Figueiredo1, J. Paulo Vilas-Boas1, CIFID2 and LABIOMEP, University of Porto, Porto, Portugal. 1Faculty of Sport Sciences, University of Murcia, Murcia, Spain. 2Faculty of Physical Activity and Sport, University of Alcalá de Henares, Madrid, Spain. (Sponsor: Carlo Baldari, FACS)

No relationships reported.

Swimming incremental protocols are frequently used for swimming aerobic performance assessment. Nevertheless, different step lengths might impose differences in swimming technique.

PURPOSE: To determine and compare the stroke rate (SR) and length (SL) and arm coordination (IdC) and propelling efficiency (η) during an intermittent incremental protocol with different step lengths.

METHODS: Eight long distance swimmers (25.6±8.8yrs, 69.9±5.5 kg, 1.78±0.49m) performed 7x200, 300 and 400m (0.05 m/s increments; 30s rest between steps and 24h between protocols) in front crawl until exhaustion; the velocity of each step was common to the three protocols. Two arm stroke cycles of the last 50m lap of each step were digitized (APASystem). SL was assessed using the right hip point, and SR was measure as the ratio of velocity to SL.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Protocol/Steps (%)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>IdC</td>
<td></td>
<td>2.55±0.14</td>
<td>2.47±0.14</td>
<td>2.49±0.17</td>
<td>2.59±0.14</td>
<td>2.43±0.16</td>
<td>2.44±0.25</td>
<td>2.53±0.28</td>
<td>2.51±0.16</td>
</tr>
<tr>
<td></td>
<td>7x200</td>
<td>0.43±0.02</td>
<td>0.45±0.03</td>
<td>0.43±0.09</td>
<td>0.41±0.07</td>
<td>0.38±0.08</td>
<td>0.33±0.05</td>
<td>0.30±0.04</td>
<td>0.30±0.03</td>
</tr>
<tr>
<td></td>
<td>7x300</td>
<td>0.40±0.07</td>
<td>0.40±0.08</td>
<td>0.40±0.12</td>
<td>0.37±0.05</td>
<td>0.36±0.05</td>
<td>0.33±0.04</td>
<td>0.32±0.04</td>
<td>0.32±0.04</td>
</tr>
<tr>
<td></td>
<td>7x400</td>
<td>0.39±0.07</td>
<td>0.39±0.06</td>
<td>0.37±0.05</td>
<td>0.35±0.04</td>
<td>0.34±0.04</td>
<td>0.33±0.03</td>
<td>0.32±0.04</td>
<td>0.32±0.04</td>
</tr>
<tr>
<td>η</td>
<td></td>
<td>0.60±0.08</td>
<td>0.60±0.08</td>
<td>0.60±0.08</td>
<td>0.60±0.08</td>
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</tbody>
</table>

In Table 1 it is possible to observe a SR increase and a SL decrease throughout the protocols, with a tendency to lower SL values in the last steps of the 400m protocol. The IdC decreased throughout the steps of each protocol, without significant differences between protocols.

CONCLUSIONS: The different step lengths of progressive swimming steps seem not to significantly affect the swimming technique, reinforcing the use of the 7x200m in training diagnostics due to pragmatic reasons.

Supported by PTDC/DES/101224/2008 (FCOMP-01-0124-FEDER-009577).

1909  Board #317  MAY 30  3:30 PM - 5:00 PM
The Effect of a Dynamic and Static Start on Snatch Pull Technique and Performance
Erich J. Petushek1, Karen Roemer1, Brett Hamlin2, William P. Ebben2, Beanne R. Carlson2, Casey Mallo3, Andy Tysz3, Randall L. Jensen, FACSM4. 1Michigan Technological University, Houghton, MI. 2University of Wisconsin-Parkside, Kenosha, WI. 3Northern Michigan University, Marquette, MI. 4University of Michigan, Ann Arbor, MI. (No relationships reported)

The start and "first pull" phase of the snatch lift is important for weightlifting success, however, two styles are often displayed. The variations are a “static” and “dynamic” movement of the hips just prior to barbell liftoff. The differences in these technique variations have yet to be assessed in elite weightlifting athletes.

PURPOSE: To assess the differences between a static and dynamic start on snatch pull technique and performance at various loads.

467

CONCLUSIONS: The knee joint ROM and peak angles were different between groups. Moreover, knee joint internal-external rotation was correlated with VL activity among the AL group whereas with VM among the BL group. Further investigation should focus on the differential effect of knee rotation on different muscle groups among different TC practice levels.

Supported by Shanghai Key Discipline Construction: S30803
METHODS: Eight male and three female weightlifters (Mean ± SD; Age = 20.18 ± 1.40 yrs; Mass = 77.89 ± 17.12 kg; Ht = 169.55 ± 11.37 cm; Snatch 1RM= 99.09 ± 32.35 kg) competing at the national or international level performed two snatch pulls at 90, 100 and 110% of their 1RM in the snatch using a static and dynamic starting technique, which were counterbalanced. Performance was assessed by maximum ground reaction force (VGRFmax), barbell displacement (Ymax), and velocity (Vmax) while technique was assessed by maximum horizontal barbell displacement (Hmax) and mean angle of the resultant GRF vector during the first pull (GR Fang). A two-way repeated measures ANCOVA was used to compare differences between a static and dynamic starting technique across loads while controlling for the athlete’s preferential starting technique.

RESULTS: Five athletes preferred the static whereas five preferred the dynamic technique. Significant main effects for load condition were displayed for VGRFmax (110±100, 110±90), Ymax, and Vmax (Both: 90±100±110% regardless of starting technique (p<0.01). No significant main effect or interaction for starting technique were displayed for any of the performance: VGRFmax (dynamic = 2801.89 ± 691.02 N, static = 2784.69 ± 689.85 N), Ymax (dynamic = 1.15 ± 0.09 m, static = 1.14 ± 0.09 m), and Vmax (dynamic = 1.72 ± 0.18 m/s, static = 1.72 ± 0.19 m/s); or technique: Hmax (dynamic = 0.074 ± 0.029 m, static = 0.073 ± 0.021 m) and GR Fangle (dynamic = 89.35 ± 0.58°, static = 89.23 ± 0.51°) variables (p>0.05).

CONCLUSIONS: Snatch pull performance and technique at various high intensities remains unaffected by a dynamic or static starting technique. Thus, coaches may teach either starting technique based on individual athlete needs.

1910 Board #318 MAY 30 3:30 PM - 5:00 PM Simulation Of Micro-fracture In Skiers Harcharan S. Ranu, King Saud University, Riyadh, Saudi Arabia. (Sponsor: WF Straub, FACSM) (No relationships reported)

METHODS: To simulate and quantify the micro-fracture in skiers.

RESULTS: The crack growth model is taken as a o  with an instrumented rear wheel (Powertap SL+) and targeted to demand 70% of peak oxygen uptake. A Vic on motion analysis system was used to record bike and rider 3D positions at 100 Hz. Bike lean, yaw, steering, and pedaling angles were calculated along with rider relative motion during 60 seconds of stable riding.

RESULTS: Similar behavior of crack growth rate characteristics for a planar pressure of 792 N.cm-2 and m being 1.25, reveals that 6 take-offs were sufficient to initiate micro-fracture of big toe bone in skiers. Similarly for a planar pressure of 321 N.cm-2 and m being 1.25, reveals that 15 take-offs were sufficient to initiate micro-fracture in heel bone of skiers. The results of this study also indicate that the number of take-offs for micro-fracture of skier bone decreases as the value of m increases.

CONCLUSIONS: These data predicted development of an in vivo micro-fracture in skiers even for it occurred and micro-fracture was sensitive to number of take-offs. Model was of significance in bone remodeling, fracture fixation of bone, prosthetic and shoe design, etc. It showed that shoes, and other supports can reduce the propagation of bone crack or injury prevention.

1911 Board #319 MAY 30 3:30 PM - 5:00 PM Cycling on Rollers: Motion Characteristics for Dynamic Stability Gerald A. Smith, FACSM, Andrew Miller, Eadric Bressel, Edward Heath, FACSM, Utah State University, Logan, UT. (No relationships reported)

RESULTS: Comparing the differences in technique between the roller and stationary conditions, no statistically significant differences were found for VGRFmax (dynamic = 2801.89 ± 691.02 N, static = 2784.69 ± 689.85 N), Ymax (dynamic = 1.15 ± 0.09 m, static = 1.14 ± 0.09 m), and Vmax (dynamic = 1.72 ± 0.18 m/s, static = 1.72 ± 0.19 m/s); or technique: Hmax (dynamic = 0.074 ± 0.029 m, static = 0.073 ± 0.021 m) and GRFangle (dynamic = 89.35 ± 0.58°, static = 89.23 ± 0.51°) variables (p>0.05).

CONCLUSIONS: The data show that the dynamic starting technique is not significantly different from the static technique, indicating that coaches may teach either starting technique based on individual athlete needs.

1912 Board #320 MAY 30 3:30 PM - 5:00 PM Strength Ratios of Hip Musculature in Male and Female Collegiate Soccer Players Meghan M. Miller,1 Jay Hertel, FACSM2, Bonnie Van Lunen,1 Nelson Cortes,3 Matthew Schroeder,1 Dustin Grooms,1 James Onate,1 1The Ohio State University, Columbus, OH. 2University of Virginia, Charlottesville, VA. 3Old Dominion University, Norfolk, VA. 4George Mason University, Washington, DC. (Sponsor: WF Straub, FACSM) (No relationships reported)

RESULTS: Hip muscle strength and power ratios were significantly higher (p<0.05) for males (1.10 ± 0.30) than females (0.82 ± 0.27). The ratio values were obtained by dividing peak strength of the agonist muscle by peak strength of the antagonist muscle in the respective pairs. A 2 (gender) x 3 (strength ratio) MANOVA was conducted, with an alpha level of 0.05, in order to determine the existence of gender differences in strength ratios.

CONCLUSIONS: No significant differences were obtained for any of the three strength ratios (FLX:EXT x 1.10 ± 0.30, ADD x 0.82 ± 0.27, EXT x 0.82 ± 0.27) for males and 0.82 ± 0.27 for females, REJIR x 0.82 ± 0.27 for males and 0.82 ± 0.27 for females. However, no significant gender differences were observed in the hip strength ratios.
Increasing weight-bearing activity has been suggested to improve bone health and minimize fracture risk. Cyclocross, in contrast to conventional cycling, demands bouts of weight-bearing activity as cyclists dismount and remount their bicycles to jump over barriers and run pitched terrain.

**PURPOSE:** To measure peak and mean vertical ground reaction forces (vGRF) during cyclocross-specific activities and calculate their osteogenic index (OI).

**METHODS:** The measurement of lower limbs force has been assessed in studies including individual swimming start techniques for ventral and dorsal events. Concerning the contribution of the upper limbs for the total impulse, the number of studies is rather scarce, and none of which has yet dealt with the technical adjustments allowed by the new international rules for backstroke start.

**CONCLUSIONS:** Peak vGRF generated during the backstroke start variant measured in this study is similar in magnitude to previously reported GRFs during running and soccer. vGRFs during all four activities were significantly higher than those during cycling. OI of the backstroke start condition alone is higher than during cycling for an equivalent number of loading cycles. Cyclocross-specific activities may be more beneficial to bone health than seated road cycling.

**Board #322**

**May 30, 3:30 PM - 5:00 PM**

**Analysis of Upper Limbs Dynanometry in Two Variants of Backstroke Start Technique**

Karla de Jesus1, Kelly de Jesus1, Pedro A. Figueiredo1, Pedro Gonçalves1, Suzana M. Pereira1, João Paulo Vilas-Boas2, Ricardo J. Fernandes1. 1Faculty of Sport, Porto University, Porto, Portugal. 2State University of Santa Catarina, Porto, Portugal. (Sponsor: Carlo Baldari, FACS)

The measurement of lower limbs force has been assessed in studies including individual swimming start techniques for ventral and dorsal events. Concerning the contribution of the upper limbs for the total impulse, the number of studies is rather scarce, and none of which has yet dealt with the technical adjustments allowed by the new international rules for backstroke start.

**PURPOSE:** To compare upper limbs horizontal impulse during backstroke start variants performed with the feet parallel and entirely submerged and with the feet parallel and entirely above the water surface.

**METHODS:** Five high level swimmers (age: 21.40 ± 3.36 years, weight: 74.54 ± 8.28 kg of body mass, height: 1.78 ± 0.05 m, training experience: 13.60 ± 6.06 years) performed two sets of four maximal repetitions of each backstroke start variant over a distance of 15 m. An iron handgrip instrumented with a load cell (Globus, Italy), recording at 100Hz, was fixed to the starting block and was connected to a Globus Ergometer data acquisition system (Globus, Italy). The handgrip system was adapted to comply with the swimming rules: 0.30 to 0.60 m above the water surface both horizontally and vertically. Data obtained from the load cell were low-pass digital filtered (20Hz Butterworth). Data were normalized for body weight. The backstroke start variants were divided into three phases: initial starting position, trunk lifting and release of the hands. The reference instants determined to assess the three phases were characterized in each individual force-time curve. Descriptive statistics, Student’s t-test for paired samples (p < 0.05) and effect size (d) were calculated.

**RESULTS:** Similar values were observed for the horizontal impulse between backstroke start variant performed with the feet parallel and immersed and the feet parallel and emerged at initial starting position (0.055 ± 0.023 s vs 0.056 ± 0.026 s, d = -0.02, p > 0.05), at trunk lifting phase (0.026 ± 0.007 s vs 0.029 ± 0.011 s, d = -0.26, p > 0.05) and, at release of the hands phase (0.101± 0.022 s vs 0.097 ± 0.022 s, d = 0.13, p > 0.05).

**CONCLUSION:** Despite the task constraint provided for the new rules for backstroke start, high level swimmers were able to apply similarly horizontal impulse throughout hands-off phases in both starting variants.
PURPOSE: To examine muscle activation and co-contraction patterns of the knee joint in Chair (CH), Tree (TR), Warrior I (W1), and Warrior II (W2) Yoga poses performed by healthy older adults.

METHODS: 20 healthy older adults (70.6 ± 3.8 yrs) participated in a 16-week Yoga program. After intervention, the participants were instrumented for biomechanical analysis and performed the Yoga poses with guidance from an instructor. Surface electromyographic (sEMG) data was collected at 1560 Hz for a 3-s interval during the pose. The sEMG data were full-wave rectified and smoothed with a 75-ms constant window. The processed sEMG data were further integrated over the collected interval (iEMG) to quantify muscle activation. The average co-contraction value (CV) was calculated as iEMG_ham/iEMG_vl times the summation of iEMG_ham and iEMG_vl. It reflects the level of muscle co-contraction and takes the overall activation level into account. Repeated measures ANOVA and Tukey’s HSD post hoc tests were used to examine the difference in muscle activation and CV across the poses.

RESULTS: Both HAM and VL muscle activation during TR were significantly less than during CH, W1, and W2 (p < .05). There was no significant difference between poses among CH, W1 and W2. CV during W1 and W2 was significantly greater than during CH and TR (p<.05). No significant difference was observed between W1 and W2, or between CH and TR.

CONCLUSION: Comparing the target poses, TR placed less demands on both knee flexors and extensors. High muscle co-contraction values at the knee in W1 and W2 indicate higher joint loading when performing these poses. These findings suggest that senior practitioners with knee OA should reduce or avoid Warrior I and II poses to prevent exacerbation of their OA. Supported by NIH Grant R01-AT004869-01

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**1917 Board #325** MAY 30  3:30 PM - 5:00 PM

Gender Differences In Heave And Pitch Phase Relationships In Maximal Undulatory Underwater Swimming (UUS).

Chris Connaboy1, Simon Coleman2, Ross H. Sanders 1

1Edinburgh Napier University, Edinburgh, United Kingdom. 2University of Edinburgh, Edinburgh, United Kingdom.

(No relationships reported)

The phase relationship between the heaving and pitching motions of the end-effector in UUS is critical to the production of an effective propulsive force and simultaneous minimisation of active drag, as it determines the formation and the timing of the shedding of the vortices from the leading edge of the end-effector (Anderson et al., 1998, Jnl Fluid Mech, 360, 41-72). A phase angle difference of approx. 75° has been shown to represent the optimal phase difference between heaving and pitching motions in oscillating foils with high propulsive efficiency (Anderson et al., 1998).

PURPOSE: Examine gender differences in the relationship between the mean absolute relative phase of the heaving and pitch (MARP HnP) movements of the end-effectors with the production of maximal UUS velocity in skilled swimmers.

METHODS: 17 (Male=8; Female=9) national age-group swimmers (Age 16.9±1.3yrs, Ht 171.2±9.4cm, Wt 63.2±11.4kg) were recorded using a single underwater video camera swimming 3 trials of maximal UUS to collect 6 cycles of data. 2D kinematics were analysed from the digitised motions of the wrist, shoulder, hip, kne ankle and 5th metatarsal phalangeal joint (MPJ) centres. Continuous Relative Phase (CRP) was determined from the phase angles of vertical heave motions and pitch angle of the end-effector. The MARP was calculated from the CRP using circular statistics. The relationships between the cycle frequency (Hz) of the end-effector (5th MPJ), cycle length (CL-distance travelled by the hip marker per cycle) and the average velocity of the hip marker per cycle (VEL) to the MARP HnP were determined using Pearson’s correlation coefficient.

RESULTS: No sig. differences in Hz, CL, or VEL by gender. MARP HnP (female 117.4±4.5; male=118.9±4.4; p=0.088) also showed no difference by gender. Correlation coefficients showed moderately large relationship between MARP HnP and Hz (female r=0.553, p=0.003; Male r=0.597, p=0.002). Female swimmers showed a large correlation with CL (r =0.704, p=0.001) compared to males (r=0.182, p=0.395). All correlations between MARP HnP and VEL were small and not sig.

CONCLUSION: MARP HnP was considerably different to the suggested 75° optimal phase relationship. The differences in the correlation coefficients suggest males and females adopt different coordination patterns to achieve maximal UUS.

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**1918 Board #326** MAY 30  3:30 PM - 5:00 PM

100-m Freestyle Race Analysis of the 5th World Down Syndrome Swimming Championship

Ana Querido1, Dália Araújo1, Susana Soares1, J. Paulo Vilas-Boas1, Rui Corredeira1, Daniel Daly2, Ricardo J. Fernandes 1

1University of Porto, Faculty of Sports, Porto, Portugal. 2University of Leuven, Faculty of Kinesiology and Rehabilitation Sciences, Porto, Belgium. (Sponsor: Carlo Baldari, FACSAM)

(No relationships reported)

Down syndrome (DS) is a common genetic cause of intellectual disability but there is a lack of knowledge on factors leading to sport success in these persons.

PURPOSE: To analyze 100-m freestyle race from the 5th World DS Swimming Championships.

METHODS: The event was videotaped with two side view cameras, and 34 swimmers (17 men and 17 women) from the preliminary heats were analyzed for start, turn and swim times and stroke length (SL) and rate (SR). Mean and SD were obtained, Student t-tests and repeated measures ANOVA were computed to compare gender groups. Correlation analysis was performed between race components, stroking variables and end results (p<0.05).

RESULTS: There were significant differences between male and females swimmers in start time (6.07±0.47 & 7.37±0.99s), swim time (34.45±2.90 & 44.18±4.49s), turn time (32.36±2.64 & 37.90±3.85s), finish time (9.08±1.32 & 10.25±1.33s), final time (81.97±6.44 & 99.74±9.63s), speed (1.08±0.09 & 0.92±0.09m/s), and SL (1.65±1.6 & 1.38±1.7m); no differences between genders were observed for SR (43.16±8.47 & 40.78±5.45s/min). Differences within laps can be observed on Figure. The higher r values were obtained for swim time and final time (men: 0.97 & women: 0.91) and final time and turn time (men: 0.94 & women: 0.95). Inverse correlations were observed between stroke rate and stroke length (men: -0.67 & women: -0.76).

CONCLUSIONS: Male DS swimmers are significantly faster than female counterparts in the 100-m freestyle event. For a similar number of swim and turn times are most determinant for the final time and SL is determinant for swimming speed and not SR. Supported by FCT SFRH/BD/78513/2011

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**1919 Board #327** MAY 30  3:30 PM - 5:00 PM

Spatio-temporal Coordination in High Intensity Swimming

Pedro Figueroa 1, Ludovic Seifert 2, João Paulo Vilas-Boas 3, Ricardo J. Fernandes 1

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(No relationships reported)

Rhythmic inter-limb behavior in humans is characterized by intrinsic coordination modes: in-phase, the simultaneous contraction of homologous muscles (e.g. flexing or extending the arms simultaneously), and anti-phase, the simultaneous activation of non-homologous muscle groups (e.g. flexing one arm and extending the other one). The inter-limb coordination emerges due to changes in the constraints imposed on action. In swimming, temporal changes have been used to characterize coordination changes. However, its use could be completed with spatial data to enable spatial-temporal analysis.

PURPOSE: To assess the spatio-temporal coupling in front crawl upper limbs performed at high intensity swimming.

METHODS: Ten front crawl male competitive swimmers (21.6±2.4 yrs, 1.85±0.7 m, and 76.4±6.1 kg) swam 200 m front crawl at race pace. The swimming test was recorded by two above water and four underwater cameras operating at 50 Hz. The 21 body landmarks digitized (APASystem) underwent a three-dimensional direct linear transformation to yield the three-dimensional anatomical points position of one complete stroke cycle per each 50 m lap. The mean swimming velocity was calculated as the horizontal displacement of the whole body center of mass over its total duration. The spatio-temporal relationship between the upper limbs was quantified by the continuous relative phase. A one-way repeated measures ANOVA (Bonferroni post-hoc) and effect size (f) were used to analyze changes between the four moments over the 200 m (p<0.05).
1920  Board #328  MAY 30  3:30 PM - 5:00 PM
A Simple Instruction Increases Relative Contribution of Hip Extension Action during Concentric Cycling
(No relationships reported)

Previous authors have suggested that cycling performance can be improved by increasing relative contribution of the large, hip extension musculature. Hip extension torque functions to extend both the torso and the thigh.

PURPOSE: Determine the effect of torso extension on the relative contribution of hip extension during cycling.

METHODS: Four, recreational cyclists (75.7 ± 7.9 kg, 175 ± 5 cm) performed two submaximal cycling trials at approximately 250 watts and 80 rpm. During each trial, the participants were instructed to pedal with either their self selected technique, or to maintain the same torso position while reducing pressure on the handlebars by extending the torso. Pedal forces and limb kinematics were recorded. Joint moments were calculated using a sagittal plane, inverse dynamics model. Work produced during hip extension was determined from hip moment and hip angle data and was normalized to work delivered to the pedals. Normalized hip extension work from the self selected pedaling technique and the torso extension trials were compared with a paired Students t test.

RESULTS: The torso extension trials showed a significant decrease (p<0.05) in torso flexion and a significant increase (p<0.05) in hip extension joint moment during the first 50 m lap. The mean continuous relative work from the torso flexion joint moment decreased significantly (p<0.05) from 63.5±3.3 to 39.4±3.6% after the 50 m lap intervals. The mean continuous relative work from the hip extension joint moment increased significantly (p<0.05) from 13.5±3.9 to 19.8±3.9% after the 50 m lap intervals.

CONCLUSION: Front crawl swimming inter-limb relationship is strongly preserved in an anti-phase coordination mode despite the changes in velocity due to fatigue development. Supported by SFRH/BD/38462/2007 and PTDC/DES/101224/2008 (FCOMP-01-0124-FEDER-009577) FCT grants.

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1921  Board #329  MAY 30  3:30 PM - 5:00 PM
Insight To Muscle Activity During The Lacrosse Shot.
Ciro J. Agnello1, Jeffrey McClellan2, Jason Tarno2, Jason Nielson2, John A. Mercer, FACSM1, 1UNLV, Las Vegas, NV; 2Children’s Bone and Spine Surgery, Las Vegas, NV.
(No relationships reported)

An advanced lacrosse player typically has the ability to shoot both left- and right-handed. When shooting right-handed, the right arm is the top arm and the left the bottom arm. When shooting left-handed, the arms are switched. There is a lack of research on muscle activity of the top and bottom arms during shooting.

PURPOSE: The purpose of this study was to compare upper extremity muscle activity patterns during shooting right- and left-handed.

METHODS: Experienced high school male players (n=8; 1.7±0.1 m; 69.6±4.9 kg; 16.3±0.9 y) had the dominant instrumented with electromyography (EMG) leads to measure muscle activity of the flexor carpi radialis (FCR), extensor carpi radialis (ECR), biceps brachii (BB), triceps brachii (TB), anterior deltoid (AD), and latisimus dorsi (LD). The top arm elbow flexion/extension was recorded using an electrogoniometer. Subjects were instructed to shoot with either their self selected technique, or to maintain the same torso position while reducing pressure on the handlebars by extending the torso. Pedal forces and limb kinematics were recorded. Joint moments were calculated using a sagittal plane, inverse dynamics model. Work produced during hip extension was determined from hip moment and hip angle data and was normalized to work delivered to the pedals. Normalized hip extension work from the self selected pedaling technique and the torso extension trials were compared with a paired Students t test.

RESULTS: During the self selected and torso extension trials, hip extension activity contributed to 33 ± 8% and 48 ± 8% of total work, respectively (p = 0.01).

CONCLUSION: In cycling, the contribution of hip extension action to total work increased with a simple instruction to reduce handlebar pressure. Previous authors have suggested that experienced cyclists attempt to recruit greater involvement from the large hip extensor muscles, posing that such action may reduce localized metabolic stress. The current investigation demonstrated that a simple instruction caused a transfer of work so that the large muscles responsible for hip extension action made a greater contribution towards a given, submaximal workload. More research is needed to determine if these findings can contribute to a reduction in metabolic stress during a given workload, or to an enhancement in cycling performance. Additionally, understanding how to change the relative contribution of joint actions at the hip, knee, and ankle may have implications in rehabilitation settings, in which clinicians may want to specifically target hip extensors.

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1922  Board #330  MAY 30  3:30 PM - 5:00 PM
The Effect On Swimmer’s Hydrodynamic Drag Wearing Two Swimsuits
Daniel A. Marinhol1, Vishveshwar R. Mantha2, Rui J. Ramos3, Tiago M. Barbosa4, J. Paulo Vilas-Boas4, Abel I. Rouboua, António J. Silva4, 1University of Beira Interior / CIDESD, Covilhã, Portugal, 2University of Trás-os-Montes and Alto Douro / CIDESD, Vila Real, Portugal, 3Polytechnic Institute of Bragança / CIDESD, Bragança, Portugal, 4Porto Laboratory of Biomechanics / FADEUP, Porto, Portugal. (Sponsor: Carlo Baldari, FACSM)
(No relationships reported)

The popularization of polyurethane swimsuits has got a large media and sports attention around the pools in the past couple of seasons. However, little scientific evidence was reported in main literature about such relationship in this type of high-tech swimsuits.

PURPOSE: To analyze the effect of wearing a swimsuit on swimmer passive drag.

METHODS: A computational fluid dynamics analysis was carried out to determine the hydrodynamic drag of a female swimmer’s model: (i) wearing a textile swimsuit (ii) wearing a high-tech swimsuit (iii) with no swimsuit, wearing light underwear. The three-dimensional surface geometry of a female swimmer’s model with different swimsuit/underwear was acquired through standard commercial laser scanner. Passive drag force and drag coefficient were computed with the swimmer in a prone position at a depth of 0.75 m for a steady flow velocity of 2.0 m/s.

RESULTS: Higher hydrodynamic drag values were determined when the swimmer was with no swimsuit in comparison when the swimmer was wearing textile or a high-tech swimsuit. The high-tech swimsuit was the one with lower hydrodynamic drag values, although very similar to textile swimsuit (table 1).

Table 1. Drag coefficient and drag force values to each swimsuit condition.

<table>
<thead>
<tr>
<th>Swimsuit condition</th>
<th>Drag coefficient</th>
<th>Drag force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textile suit</td>
<td>0.323</td>
<td>76.23</td>
</tr>
<tr>
<td>High-tech suit</td>
<td>0.323</td>
<td>75.82</td>
</tr>
<tr>
<td>Underwear</td>
<td>0.453</td>
<td>80.84</td>
</tr>
</tbody>
</table>

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CONCLUSIONS: One can state that wearing a swimsuit may positively influence swimmer’s hydrodynamics, especially reducing the pressure drag component. Moreover, minor differences were obtained between a standard and a high-tech swimsuit.

The Portuguese Government supported this work by a grant of the Science and Technology Foundation (PTDC/DES/098532/2008; FCOMP-01-0124-FEDER-009569).

1923 Board #331 MAY 30 3:30 PM - 5:00 PM Changes in Speed Skating Technique are Related to Changes in Skating Velocity Dione A. Noordhoff, Carl Foster, FACSM, Marco J. M. Huizeman, Jos J. de Koning, FACSM. VU University, Amsterdam, Netherlands. University of Wisconsin-La Crosse, La Crosse, WI. (No relationships reported)

BACKGROUND: Efficiency is an important parameter in endurance sports. In speed skating the push-off angle, or effectiveness (e), is most likely related to efficiency. As the skating posture favors lactate accumulation resulting in muscle fatigue, we hypothesized that skating efficiency decreases during a race.

PURPOSE: To evaluate the change in e and skating velocity (v) during a 5000 m speed skating race and to determine whether Δe is associated with Δv.

METHODS: Video recordings were made during a 5000 m ISU World Cup race (n = 34 males). Two FACAM mini DV cameras were placed outside the track, in line with the straight part of the lap. Ones every 400 m lap pixel coordinates of the middle of the push-off leg at the height of the hip and the tip of the skate blade were determined just before opening the hinge of the klapskate. was determined, as the angle between the push-off leg and the horizontal. The average v was determined over the same part of the track. To increase precision, e and v were averaged over 3 successive laps, and differences were determined between these averages: The association between Δe and Δv, accounting for the effect of part of the race, was determined with Generalized Estimating Equations (GEE).

RESULTS: Fig. 1 shows that e increased and v decreased during the race. The interaction between Alap and Δe, which would indicate a different association between Δe and Δv for each of the Alaps, was not significant. Therefore, Alap was only included as a confounder in the regression (not significant), which resulted in a significant association between Δe and Δv (β = -0.066, p < 0.001).

CONCLUSION: During a 5000 m speed skating race e increased and v decreased. Besides that, Δe is significantly associated with Δv, independent of part of the race.

1924 Board #332 MAY 30 3:30 PM - 5:00 PM Hip And Knee Joint Mechanics During Cutting Maneuver With And Without A Lacrosse Stick Manabu Sanomura, Masanori Sakaguchi, Yasuaki Saho, Toru Fukubayashi. Waseda university, Saitama, Japan. (No relationships reported)

Most non-contact anterior cruciate ligament (ACL) injuries occur during jumping and cutting maneuvers. Women’s lacrosse is associated with a higher incidence rate of ACL injuries than other women’s sports. Lacrosse-specific movements such as jumping and cutting maneuvers with a lacrosse stick cause compensatory lower limb motions such as excessive knee abduction and hip adduction.

PURPOSE: To compare the hip and knee joint kinetics and kinematics during a cutting maneuver with and without a lacrosse stick.

METHODS: Nine female collegiate lacrosse players (mean age, 20.0 ± 1.3 years; height, 159.6 ± 5.8 cm; weight, 55.1 ± 6.3 kg; lacrosse experience, 24 ± 3.4 months) participated in this study. Thirty-six reflective markers were placed on the upper limb, trunk, pelvis, and right lower limb. An eight-camera motion analysis system (Motion Analysis Corp.) and a force plate (Kistler Corp.) were used to record the three-dimensional marker positions and ground reaction forces sampled at 240 Hz and 2400 Hz, respectively, during the cutting maneuver. The subjects were instructed to run a distance of 4-5 m and then land with their right foot on a force plate, followed by a change in direction to the left to cut an angle of 45°. Each trial was performed while holding a lacrosse stick in the right hand (with their right and left hands on the top and bottom of the shaft, respectively; RH), left hand (with their left and right hands on the top and bottom of the shaft, respectively; LH), and not holding a lacrosse stick (NH). The peak values of knee abduction angle, hip adduction angle, knee abduction moment, and hip adduction moment during the stance phase of the cutting maneuver were analyzed.

RESULTS: The peak hip adduction angle in the RH trial was significantly greater than that in the NH trial (5.7 ± 5.8° vs. 1.1 ± 7.9°, p = 0.041), and the peak hip adduction moment in the RH trial was significantly higher than that in the NH trial (2.02 ± 0.63 vs. 1.76 ± 0.56 Nm/(kg*h), p = 0.043). Moderate positive correlation coefficients were observed between DAC SBV and PPRV during the forward swing phase (r = 0.47), PUTRV during the forward swing phase (r = -0.066), and PPTSA at the top of the back swing phase (r = 0.56). A multiple regression analysis predicting SBV from the rotational variables for DAC spikes resulted in a statistically significant multiple R² value (R² = 0.58). The most important predictor of SBV was PPTSA. Additionally, a low to moderate positive correlation (r = 0.31) was observed between SBV and PPTSA at the top of the back swing phase for the DL spikes. A multiple regression analysis for DL spike was not statistically significant.

CONCLUSION: The results of this study suggested that the cutting maneuvers with a lacrosse stick have significant effect on hip joint mechanics which has been implicated as a risk factor for non-contact ACL injury compared to those without a lacrosse stick.

1925 Board #333 MAY 30 3:30 PM - 5:00 PM Rotational Velocities, Pelvic: Torso Separation, and Spiked Ball Velocity in Female Collegiate Volleyball Athletes Charlie A. Hicks-Little, Patricia A. Eisenman, FACSM, Michael Waller, Justin Brown, Bader J. Alsarraf. University of Utah, Salt Lake City, UT. (No relationships reported)

High velocity spikes provide a competitive advantage in volleyball. High ball velocity in other rotational skills, like the baseball pitch and golf swing, is achieved by initiating pelvic rotation before torso rotation (Pelvic: Torso Separation Angle) in combination with high rotational velocities of the pelvis and torso. Little is known about the contribution of pelvic and torso rotational velocities and the amount of separation of the pelvic and torso rotation on ball velocity during the spike.

PURPOSE: The primary aim of the current study was to examine the influence of peak pelvic rotational velocity (PPRV), peak upper torso rotational velocity (PUTRV), and peak pelvic torso separation angle (PPTSA) on spiked ball velocity (SBV) during both down-the-line (DL) and diagonally across-court (DAC) spikes.

METHODS: Three-dimension motion capture data was used to examine the kinematics of the volleyball spike. Fourteen collegiate female players (20.9±2.8 yrs) were fitted with 21 reflective markers; each performed 10 DL spikes and 10 DAC spikes. Differences in SBV, PUTRV, PPRV, and PPTSA between DL and DAC spikes were determined by using a two-way factor mixed repeated measures factor ANOVA. Correlations were used to examine relationships between the kinematic variables and SBV.

RESULTS: Statistically significant differences between the DL and DAC spikes were observed for SBV (17.5±2.5 m/s vs. 15.9±2.3 m/s, p < 0.039) and for PPTSA (-9.1±6.5° vs. -12.6±5.3°, p = 0.043). Moderate positive correlation coefficients were observed between DAC SBV and PPRV during the forward swing phase (r = 0.47), PUTRV during the forward swing phase (r = 0.066), and PPTSA at the top of the back swing phase (r = 0.56). A multiple regression analysis predicting SBV from the rotational variables for DAC spikes resulted in a statistically significant multiple R² value (R² = 0.58). The most important predictor of SBV was PPTSA. Additionally, a low to moderate positive correlation (r = 0.31) was observed between SBV and PPTSA at the top of the back swing phase for the DL spikes. A multiple regression analysis for DL spike was not statistically significant.

CONCLUSION: PPTSA is an important contributor to DAC SBV. Further research is warranted to determine if PPTSA can be altered, thus improving SBV.

1926 Board #334 MAY 30 3:30 PM - 5:00 PM Intra-limb Coordination In Karate Roundhouse Kick Federico Quinzi, Valentina Camonilla, Paola Shriccoli. Rome Foro Italico, Rome, Italy. (Sponsor: Carl Foster, FACSM) (No relationships reported)

INTRODUCTION: Intra-limb coordination in sport activities has been the focus of many studies, where it has been quantified using Continue Relative Phase (CRP). In martial arts no previous study investigated lower limb coordination during kicking actions.

PURPOSE: The aim of this study is to investigate differences in CRP in elite athletes performing the roundhouse kick, directed respectively to the opponent’s face (HRK) and waist (LRK).

METHODS: After signing informed consent, 6 elite karateka volunteered to participate in this study. All subjects performed 3 trials of each kick (HRK, LRK). Pelvis and lower limb kinematics were acquired with a stereophotogrammetric system (Vicon System), using the CAST protocol. Intra-limb coordination was computed for the Hip and Knee joints of the kicking leg
on the sagittal plane starting from the ready stance to knee full extension (considered as the end of the kick). For both joints, the Phase Plots (PP) was generated by plotting the normalized angular displacement vs. the normalized angular velocity (Li et al. 1999). Subsequently, for each joint the angle between the positive horizontal axis and each point of the PP was computed (Phase Angle-PA). The Continue Relative Phase (CRP) was computed by subtracting the PA of the Distal segment from that of the Proximal one. A CRP value of 0 rad means in-phase movement whereas ±5.314 rad means anti-phase movement. In order to test for differences between the CRP of HRK and LRK, a repeated measures ANOVA was performed on the CRP mean peak.

RESULTS: The CRP differentiated the kicks only from 51 to 80% of the kick corresponding to Hip and Knee flexion phase: being higher in the HRK from 51 to 70% (51-60%: HRK 0.47±0.07 rad; LRK 0.20±0.04 rad; 61-70%: HRK 1.34±0.07 rad; LRK 0.55±0.08 rad; pc. 0.002) and then in the LRK from 71 to 80% (LRK 1.21±0.14 rad; HRK 0.58±0.10 rad; pc.0.002).

CONCLUSION: Kicking height influences the timing but not the magnitude of Hip and Knee flexion-extension CRP mean peak in Karate elite athletes. This difference in timing might be attributed to differences in the occurrence of angular velocity peak between the two joints during the flexion phase.

REFERENCES


1927 Board #335 MAY 30 3:30 PM - 5:00 PM
Gender Differences in Plantar Loading During Unanticipated Cutting on FieldTurf
Conon Irwin, Robert J. Butler, Claude T. Moorman, III, William E. Garrett, Jr, FACSM, Robin M. Queen. Duke University, Durham, NC.

Fifth metatarsal stress fractures are more common in men and have a high incidence of delayed union, non-union, and re-fracture. Cleat plate design has been altered to avoid loading beneath the fifth metatarsal, however, gender differences in loading patterns were not considered in the design process.

PURPOSE: To determine if total foot, lateral midfoot (LMF) and lateral forefoot (LFF) loading (as defined by maximum force [MF], contact area [CA], and force-time integral [FTI]) were significantly different between men and women when performing an unanticipated cut on FieldTurf.

METHODS: Plantar loading in 32 (16 men, 16 women) healthy, collegiate, recreational athletes was evaluated using the Pedar-X in-shoe system collecting at 100Hz (Novel, St. Paul, MN, USA). Exclusions included any lower extremity injuries in the past 6 months, foot or ankle surgery in the past 3 years, and previous metatarsal stress fractures. Subjects completed 12 unanticipated cutting trials in a firm ground soccer cleat on FieldTurf. Subjects were asked to run straight forward until a light came on to have them cut to the left or right at which time they cut 45 degrees in the indicated direction. The plant foot was used for analysis. A series of independent t-tests were used to examine differences between genders during unanticipated cutting (α=0.05).

RESULTS: Men were significantly taller and heavier than the women (P<0.001). CA was greater for the women in the LMF (8.3%, P=0.046) and the LFF (9.9%, P<0.001). The FTI was greater beneath the total foot for the men when compared to the women (23.9%, P<0.001), with no significant differences in the LMF and LFF. MF was greater for the women than the men in the LMF (21.7%, P=0.001) and the LFF (17.2%, P=0.001).

CONCLUSIONS: During unanticipated cutting, women loaded the lateral column of the foot more than men, which is contrary to the current literature. Future work will need to examine the differences between genders to determine the need for gender specific footwear design as well as to determine if different cleat plate configurations are able to optimize foot loading patterns while completing an unanticipated cutting task.

1928 Board #336 MAY 30 3:30 PM - 5:00 PM
Biomechanical Measures of the Knee Predict Anterior Cruciate Ligament Injury Risk in Female Basketball Athletes
Heng-Ju Lee, Tung-Hsi Tseng, Yu-Ming Lee. National Taiwan Normal University, Taipei, Taiwan.

(Bioinformatics) One-way ANOVA with significance level of 0.05 was used to compare biomechanical measures of the supporting leg between two different step maneuvers, RESULTS: Knee anterior shear force (5.05±4.88 vs. 3.55±1.17 N/kg, P=0.05), knee valgus moment (0.66±0.17 vs. 0.20±0.10 Nm/kg, P=0.05) and hip flexion moment (0.81±0.60 vs. 0.51±0.34 Nm/kg, P=0.05) during cutting were significant greater than cross over step maneuver of the supporting leg.

CONCLUSION: Knee anterior shear forces and valgus moments were the primary predictors of ACL injury risk. Physiologic valgus torques on the knee can increase anterior tibia1 translation and loads on the ACL by several-fold. The current findings indicate that female basketball players might have higher risk of knee injury during cutting step than cross over step maneuver. Supported by NSC grant 100-2628-H-003-013-MY2.

1929 Board #337 MAY 30 3:30 PM - 5:00 PM
Footwear Intervene in Typical Badminton Movement
Yaodong Gu1, Jianshe Li2, Zhiyong Li1. 1Ningbo University, Ningbo, China. 2Ningbo University, ningbo, China. 3Southeast University, Nanjing, China.

(Bioinformatics) One-way ANOVA with significance level of 0.05 was used to compare biomechanical measures of the supporting leg between two different step maneuvers, RESULTS: The contact time of whole lunge step in BS is significantly larger than the TS (P<0.05), as the mean value of movement completion in former condition is 0.68s, and the latter condition is 0.59s. Although the peak reaction force in BS (961N) is smaller than this in TS (978N), no significant different exist (P>0.05). Meanwhile, the peak friction force in BS is significantly larger than this in TS (386N vs. 361N, P<0.05).

CONCLUSIONS: From the experimental results finding in this study, it suggested that BS had certain advantages in preventing injury and improving performance through the good ground grip ability. The cause is likely that material and stripe pattern in the sole of BS can better increase friction between outsole and ground.
Success of competitive figure skaters (FS) is heavily dependent on the quality of jump landings. Though landing technique is emphasized during training, most FS injuries occur in the lower back and lower extremities. Impact force properties such as time to stabilization (TTS) of ground reaction forces (GRF) and peak relative GRF (GRF/Body Weight) axes. A backward single leg landing (SLL) test, compared with NS: 1) FS would have lower TTS; and, 2) greater GRF along the M-L (1.97±0.93 vs. 1.12±0.48 N/kg), A-P (10.42±3.34 vs. 2.24±1.63 N/kg), and vertical (37.64±7.60 vs. 30.28±6.62 N/kg) axes.

CONCLUSIONS: Hypothesis one was not supported as FS exhibited greater TTS than NS along the A-P and vertical axes. This may have been due to the unfamiliarity of landing barefoot rather than in a skate boot, and/or of landing in a stationary position rather than gliding backwards. Hypothesis two was supported as FS demonstrated greater GRF than NS along all three axes, a result previously documented in gymnasts. Future studies should explore the effectiveness of interventions aimed at decreasing GRF in FS either through technique or equipment modifications.

1831 Board #340 MAY 30 3:30 PM - 5:00 PM
Grip Force And Muscle Activity Are Associated With Cinematics In The Golf Swing
James Parker, M Charlotte Olsson, Sofia Brorsson. School of Business and engineering, Halmstad, Sweden.

PURPOSE: Golf is a popular sport in the world, today there is little limited information in the literature that discusses the hand motion and grip force and its relation to the golf swing. A better understanding of how the interaction between grip force, muscle activity and coordination influences the shot length in a golf swing would be beneficial to improve the game for both elite and recreational golfers. Thus, the purpose of this study was to analyze if grip force (finger extension and flexion force) and muscle activity in the forearm were associated to kinematics in the golf swing and to shot length.

METHODS: Seven elite golf players (mean age: 22.4 years) were included in the study. Primary outcomes were shot length, finger extension- and flexion force, and muscle activity measured with surface electromyography on the m. extensor digitorum communis (EDC) and the m. flexor carpi radialis (FCR) when performing a golf swing. Maximal voluntary isometric contraction for flexion- and finger extension force was measured one the dominant hand. Each subject was instructed to take five ‘normal’ swings with their 7-iron and hit into a net 8 meters from the tee area. EMG was synchronized with kinematic data and split the swing up in three phases, backswing, downswing and follow through.

RESULTS: Finger extension force was 54±20 N and grip force was 42±108 N in the group. Both extension (r=0.81, p<0.01) - and flexion force (r=0.78, p<0.01) were positively associated with shot length. Muscle activity in both FCR and EDC was significantly different in the three swing phases (p<0.02), and the muscle activity in all phases were related to shot length (p<0.02).

CONCLUSIONS: This study showed that increased grip force and muscle activity in all phases of the swing is positively associated with shot length. These results indicates that both maximal grip force and high muscle activity in the FCR and EDC can be important factors for increasing shot length, and that a highly coordinated pattern between these muscles are useful in order to maximize shot distance.

1933 Board #341 Abstract Withdrawn

1934 Board #342 MAY 30 3:30 PM - 5:00 PM
Different Pacing Strategies during Time Trials in 18°C and 30°C.
Bart Roeland,1 Jos de Koning, FACS/M, Floor Hettinga,1 Romain Meeusen, FACS/M,1 Vrije Universiteit Brussel, Brussels, Belgium.2 VU-University Amsterdam, Amsterdam, Netherlands.1 University of Groningen, Groningen, Netherlands.

PURPOSE: To determine maximal T-C and P-C relationships of sprint track cyclists in seated and standing positions.

METHODS: Twenty-six female FS (14.7±4.5 yr, and 50.4±11.8 kg) with a wide range of competition experience (5.4±3.1 yr) and 18 NS controls (15.4±5.3, and 54.1±14.7 kg) completed three trials of a backward SLL from a 20cm high platform. GRF data along the mediolateral (M-L), anteroposterior (A-P), and vertical axes were collected from a single force plate at 1000 Hz and subsequently low-pass filtered at 10 Hz with a fourth-order zero-lag Butterworth filter. From that data we were able to calculate TTS and GRF. Between group differences in TTS (M-L, A-P, and vertical) and GRF (M-L, A-P, and vertical) were determined with two-tailed two-sample t-tests. Significance level was set a priori at P < 0.05.

RESULTS: While there were no differences between FS and NS in M-L TTS (2.44±0.54 s, and 2.50±0.50 s, respectively), FS had significantly greater A-P TTS (2.86±0.10 s vs. 2.75±0.11 s) and vertical TTS (2.38±0.07 s vs. 2.22±0.07 s). FS had significantly greater GRF along the M-L (1.19±0.93 vs. 1.12±0.48 N/kg), A-P (10.42±3.34 vs. 2.24±1.63 N/kg), and vertical (37.64±7.60 vs. 30.28±6.62 N/kg) axes.

CONCLUSIONS: The analysis of track sprint cyclists’ performances can be improved by the determination of position-specific maximal T-C and P-C relationships.
1935  Board #343  MAY 30  3:30 PM - 5:00 PM
Modeling Relationships between Swimming Attributes for Performance Prediction
Bahadorreza Ofoghi1, Danielle Stefano2, John Zeleznikow1, Claire MacMahon1. 1Victoria University, Melbourne, Australia. 2Vicotorian Institute of Sport, Melbourne, Australia.
(No relationships reported)
Swimming is a high profile sport in which an athlete with the fastest overall time wins and even a very small difference in overall times is decisive for medal winning. The inter-relationships between different swimming attributes and the overall time can be used to predict and optimize overall times hence to increase the medal winning chance.

METHODS: A linear regression analysis was performed to model the pair-wise inter-relationships between swimming attributes and the overall times in specific subsets of swims from a database of international events, filtered based on sex, age group, stroke, pool size, and distance. The F-statistic was calculated to evaluate regression models.

RESULTS: Examples of the results are shown in Table 1. In many cases, as evidenced by the small F-statistics, no significant relationship was found between attributes. We found this was the result of many missing values for those attributes. In some cases, no values were reported for the performance attributes, resulting in a “<” in Table 1. In some other cases, e.g., breath count in M, freestyle, 50m, lcm, open swims, a significant relationship was found thus the model could be used for predicting overall times.

CONCLUSION: The linear regression analysis of swimming attributes requires more sophisticated analysis that can handle the large number of missing values. Where enough data exists; however, this model can effectively be used for prediction of overall swim times.

Table 1. Examples of the evaluation results of linear regression analysis of swimming performance attributes and overall times

<table>
<thead>
<tr>
<th>Swims (sex, stroke, distance, pool size, age group)</th>
<th>p-statistic for some swimming performance attributes</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>M, breaststroke, 100m, lcm, open</td>
<td>0.3002</td>
<td>0.6533</td>
</tr>
<tr>
<td>M, butterfly, 50m, lcm, open</td>
<td>0.0007</td>
<td>0.0099</td>
</tr>
<tr>
<td>M, freestyle, 50m, lcm, open</td>
<td>0.6383</td>
<td>0.0515</td>
</tr>
<tr>
<td>F, breaststroke, 50m, lcm, open</td>
<td>0.4759</td>
<td>0.0041</td>
</tr>
<tr>
<td>F, individual medley, 200m, lcm, open</td>
<td>0.2015</td>
<td>0.5870</td>
</tr>
<tr>
<td>F, freestyle, 50m, lcm, open</td>
<td>0.0143</td>
<td>0.0140</td>
</tr>
</tbody>
</table>

1936  Board #344  MAY 30  3:30 PM - 5:00 PM
Delivery and Pitch Type After Ground Reaction Forces in Baseball Pitching
Michael E. Feltner, FACSM, Garrett Kass. Pepperdine University, Malibu, CA.
(No relationships reported)
Ground reaction forces (GRFs) exerted on a pitcher in reaction to the push of their legs against the ground create torques about the center-of-mass (CM) and generate the angular momentum necessary to rotate the body, including the segments of the throwing arm. Thus examination of GRFs provides insight into the causal mechanisms responsible for segmental rotation in baseball pitching.

PURPOSE: To determine the effects of delivery [wind-up (WU) vs. stretch (ST)] and pitch type [fastball (FB) vs. change-up (CU)] on GRFs in pitching.

METHODS: Eight collegiate baseball pitchers (3 right-handed and 5 left-handed) provided voluntary informed consent and threw maximal effort FB and CU pitches from the WU and ST positions from a regulation indoor pitching mound. Five pitches of each type were thrown from each delivery position. Two Kistler (Model 9281B) force plates mounted rigidly to the floor and imbedded in the pitching mound recorded GRFs (1200 Hz) under the push-off and stride foot, respectively. A video camera (60 Hz) was used to estimate the instant of ball release and a radar gun (JUGS Pro-Sports Model; accuracy ± 0.25 m/s) recorded ball speed. Comparisons of the GRF variables were made using two-way repeated measures ANOVA.

RESULTS: As expected, FB pitches had a higher ball speed relative to CU pitches (37.3±1.3 m/s vs. 33.3±1.9 m/s; p<0.01); ball speed did not differ by delivery type. No pitch by delivery interactions were present. FB pitches had larger peak magnitude GRFs exerted in the anterior direction (direction of the pitch) on the push-off foot (FB: 0.78±0.13; CU: 0.75±0.14 BW; p<0.05) and exerted in the posterior direction on the stride foot (FB: -1.12±0.13; CU: -1.03±0.12 BW; p<0.01). WU pitches had larger mediolateral GRFs directed toward the throwing arm side exerted on the push-off foot (WU: 0.14±0.03; ST: 0.07±0.04 BW; p<0.01) and larger GRFs directed perpendicular to the surface of the mound (WU: 1.44±0.32; ST: 1.84±0.30 BW; p<0.05) exerted on the stride foot.

CONCLUSIONS: FB pitches require greater anteriorly directed forces on the push leg to accelerate the pitcher forward and larger posteriorly directed forces on the stride leg to decrease the forward momentum of the pitcher. WU pitches involve a greater mediolateral range-of-motion of the CM and require larger mediolateral forces exerted on the push-off foot.

1937  Board #345  MAY 30  3:30 PM - 5:00 PM
Influence Of Exercise-induced Fatigue On Submaximal And Maximal Joint-specific Power Production
Steven J. Elmer1, Camden S. Marshall1, Kyle W. Wehmanen1, Markus Amann1, John McDaniel2, David T. Martin1, James C. Martin, FACSM1. 1University of Utah, Salt Lake City, UT. 2Kent State University, Kent, OH. 3Australian Institute of Sport, Canberra, Australia.
(No relationships reported)
Previous authors have reported reductions in maximum power after high-intensity endurance exercise. Exercise-induced changes in power produced by ankle, knee, and hip joint actions (joint-specific powers), however, have not been reported.
PURPOSE: To evaluate joint-specific power production during a cycling time trial (TT) and also compare pre- to post-TT changes in maximal cycling (MAX_cyc) joint-specific powers.

METHODS: Ten male cyclists performed MAX_cyc trials (90 rpm) before and after a 10 min TT (288 ± 10W, 90 rpm). Pedal forces and limb kinematics were determined with a force-sensing pedal and an instrumental spatial linkage, respectively. Joint-specific powers were calculated and averaged over complete pedal cycles and over extension and flexion phases.

RESULTS: Absolute pedal and joint-specific powers did not change during the TT. Pedal power produced during post-TT MAX_cyc was reduced by 32 ± 3% (P < 0.001) relative to pre-TT. Relative pre- to post-TT changes in ankle plantar flexion (43±5%) and knee flexion powers (52 ± 5%) were similar but were greater than changes in knee extension (12 ± 4%) and hip extension powers (28 ± 6%) (P < 0.05). Pedal and joint-specific powers produced during post-TT MAX_cyc were greater than those powers produced during the final 3s of the TT (P < 0.05).

CONCLUSION: Exercise-induced changes in MAX_cyc power manifested with differential power loss at each joint action with ankle plantar flexion and knee flexion exhibiting relatively greater fatigue than knee extension and hip extension. However, changes in MAX_cyc joint-specific powers were not presaged by changes in TT joint-specific powers. Despite working near maximal effort at the end the TT, participants had considerable neuromuscular reserve as they were able to produce substantially greater power during post-TT MAX_cyc. We conclude that fatigue induced via high-intensity cycling does not alter submaximal joint-specific power production but has distinct functional consequences for maximal cycling joint-specific powers.

<table>
<thead>
<tr>
<th>BL (deg)</th>
<th>SA (deg)</th>
<th>AA (deg)</th>
<th>MLD (m)</th>
<th>APD (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made</td>
<td>228 (+18)</td>
<td>102 (+10)</td>
<td>34 (+3)</td>
<td>0.79 (+0.05)</td>
</tr>
<tr>
<td>Missed</td>
<td>197 (+21)</td>
<td>97 (+10)</td>
<td>34 (+3)</td>
<td>0.36 (+0.08)</td>
</tr>
<tr>
<td>Level</td>
<td>0.81</td>
<td>0.14</td>
<td>0.97</td>
<td>0.46</td>
</tr>
</tbody>
</table>

1938 Board #346 MAY 30 3:30 PM - 5:00 PM
Kinematic Factors Related to Accuracy for Placekicking in American Football

American football placekickers can score a majority of the team’s points and often determine the outcome of a game. Despite the importance of the position and the popularity of football, little effort has been made to quantify the biomechanical aspects of placekick accuracy.

PURPOSE: To analyze biomechanical factors known to be related to accuracy during made and missed placekicks.

METHODS: Five experienced male placekickers were analyzed in three-dimension using two cameras (JVC 240Hz) and motion analysis software (Vicon-Peak Performance Inc. Motus). Each subject performed seven trials, kicking from 40 yards away from the post and dead center. Five variables known to affect kicking accuracy were selected: body lean angle (BL), side arm angle (SA), approach angle (AA), mediolateral plant foot distance from the ball (MLD), and anteroposterior plant foot distance from the ball (APD). All variables were analyzed using dependent t-test (α = 0.01, SPSS, Chicago, IL). 

RESULTS: No significant differences were found between made and missed placekicks (Table 1).

CONCLUSION: For the variables measured, the findings indicate no significant changes in placekicking mechanics between kicks that were made or missed. The participants in this study performed similar mechanics between kicks and can be considered “well coached” in terms of current coaching perspectives. This indicates the overall complexity of the placekick. The findings necessitate further biomechanics research, particularly with the timing aspects of the placekick.

Table 1. Average body lean angle (BL), side arm angle (SA), approach angle (AA), mediolateral plant foot distance (MLD), and anteroposterior plant foot distance (APD) measurements for made and missed attempts.

1939 Board #347 MAY 30 3:30 PM - 5:00 PM
Automatic 3D Motion Capture of Swimming: Marker Resistance
Per-Ludvik Kjendlie, Bjørn Harald Olstad. Norwegian School of Sport Science, OSLO, Norway.

Motion capture (mo-cap) of swimmers have traditionally been done using manual digitalization of body points. New technology makes automatic 3D mo-cap available for aquatic purposes, and necessitates methodological studies.

PURPOSE: The aim of this study was to pioneer a 3D automatic mo-cap system used on human swimmers and to find the increased drag on human swimmers due to mo-cap markers attached to a swimmers body.

METHODS: Two subjects performed a total of 80 push-offs with an 8 m underwater gliding phase. During each test, the velocity of the swimmer's body was recorded using a Qualisys automatic tracking 3D motion capture system. Six underwater motion capture cameras (Oqus Underwater, Qualysis, Sweden) recorded spherical markers attached to the swimmer, using cyan LED light. Using inverse dynamics the drag coefficient was estimated in 40 tests wearing only 3 markers and compared to 40 tests where a total of 24 markers were attached to the swimmer. All markers had a diameter of 19mm.

RESULTS: The mean (±sd) passive drag coefficient when gliding with 24 markers was 0.49±0.72 and 26.37±0.96 for the two subjects respectively. Without markers the drag coefficients were 28.49±1.40 and 23.87±0.97 respectively. There was a statistically significant higher drag when wearing markers compared to without (p<0.01), the difference averaging to 7% and 10% for the two subjects respectively, and the effect sizes were large and 1.17 and 2.57 respectively.

CONCLUSION: Although spherical markers at a sufficient size are necessary for accurate motion capture under water, these markers create a significant increase in the passive drag of swimmers. This should be taken into account when making kinematical analyses with this system in the aquatic space. The importance of the position and the popularity of football, little effort has been made to quantify the biomechanical aspects of placekick accuracy.

B-41 Free Communication/Poster - Strategies to Reduce Heat Stress
MAY 30, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

1940 Board #348 MAY 30 2:00 PM - 3:30 PM
Passive Cooling Effects on Microenvironmental and Thermoregulatory Responses in Soft Body Armor in Hot Environments
Greg A. Ryan1, Charles P. Katic1, Stacy H. Bishop1, Robert L. Herron1, Andy M. Bosak2, Phillip Bishop2.1University of Alabama, Tuscaloosa, AL.2Georgia Southwestern State University, Americus, GA.

It has been well established that convective heat loss is reliant on the temperature gradient between the skin and the microenvironment and the volume of air movement over the skin. When either is compromised, excess heat is stored, raising core body temperature (Trec). This heat storage is further attenuated when an individual is wearing soft body armor (SBA) which inhibits...
convective and evaporative heat loss. In the case of police and military personnel, where SBA use is required, any reduction in heat storage may be able to greatly reduce mortality and morbidity from heat injury. One way to possibly circumvent this excess heat storage is to promote the "chimney effect", which can be achieved by promoting airflow through bodily movement or by creating vents, and may be beneficial in controlling heat strain.

**PURPOSE:** The purpose of this study was to investigate the effects of adding 1.27 cm standoffs to a Class II Soft Body Armor (SBA) on heat strain and perceived comfort compared to traditionally worn SBA.

**METHODS:** A counterbalanced, repeated measures protocol was performed with seven volunteers (20 ± 2 yr). Prior to each trial, participants were outfitted with a SBA in a traditional vest carrier or one fitted with 1.27 cm standoffs which moved the SBA off the body. Each participant performed cycles of 12 minutes of walking (1.25 L/min) and three minutes of arm curls (14.3 kg, 0.6 L/min) with a five min rest after every other cycle for a total of 120 min in a hot, humid environment (32°C, 80% RH). During each trial the following variables were recorded every six min: Trec; SBA micromelate (temperature and humidity [Buttons]); skin temp (forearm, chest); heart rate; thermal comfort; and perceived exertion. Sweat rate was calculated at the end of each trial. Paired t-tests were used to evaluate: Trec (main determinant); micromelate; heart rate; sweat rate; perceived exertion; and comfort.

**RESULTS:** No significant differences (p < 0.05) were noted between the standoff condition and the control in any of the variables tested. The micromelate under the SBA was warmer than the macromelate during the majority of the tests.

**CONCLUSIONS:** The results indicate that in a controlled environment, the addition of standoffs on Class II SBA did not improve the body’s ability to dissipate heat relative to traditional SBA.

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**1941**

**Board #349**

**MAY 30**

**2:00 PM - 3:30 PM**

**Passive Vents in CB Uniforms During Low Dressed States Improve Tolerance During High Dressed States**

Tom M. McElhan, FACSM1, Cathy Boscarmo1, EJ Scott Duncan1, 2 DRDC - Toronto, Toronto, ON, Canada. 2 DRDC - Suffield, Medicine Hat, AB, Canada. (No relationships reported)

New lightweight protective assault uniforms (PTAUs) that can be worn as a stand-alone uniform and provide, as required, protection in a chemical and biological (CB) environment are being developed for unique tactical combat situations. The PTAU is designed to lower heat strain and increase tolerance time (TT) when worn in the highest protective dressed state (DShigh) but also is intended to replace the battle dress uniform (BDU) and worn when the threat is low, during DShigh.

**PURPOSE:** The purposes of these studies were twofold; first, to examine whether the use of vents in the arms, legs and chest of the PTAU reduced heat strain during DShigh, and second, to determine whether the use of vents in the PTAU improved TT after the transition to DShigh compared with the use of the BDU and overgarment (BDU+O).

**METHODS:** In study 1, six males (27 ± 4 yr, 77 ± 9 kg, 177 ± 5 cm) performed a familiarization session and 4 trials (2 PTAUs with vents open or closed) at 35°C and 50% relative humidity with low wind (1 m/s) walking at 4.5 km/h for 90 min in DShigh. For study 2, seven males (27 ± 4 yr, 78 ± 8 kg, 177 ± 5 cm) performed 3 trials (2 PTAUs with vents open during DShigh and BDU+O) which included up to a further 90 min in DShigh. All trials included wearing a helmet, fragmentation and tactical assault vests, and carrying a rifle.

**RESULTS:** In Study 1, core temperature (Tc), heart rate and vapor pressures over the thigh and shin were reduced significantly during DShigh at 90 min when vents were open (37.9 ± 0.2°C, 120 ± 10 b/min, 3.7 ± 0.4 and 3.5 ± 1.0 kPa) vs closed (38.0 ± 0.1°C, 127 ± 5 b/min, 4.3 ± 0.3 and 4.6 ± 0.5 kPa). The vents had no effect on weighted mean skin temperature, ratings of perceived exertion or thermal comfort. In Study 2, there was no difference in physiological strain during DShigh when the vents were open vs the PTAUs compared with BDU. After the transition to DShigh, the rate of increase in Tc, heart rate and TT increased significantly with the PTAUs (1.1 ± 0.2°C/h and 46 ± 24 min) vs BDU+O (1.6 ± 0.2°C/h and 33 ± 16 min).

**CONCLUSION:** It was concluded that the use of vents in the legs of the PTAU reduced heat strain during DShigh when a fragmentation vest was worn and a rifle was carried. Further, physiological strain during DShigh with the use of vents in the PTAU was similar to the BDU thereby extending TT and reducing the increase in Tc after the transition to DShigh compared with BDU+O.

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**1942**

**Board #350**

**MAY 30**

**2:00 PM - 3:30 PM**

**Bomb Disposal In The Tropics: An Explosive Cocktail Of Environmental And Metabolic Heat**

Ian B. Stewart, Andrew D. Townshend, Amanda M. Rojek, Andrew P. Hunt. Queensland University of Technology, Brisbane, Australia. (Sponsor: Ed Melanson, FACSM)

(No relationships reported)

Bomb technicians perform their work while encapsulated in explosive ordnance disposal (EOD) suits. Designed primarily for safety, these suits have an unintended consequence of impairing the body’s natural mechanisms for heat dissipation. In tropical environments the potential for heat illness is increased.

**PURPOSE:** To quantify the heat strain encountered during an EOD operational scenario in the tropical north of Australia.

**METHODS:** All active police bomb technicians, located in a tropical region of Australia (n=4, experience 7±2.1 yrs, age 34±4.9 yrs, height 183±4.7 cm, body mass 87±6.6 kg, VO2max 43±4.6 mL/kg/min) undertook an operational scenario wearing the Med-Eng EOD 9 suit and helmet (weight ~35 kg). The climatic conditions ranged between 27.1-31.8ºC ambient temperature, 66-88% relative humidity, 66-88% relative humidity, and 30.7-34.3ºC wet bulb globe temperature. The scenario involved searching a two story non air-conditioned building for a target; carrying and positioning equipment for taking an x-ray; carrying and positioning equipment to disrupt the target; and finally clearing the site. Core temperature (ingestible pill) and heart rate were continuously monitored, and were used to calculate a physiological strain index (PSI, 1 - no/little strain, 9 - very high strain). Urine specific gravity (USG) assessed hydration status and heat associated symptomology was reported.

**RESULTS:** The scenario was completed in 120±22 mins (24±0.4% work, 76±0.4% rest/recovery). Maximum core temperature (38.3±0.2°C), heart rate (173±4.8 bpm, 94±3.3 %max), PSI (7.05±0.44) and USG (1.031±0.002) were all significantly elevated. Heat associated symptomology highlighted that moderate-severe levels of fatigue and thirst were universally experienced, with muscle weakness and heat sensations also experienced by 75% of the bomb technicians. Neurological symptoms of light-headedness, dizziness and confusion were also reported.

**CONCLUSION:** All bomb technicians demonstrated moderate-high levels of heat strain, evidenced by elevated heart rate, core body temperature and PSI. Severe levels of dehydration and noteworthy heat-related symptoms further highlight the risks to health and safety faced by bomb technicians operating in tropical locations.

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**1943**

**Board #357**

**MAY 30**

**2:00 PM - 3:30 PM**

**Effects of Loggers’ Protective Clothing on Thermoregulation**

Aitor Coca, Jeffrey B. Powell, Jung-Hyun Kim, W. Jon Williams, Raymond J. Roberge. NIOSH/NPPTL, Pittsburgh, PA.

(No relationships reported)

Heat stress is common among forestry workers, including loggers.

**PURPOSE:** Evaluate the thermal responses to wearing loggers’ protective clothing (LPC) while performing moderate intensity exercise in the heat.

**METHODS:** Six healthy male participants performed two trials of treadmill exercise in a warm environmental chamber (35°C, 50% relative humidity [RH]) while wearing either sports clothes (CON) or LPC which included a safety vest, chainsaw chaps, gloves, safety helmet, long trousers, nylon socks, wool socks and boots. The study protocol consisted of two stages of 20 min of exercise at a relative workload of 30% and 50% VO2max. The participants then performed a chainsaw maneuver (sawing motion against a vertical object) for 1 min followed by a recovery period (15 min rest) in the chamber. Study variables included core temperature (Tco), mean skin temperature (Tsk), and heart rate (HR). Data were analyzed by two-way (Trials × Time) repeated measures ANOVA.

**RESULTS:** All 6 subjects (CON) completed 41 min of exercise for CON, but only averaged 38.7 min of exercise (37.7 min treadmill and 1 min chainsaw maneuver) while wearing LPC. Tco in the LPC was higher than CON. However, it was only statistically higher in the recovery time suggesting that wearing LPC in warm environments hinders the recovery of the users.


### Results

Subjects rode longer before reaching critical core temperature with the vest (~39 min) compared to NV (~34.75 min), however this difference was not statistically significant (p=0.48). The mean

### Methods

Advances, alternating cycles of 2 min rest with 2 min of activity. Physiological and perceptual measurements were obtained pre- and post-FF activities.

### Conclusions

Firefighters (FFs) routinely perform demanding physical work in extreme environmental temperatures. In addition, the weight and encapsulating nature of their protective turnout (TO) gear adds to the thermal and cardiovascular strain.

**Purpose:** To examine the effects of two TO gear ensembles (standard vs enhanced) on physiological and perceptual responses to an acute bout of FF activity in the heat.

**Methods:** 119 male FFs (M±SD: age=29.45 ± 7.94 yr; ht=177.7 ± 0.07 m; mass=87.81 ± 15.44 kg; BMI=28.07 ± 4.41) free from known cardiovascular disease were randomly assigned to one of the two TO gear ensembles. The standard TO gear (n=59) consisted of bunker gear with spun Nomex lining, Kevlar fully-encapsulating hood, leather gloves, rubber boots, traditional-style helmet: M wt = 11 kg. The enhanced TO gear (n=60) consisted of bunker gear with Indura FR cotton lining, which circulated exhaled air from the firefighter to the coat’s inner lining, Nomex hood, low-profile helmet, leather gloves, lightweight leather boots: M wt = 8.6 kg. FFs underwent 18 min of simulated FF activity (stair climbing, forcible entry, secondary search, hose advance), alternating cycles of 2 min rest with 2 min of activity. Physiological and perceptual measurements were obtained pre- and post-FF activities.

**Results:** No significant differences were observed between TO gear ensembles (P > 0.05). Overall, FF activity resulted in significant (P < 0.05) increases in heart rate (Mpre, 92.9 ± 18.8 b·min⁻¹; Mpost, 168.3 ± 14.8 b·min⁻¹); core temperature (Mpre, 37.56 ± 0.37°C; Mpost, 38.40 ± 1.23°C); thermal sensation (Mpre, 4.3 ± 0.7; Mpost, 5.9 ± 0.9); and respiratory distress (Mpre, 1.1 ± 0.4; Mpost, 2.8 ± 1.1). Conversely, there was a significant (P < 0.05) decrease in feeling scale (Mpre, 3.8 ± 1.2; Mpost, 1.9 ± 1.9).

### Discussion

CONCLUSIONS: Significant changes in physiological and perceptual measures. TO gear configuration (standard vs enhanced) did not differentially influence the physiological or perceptual strain.
CONCLUSION: We conclude that wearing a cooling vest during a cycling time trial in a hot and humid environment does not blunt the rise in $T_{ec}$ and $T_{as}$, or HR, and does not influence $Time_{waste}$, RPE, ThC or ThS. Therefore, cooling vest use during a time trial does not improve cycling performance.

1947 Board #355 MAY 30 2:00 PM - 3:30 PM
The Effect Of Pre-heating And Intermediate Cooling On Firefighting Performance
Koen Levels1, Eric Moël2, Carl Foster, FACSM1, Jos J. De Koning, FACSM1, Hein A.M. Daanen1, 2. Research Institute MOVE, VU University Amsterdam, Amsterdam, Netherlands. 1DeRijn, innovation eXperts for emergency Responders, Asten, Netherlands. 2University of Wisconsin-La Crosse, La Crosse, WI. TNO Behavioural and Societal Sciences, Soesterberg, Netherlands.
(No relationships reported)

During firefighting activities core temperature ($T_{c}$) can exceed 39.0°C and reduce performance. Therefore it is crucial to prevent or delay the attainment of high $T_{c}$.

PURPOSE: To determine the effect of pre-heating and intermediate cooling on speed and quality of firefighting activities.

METHODS: Twelve firefighters visited the Fire Training Center based lab three times. In one trial, they were pre-heated (HEAT) prior to a search-and-rescue and fire extinguishing task within a fire drill in a burn building. In the other trials, subjects remained thermonutral prior to the drill and afterwards they were either cooled by forearm immersion in 10°C water (FC) or remained seated in 20°C ambient temperature (CONTROL). After this 20-min recovery period, they performed a second drill. Core and skin temperature ($T_{sk}$), heart rate (HR), rating of perceived exertion (RPE), speed, and quality of performance (QoP) were measured during the trials. QoP was ranked by two experienced fire instructors and the subjects themselves.

RESULTS: $T_{c}$ was 0.54 ± 0.20°C ($P<0.05$). After the first drill, $T_{c}$ was higher for HEAT (38.4 ± 0.4°C) than for CONTROL (37.9 ± 0.2°C; $P<0.05$). Cooling rate of FC did not differ from CONTROL (0.024 ± 0.014°C·min⁻¹ and 0.016 ± 0.017°C·min⁻¹, respectively; $P=0.05$). No differences in average $T_{c}$ and HR were found in the second drill (P>0.05). RPE was higher for HEAT than for CONTROL (14.3 ± 2.1 and 12.1 ± 2.9, respectively; $P=0.001$) whereas no differences were observed between FC and CONTROL (12.4 ± 2.9 and 12.8 ± 3.5, respectively; $P=0.93$). Although no significant difference was observed in time to completion ($P=0.05$), subjects performed slower in the second half of the first drill in HEAT than in CONTROL and faster in the other half of the second drill in FC than in CONTROL ($P<0.05$). In HEAT, firefighters rated QoP lower than in CONTROL (6.3 ± 0.7 vs. 7.1 ± 0.2, respectively; $P=0.22$), whereas expert opinion revealed no differences for pre-heating ($P=0.39$). No differences in QoP were found after forearm cooling ($P=0.05$ for self report and expert opinion).

CONCLUSION: Pre-heating affected pacing of firefighting exercise and self reported quality of performance. Intermediate forearm cooling was beneficial for pacing but not the quality of firefighting exercise.

1948 Board #356 MAY 30 2:00 PM - 3:30 PM
A Comparison Of Two Commercially Available Practical Cooling Interventions On Cycling Performance In The Heat
Christopher J. Tyler1, Victor Kir1, Saal Cuttell2. Roehampton University, London, United Kingdom. 2Moulton College, Moulton, United Kingdom.
(No relationships reported)

Exercise performance and capacity are both impaired in hot conditions but cooling interventions can attenuate this impairment. The majority of cooling literature has focussed on cooling prior to exercise (pre-cooling) but cooling during exercise using cooling vests (CV) and modified cooling collars (CC) has recently been shown to also enhance performance in hot conditions. Due to improvements in the technology behind commercially available cooling devices (e.g. reductions in bulk and improvements in cooling magnitude and duration) and an increase in their availability cooling during, rather than before, exercise is receiving greater attention.

PURPOSE: To investigate the effect of two modified, commercially available cooling devices on cycling capacity in a hot environment.

METHODS: Eight non-acclimated, untrained but healthy ($W_{max}$: 240 ± 25 W) males completed an incremental cycle test to determine maximum power output ($W_{max}$), a full familiarisation and three experimental cycle tests (either wearing a CV or a CC throughout or with no cooling (NC)). During the familiarisation and main trials the participants cycled to volitional exhaustion at 60% $W_{max}$ in a hot environment (35.0 ± 0.1°C, 50 ± 1% rh). Exercise capacity, rectal temperature, weighted-mean skin temperature, torso temperature, neck temperature, heart rate, fluid loss and consumption, rating of perceived exertion, thermal sensation and feeling scales were recorded. One-way and two-way repeated-measures analysis of variance tests were conducted to evaluate differences between variables. Significance was set at the P < 0.05 level.

RESULTS: Cycling capacity was longer in VC (32.2 ± 9.5 min) compared to NC (27.6 ± 7.6 min; $P=0.03$; d = 0.57) and CC (30.0 ± 8.8 min; $P=0.02$; d = 0.26). There was no difference in cycling capacity in CC compared to NC ($P=0.12$). Both cooling interventions lowered site-specific skin temperature and site-specific thermal sensation ($P<0.01$) but had no effect on any of the other physiological or perceptual variables ($P>0.05$).

CONCLUSIONS: Practical torso cooling using a commercially available CV improves the cycling capacity of untrained males in a hot environment without altering non-site-specific physiological or perceptual responses but cooling the neck using an unmodified, commercially available CC does not.

1949 Board #357 MAY 30 2:00 PM - 3:30 PM
The Effect Of Wearing A Cooling Vest Between Two Heated Exercise Bouts On Core Temperature
(No relationships reported)

PURPOSE: The purpose of the investigation was to evaluate the effectiveness of a cooling vest to regulate core temperature following heated self-paced exercise, and the effect on exercise duration of a successive heated exercise bout.

METHODS: Six males (age = 24.5 ± 1.76 yrs; body fat = 12 ± 2.28%; estimated VO₂peak = 41.59 ± 5.52 ml·kg⁻¹·min⁻¹) and six females (age = 23.83 ± 1.94 yrs; body fat = 21.5 ± 1.64%; estimated VO₂peak = 43.47 ± 4.36 ml·kg⁻¹·min⁻¹) participated in two testing sessions. Each session consisted of two self-paced cycling bouts in a modified heat chamber separated by seated rest. Subjects were required to cycle until core temperature reached 38.5°C during the first exercise bout. Subjects were then removed from the heat chamber and required to sit until core temperature returned to within 3°C of baseline. During the seated rest, subjects wore a cooling vest (experimental session), or a normal t-shirt (control session). During the second exercise bout subjects exercised at the same RPM and wattage as the first bout until core temperature reached 38.5°C or volitional fatigue. Subjects exercised using the same RPM and wattage for both exercise sessions. Thermoregulatory data was taken every 5 min, except for blood (HCT, HB) which was taken every 20 min.

RESULTS: Time to reach 38.5°C during the second exercise bout was significantly (p<0.05) longer following the cooling vest trial (43.66 ± 4.34 min) than the control trial (34.28 ± 3.97 min). No significant difference in time to decrease core temperature during seated rest was found between the cooling vest and the control trial (p>0.05). $T_{ec}$ was significantly (p>0.05) greater in female subjects (32.92 ± 17°C) during seated rest in comparison to male subjects (32.13 ± 17°C). Core to shell gradient was significantly (p<0.05) greater in male subjects (5.74 ± 18°C) during seated rest in comparison to female subjects (5.12 ± 18°C).

CONCLUSIONS: Independent of gender, a cooling vest worn between two heated exercise bouts significantly lengthens time to increase core temperature during the second exercise bout. Gender differences in core to shell gradient may be attributed to the higher body fat percentage in the female subjects.

1950 Board #358 MAY 30 2:00 PM - 3:30 PM
Running Performance and Thermoregulation is not Improved when Wearing a Palm Cooling Device
Cory M. Scheidler, Nathan W. Saunders, Nicholas J. Hanson, Steven T. Devor, FACSM. The Ohio State University, Columbus, OH.
(No relationships reported)

There is evidence that attenuating the rise in core temperature with sophisticated negative pressure and cold application to the palm increases time to exhaustion during endurance exercise. To be athletically applicable during training and competitions evidence for this effect is necessary with palm cooling devices that are portable.

PURPOSE: Our aim was to test the efficacy of a portable palm cooling device at attenuating the rise in core temperature and prolonging time to exhaustion during a run in hot conditions,
METHODS: Twelve subjects completed two randomly ordered time to exhaustion (TTE) runs at 75% of their VO2max at 30°C and 50% relative humidity. Randomization was based on the use (treatment) or absence (control) of a palm cooling device (PCD), placed in the palm of the hand at the beginning of the TTE. TTE runs started once core temperatures reached 37.5°C during the warm-up. Heart rate (HR), rating of perceived exertion (RPE), feeling, and core temperature (CT) were recorded at 2 minute intervals during the run.

RESULTS: The rate of rise of CT was moderate-strongly correlated with TTE in treatment (r2 = 0.91, p < 0.05) and control (r2 = 0.68, p < 0.05) trials. No significant differences occurred between treatment and control trials for HR, RPE, Feeling and CT. TTE was longer in control than treatment (46.7 ± 31.1 vs. 41.3 ± 26.3 minutes, respectively, p < 0.05), however, when warm-up time was included in analysis, there was no difference between trials for total exercise time (52.5 ± 24.2 vs. 54.5 ± 31.4 minutes, respectively).

CONCLUSION: The use of a PCD during a run in hot conditions did not attenuate the rise in CT. Exercise time in hot conditions did not increase with the use of the PCD and time to exhaustion may have been negatively affected.

1951 Board #359 MAY 30 2:00 PM - 3:30 PM
Effects Of Sportswear Design On Thermal Stress And Endurance Running Performance In Hot Condition
Jiao Jiao1, Lei Yao1, Ya Jun Chen2, Stephen H. S. Wong, FACSM3, Yue Ping Guo1, Frency S. F. Ng1, Yi Li4, 1The Hong Kong Polytechnical University, Hong Kong, China. 2The Chinese University of Hong Kong, Hong Kong, China.

CONCLUSIONS: Clothing designed to minimize total air resistance and facilitate moisture transport would be possible to reduce athlete’s thermal stress and improve running performance.

PURPOSE: to investigate the effects of clothing design on thermal stress and endurance running performance in hot condition.

METHODS: Eight healthy male athletes (mean ± SD: age 21.8±0.5 years, body mass index 20.7±0.6 kg·m⁻²; maximal oxygen consumption- max 57.0±2.4 ml·kg⁻¹·min⁻¹) participated in a cross-over designed study. Three garments, A, B and C consisted of vest and knee-length short pants and made of Nylon Fabrics, were used in this study. Clothing A had the lower Air Resistance (AR: 0.05 KPa·s·m⁻¹) and the higher Overall Moisture Management Capacity (OMMC: 0.70) than Clothing B (AR: 0.08 KPa·s·m⁻¹; and OMMC: 0.68). Clothing C was set as the control (AR: 0.67 KPa·s·m⁻¹; and OMMC: 0.54). Under hot condition (temperature: 30±0.2°C, relative humidity: 50±5%), the athletes rested for 30min and then performed 5min warm up. After that, they performed 45min running at their 70% max and 1.5km time trial running. Skin and core temperature were continuously collected throughout the whole study at 1min interval. Mean skin temperature (Tsk) was calculated by recording the skin temperature at chest, upper arm, thigh and calf respectively by four thermistors, whereas core temperature (Tc) was recorded by ingested telemetry pill.

RESULTS: During 30min resting, Tc was higher for A when compared with B (T vs. O: 33.8±0.3°C vs. 33.5±0.3°C, p<0.05) and during 45min running, Tc was the lowest for A among the three garments (Ts vs Os A: 32.4±0.6°C vs. 32.8±0.5°C vs. 32.7±0.5°C, p<0.05). Differences were also found in the change of Tc (ΔTc) for A and C during the resting period and during the 10th min of running, respectively (p<0.05). The 1.5km running performance was found when wearing A as compared to the C (Ts A: 323.1±10.4s vs. 349.9±12.0s, p<0.05).

CONCLUSIONS: clothing with lower AR and higher OMMC can reduce athletes’ thermal stress and enhance endurance performance. Supported by Hong Kong Innovation and Technology Commission and HKITI, China (ITIP081005) and HKSI, China (ITI001141).
A Meta-analysis Of The Hypothermic Properties Of Exogenous Melatonin In Humans

Kelly Marin1, Barry Drust2, Warren Gregson2, Greg Atkinson1,1 Edge Hill University, Ormskirk, United Kingdom. 2Liverpool John Moores University, Liverpool, United Kingdom.

(No relationships reported)

A number of pre-cooling methods have been developed in order to reduce starting core temperature at rest and thereby attempt to enhance subsequent performance in hot conditions. However, interventions such as cold showers can be impractical and difficult to tolerate (Marino, 2002, Br J Sorts. Med., 36: 89-94). The extent to which exogenous melatonin changes core body temperature in humans is enigmatic. Individual studies have involved small samples, which leads to imprecision in the population estimate of temperature change. There are also between-study differences in melatonin dose, study population and protocols.

PURPOSE: To meta-analyse the effects of exogenous melatonin on core temperature and explore the impact of various moderating variables on this temperature change.

METHODS: Following an extensive literature search, 33 studies involving 193 participants and 429 separate melatonin ingestions were meta-analysed. The outcome was the mean difference (95% confidence limits) in core temperature between the melatonin and control conditions in each study, weighted by the reciprocal of each standard error of the differences.

RESULTS: Publication bias was assessed using Eggers regression intercept and no significant publication bias was evident (P>0.39). The meta-analysed reduction in core temperature was found to be 0.21 (-0.18 - 0.24) °C, which was unaffected by gender and time of day of ingestion (P>0.05). Low doses (0.1- 4.9 mg) resulted in a mean change in core temperature of 0.17 (-0.14 - 0.25) °C for rectal temperature found with a slope of 0.013 °C.mg-1 (P<0.0001). The mean hypothermic effect was 0.13 (-0.05 - 0.20) °C for oral temperature compared with 0.26 (0.20 - 0.32) °C for tympanic and 0.22 (0.19 - 0.25) °C for rectal temperature.

CONCLUSION: These data indicate that the hypothermic effect of melatonin is clinically significant and robust across genders and time of day. The hypothermic effect was lowest for oral temperature, probably because this site is more prone to masking influences. The meta-regression revealed a linear dose-response relationship that was, nevertheless, quite shallow in practical terms.
sessions, physical activity and mentoring relationships with college males to address negative attitudes and unhealthy behavior, particularly lack of physical activity. Given that sports are often the source of physical activity in boys, C.H.A.M.P.S. utilizes sports skills training to improve perceived physical competence, which could result in improved physical activity levels and related positive outcomes.

**PURPOSE:** The purpose of this study was to evaluate whether participation in C.H.A.M.P.S (6 sessions) is related to positive changes in perceived physical competence, physical activity, self esteem and social physical anxiety.

**METHODS:** Prior to and following the conclusion of the program, participants completed: 1) an exercise questionnaire (EQ), 2) the Rosenberg Self-Esteem Scale (SE), 3) The Social Physique Anxiety questionnaire (SR), and 4) a modified version of Harter’s Perceived Physical Competence scale (PPCSC). Questionnaire results were analyzed to assess changes from pre to post participation in the program.

**RESULTS:** Significant changes were noted on all measures: EQ (Mean_{pre} = 8.8 ± 0.45, Mean_{post} = 10.2 ± 0.52, p < 0.01); SE (Mean_{pre} = 23.4 ± 0.74, Mean_{post} = 25.4 ± 1.1, p < 0.05); SR (Mean_{pre} = 18.4 ± 0.95, Mean_{post} = 15.8 ± 1.2, p < 0.01); PPCSC (Mean_{pre} = 40.68 ± 2.07, Mean_{post} = 46.1 ± 2.09, p < 0.05).

**CONCLUSION:** Given that perceived competence in and enjoyment of physical activity are cited as being essential influences on young people’s participation over time, it appears that CHAMPS is an effective vehicle to address the issues which play a role in obesity prevalence in this population.

**1958**

**Board #4**

**MAY 31 8:00 AM - 9:30 AM**

**Effects of Pre-habilitation on Self-Efficacy for Exercise and Outcome Expectations for Exercise Among Patients Before and After Total Knee Arthroplasty**

Kent Brown1, Robert Toppi1, Joseph A. Brosky1, David Parisel1, Ann Swank, FACSM1, Bellemaire University, Louisville, KY. 2Marquette University, Milwaukee, WI. 3University of Louisville, Louisville, KY.

(No relationships reported)

Osteoarthritis (OA) is a clinical condition affecting over 27 million Americans. There is no known cure for OA other than replacing the diseased joint with a partial or total joint prosthesis, total knee arthroplasty (TKA).

**PURPOSE:** The purpose of this research is to compare pre and post-surgical exercise self-efficacy and outcome expectations for exercise among TKA patients who do and do not receive prehabilitation (exercise intervention before surgery).

**METHODS:** 31 participants (22 female, 9 male) scheduled for a TKA from a single orthopedic practice were randomly assigned to a Control (CON) or a prehabilitation (PRE) group following baseline testing. Outcome variables at baseline testing included the Self-Efficacy for Exercise (SEE) scale and the Outcome Expectations for Exercise (OEE) scale. In addition to baseline (T1), participants completed the outcome data collection protocols just prior to surgery (T2) and at 1 (T3) and 2 (T4) weeks following surgery.

**RESULTS:** Repeated measures ANOVA were conducted examining the effect of group (PRE vs. CON) over the four data collection points (Baseline, T2, T3 & T4). Significant main or interaction effects were explored further by calculating Fischer’s least significant difference post hoc comparisons. Conducting a RM-ANOVA with time (T1, T2, T3, T4) [F(1, 18) = 42, p = .53] and group (PRE vs CON) [F(1, 18) = .03, p = .86] and interaction of group and time [F(1, 18) = .69, p = .419] as the sources of variability indicated no significant effect of the time, group or group x time on SEE. The SEE of the PRE appeared to be consistently maintained over the study, and actually trended upward after their TKA at T3 and T4, but did not significantly increase. Differences in OEE within the sample over the duration of the study indicated a significant time effect [F(1, 18) = 4.57, p = .04]. Post hoc analysis indicated that the CON group significantly declined between T2 and T4; however the PRE group did not significantly change.

**CONCLUSIONS:** These findings indicate self-efficacy for exercise was unaffected by the preoperative exercise intervention (prehabilitation), while the outcome expectations for exercise improved in the PRE group. This improvement in outcome expectations for exercise may contribute to improve compliance with post operative rehabilitation exercises among TKA patients.

**1959**

**Board #5**

**MAY 31 8:00 AM - 9:30 AM**

**Hospital-based Exercise Intervention Program Can Promote Exercise Internal Motivation of Care-giving Housewife**

Jin J. Chen1, Wen-Hui Huang1, Frank J.H. Liu2, National Yang-ming University, Taipei, Taiwan. 2National Taiwan Sports University, Taipei, Taiwan.

(No relationships reported)

Physical inactivity of care-giving housewives had been noted due to lack of time and motivation to exercise regularly. So, we developed the eight-week hospital-based exercise intervention (HEI) using day-care treatment duration of their children twice per week to provide an accessible exercise time for them. However, motivation, especially internal motivation, was the key determinant for long-term participation of regular physical activity.

**PURPOSE:** to investigate the effects of HEI on exercise motivation promotion.

**METHODS:** Sixty sedentary care-giving housewives were recruited and assigned to two groups: HEI group (n=30) and control group (CG, n=30), voluntarily. HEI program consisted of 16 exercise sessions including 8 walking sessions and 8 Yoga-Pilates sessions. Control group received one exercise consultation session during the first visit only. Chinese-version of Behavior Regulation in Exercise Questionnaire-2 (BREQ-2) was used pre- and post-HEI to evaluate the effects of HEI on motivation promotion.

**RESULTS:** After 8 weeks exercise intervention, total motivation score of HEI group significantly increased from 22.3±1.2 to 32.4±2.2, p<0.01; PPCSC (Mean_{pre} = 18.4±0.95, Mean_{post} = 22.0±1.2, p<0.05); PPCSC (Mean_{pre} = 40.68±2.07, Mean_{post} = 46.1±2.09, p<0.05).

**CONCLUSION:** Given that perceived competence and enjoyment of physical activity are cited as being essential influences on young people’s participation over time, it appears that CHAMPS is an effective vehicle to address the issues which play a role in obesity prevalence in this population.

**1960**

**Board #6**

**MAY 31 8:00 AM - 9:30 AM**

**Can Public Health Take the HIT? High-Intensity Interval Training and Affect in Obese Women**

Emily S. Decker1, Panteleimon Ekkekakis, FACSM1, University of Kansas, Lawrence, KS. 2Iowa State University, Ames, IA.

(No relationships reported)

Only 3% of obese women trying to lose weight report being physically active at the minimum recommended level (60 min daily). High-intensity interval training (HIT) is promoted as a way of combining the health and fitness benefits of high-intensity exercise and time efficiency. However, obese women report less positive affective responses compared to their normal-weight and even overweight counterparts, an effect that is accentuated at higher intensities.

**PURPOSE:** To compare the affective responses of obese women during a (shorter) HIT session and a (longer) moderate-intensity (MOD) session.

**METHODS:** Twenty-four obese and inactive women (M = 39 years) first completed a ramp test on a recumbent cycle ergometer to determine their ventilatory threshold (VT). They then completed two counterbalanced conditions: (a) a HIT session (4 iterations of 2 min at 85% of VT and 3 min at 115% of VT, for a total of 20 min) and (b) an isocarlic MOD session consisting of cycling at 90% of VT for 25 min. The Feeling Scale (FS) was administered before, during, and after exercise. The Physical Activity Enjoyment Scale (PACES) was administered post-exercise.

**RESULTS:** Analysis of FS data showed a significant affect by time interaction, F(3,29, 75.68) = 8.48, P < 0.001, as well as a significant condition main effect, F(1, 23) = 14.42, P < 0.05, with the HIT session leading to significantly lower ratings of pleasure overall. Likewise, a paired t-test of the PACES scores indicated that the women reported lower enjoyment after the HIT than the MOD, t = -2.14, P < 0.05.

**CONCLUSION:** Based on findings that affect can predict physical activity, these less positive affective responses could result in reduced adherence. Thus, the long-term sustainability of HIT in this high-risk population seems questionable given minimal time savings and less positive affective experiences.
1961  Board #7  MAY 31  8:00 AM - 9:30 AM
Improving Exercise Adherence Through Online Journaling Following Physical Therapy Treatment for Chronic Low Back Pain
Claire E. Freson, Sharon M. Henry, Paul R. Buzzell, Mike J. DeSarno. University of Vermont, Burlington, VT.
(No relationships reported)

BACKGROUND: Low back pain (LBP) is a musculoskeletal condition that affects up to 80% of all people at some point in their lives. Due to high recurrence rates, this condition often escalates into a chronic, costly problem. We examined if online journaling for a prescribed physical therapy (PT) home exercise program (HEP) increased exercise adherence (EA) and led to decreased pain and improved function for subjects with LBP.

PURPOSE: To compare whether online journaling improved 6 month outcomes for pain (Numeric Pain Rating Scale [NPRS]), function (Oswestry Disability Index [ODI]), and EA rates for subjects (age 18-55 years) with LBP.

METHODS: Subjects completed the ODI and the NPRS at pre-treatment, and 7 weeks and 6 months post-treatment initiation. Following 6 weekly PT treatments, one group (Web group [WG]; n=20) was discharged with a HEP and online journal to record, daily for 6 months, the number of exercise repetitions done for the prescribed HEP and their pre- and post-exercise pain. The journals were monitored weekly; email reminders were sent to subjects to encourage continued participation. The control group (NoWeb [NW]; n= 20) was discharged from PT with a HEP to continue on their own. Six months after the initiation of PT, the two groups were compared using NPRS and ODI scores with an ANOVA with a significance level set to P = .05. EA rates were also compared.

RESULTS: There were no significant group mean differences in the NPRS or ODI scores (P = 0.37, P = 0.73, respectively) across the three time points. However, there was a significant decrease from pre- to post-treatment in NPRS mean (P = 0.0009) and in ODI mean (P = 0.0001), but no significant mean differences from post-treatment to 6 months for either measure. Over the 6 months, the WG subjects, on average, completed specific exercises 68% (27 - 97%) of the time. At the 6-month time point, all but one NW subject reported doing specific exercises 25 - 50% of the time or less. The WG subjects demonstrated an average adherence rate for activities of daily living of 3.6 out of 4 while NW subjects reported an average level of 2.6 out of 4.

CONCLUSIONS: Although the improvements in pain or disability scores were similar between groups, the WG had better EA rates, suggesting a benefit in the use of online journaling as a method to enhance EA. Supported by a UVM URECA grant.

1962  Board #8  MAY 31  8:00 AM - 9:30 AM
A Study of Messaging for Exploring Physical Activity: Exploring Components of Persuasive Messages
Takashi Shimazaki, Koji Takanaka, Megumi Saito. Waseda University, Tokorozawa, Japan.
(No relationships reported)

To motivate individuals to adhere to a routine of regular physical activity, guidelines must be translated to a persuasive messages. Most interventions designed to increase physical activity have used a messaging process. The study of messaging includes examination of tailoring, targeting, and framing. Results of previous studies suggest that these approaches should be prepared with regard to acceptability and usability for individuals.

PURPOSE: This study explored the constructs of acceptability and usability for persuasive messages.

METHODS: Thematic analysis is widely used qualitative analytic method within psychology when notably explored theoretical framework. We examined 177 adults (Age = 19 to 68 years, 83 men and 94 women) by obtaining open-ended responses about acceptable and usable information to motivate physical activity.

RESULTS: Thematic analyses revealed six themes of acceptability: constitution of verbal messages, framing, verbal message information, visual message information, desirable delivery channel, and desirable place. Across, four themes of usability were identified: information benefiting physical activity, information about how to exercise, information related to physical activity, and tailored information about physical activity. Results of chi-square analysis showed that differences between men and women. Information about anti-aging (χ² = 16.2, df = 1, p<0.01), information about improve stiff shoulder and backache (χ² = 4.0, df = 1, p<0.05), and information about ingestion and consumption calorie (χ² = 4.6, df = 1, p<0.05) were significantly desired by women in theme of usability. No differences between the sexes were found in theme of acceptability.

CONCLUSIONS: These study results are expected to contribute to intervention aimed at increasing individuals’ physical activity for improvement of public health.

1963  Board #9  MAY 31  8:00 AM - 9:30 AM
Does Stage Of Change Predict Psychological Outcomes In A Physician Delivered Dietary And Physical Activity Intervention?
Sheree Shapiro, Heather Morton, Robert J. Petrella, FACSM, Lawson Health Research Institute, London, ON, Canada.
(No relationships reported)

BACKGROUND: The purpose of the present study was to determine whether a predictive relationship was observed in participants between baseline stage of change (SOC; prior to beginning a stage-matched, physician-delivered physical activity and nutrition counselling program) on decisional balance and self-efficacy for diet and physical activity.

METHODS: Participants were eligible for the study if they were between the ages of 30-85 and had elevated blood pressure and blood glucose. Participants (n = 69) attended 5 study visits over the course of 52-weeks. At each visit, they received a Step Test and Exercise Prescription, and were counselled on adopting a Mediterranean diet (MD). In addition, they completed the following questionnaires: 1) Physical Activity Self-Efficacy (PASE); 2) MD Self-Efficacy (MDSE); 3) Decisional Balance for Physical Activity (DBPA); 4) Decisional Balance for MD (DBMD); and 5) SOC for diet and physical activity. Linear regression was used to determine the relationship between baseline SOC, self-efficacy, and decisional balance.

RESULTS: Medium negative correlations were observed between mean baseline SOC (MD = 2.91; PA = 3.09) and cons for DBMD at baseline, 8-and 16-weeks only (mean = 2.19, r = -0.35, p<0.01) were significantly for 3 out of the 16 questions. These questions read, "If I feel aches and pains while exercising"; "If I am on vacation or away from home"; and "If I feel stressed".

CONCLUSION: Based on the results, a higher baseline SOC was a moderate predictor of lower perceived cons for diet and physical activity. Interestingly however, a higher baseline SOC for physical activity predicted lower perceived pros of physical activity at 8-and 16-weeks. A higher baseline SOC was also a moderate predictor for higher MDSE and PASE midway through the study. Baseline SOC thus may predict some aspects of success part-way through dietary and physical activity behavioral change interventions.

1964  Board #10  MAY 31  8:00 AM - 9:30 AM
A Comparison Of Exercise Self-efficacy Between Individuals With And Without Asthma
Greg Farrell, Britton Adams. University of Central Oklahoma, Edmond, OK. (Sponsor: Ellen Glickman, FACSM)
(No relationships reported)

PURPOSE: Asthma is a medical condition that is often overlooked as chronic or terminal. Its effects on a person’s performance emotionally and physically should be noted and taken into account when a person engages in physical activity. The purpose of this study was to examine the influence of having asthma on exercise self-efficacy where exercise self-efficacy refers to the relationship with exercise behavior and attitudes towards exercise.

METHODS: Fifty participants completed the Exercise Self-Regulatory Efficacy scale (Ex-SRES). Fifty participants volunteered to participate in this study and each completed the Ex-SRES. Twenty-one participants (6 male, 19 female) from a general education class at a local university served as a control group and 29 participants (8 male, 17 female) were surveyed at an area asthma clinic. The survey consists of 16 questions that measured the confidence levels of continuing to exercise under specific conditions (e.g. “If the weather was bothering him or her”; “If they had no support from others”). Each question was given a Likert-scale response of “Not at all confident” (0%) to “Highly Confident” (100%). Data was analyzed for between-group differences using a one-way ANOVA.

RESULTS: The ANOVA revealed significant difference between groups (p < 0.05) for 3 out of the 16 questions. These questions read, “If I feel aches and pains while exercising”; “If I am on vacation or away from home”; and “If I feel stressed”.

CONCLUSIONS: The findings of this study suggest there is minimal difference in exercise self-efficacy between those individuals with and without asthma.
Earlier sport specialisation of child athlete, raises the question of how the maximal speed is influenced by different sport training.

**PURPOSE:** To determine the influencing factors of different sport training on maximal speed in trained boys and girls.

**METHODS:** 11-14 years of age 53 boys and 41 girls not regularly trained normal healthy children were randomly selected from a nearby school as control group, and 146 boys and 151 girls from track and field athletics, basketball, and volleyball were selected as athletes. Two different tests were conducted in order to determine the maximal (100%), and sub maximal (97 % and 94 % maximal) velocities and running times over 50 m sprinting, during which the maximal attained 5 m velocity was timed by a photocell placed at each 5 m section. During the second test a video camera was placed to record the 5 m section where the maximal velocity was attained for stride frequency and length. Correlation coefficient of the influencing parameters of stride frequency and length was examined by Pearson Correlation Coefficient Test, and the differences between the attained maximal velocity, according to different training groups, ages and gender were tested by MANOVA.

**RESULTS:** The control group had significantly shorter strides (F=57.043, p<0.05) and lower stride frequency (F=8.363 p<0.05) at maximal and sub maximal velocities when compared to athletes. Athletes showed different stride length as a result of anthropometric variables and specific training results. There was no difference in stride frequency between the ages in both sexes (F=2.437 p<0.05) in all velocities. However, males showed higher stride frequency at all ages (F=76.934, p<0.05) when compared with female athletes. In general most of the strength parameters showed significant correlation with stride length and frequency both in male (r=0.558-0.872; r=0.552-0.813; p<0.05, respectively) and female (r=0.551-0.843; r=0.557-0.735; p<0.05, respectively) groups in maximal velocities. There was a higher reading in stride frequency in male athletes (F=76.934, p<0.05), but no difference in stride length between the sexes (F=0.289, p>0.05).

**CONCLUSION:** In conclusion at this age and training groups, stride frequency and length are influenced by age, gender, strength, anthropometric variables and specific training.
PURPOSE: This study aimed at comparing the validity of two commonly used field tests, the 20m shuttle run and the 6 min endurance run, using the gold standard for aerobic fitness, VO₂max, as the criterion reference. A second goal was to identify gender-specific differences.

METHODS: 30 children (16 boys) between 9 and 11 years of age (10.1 ± 0.7) performed a 6 min endurance run and a 20m shuttle run. VO₂max was determined via gas analysis during a progressive treadmill test with an initial pace of 6 km/h, a continuous slope of 1% and a two minutes length of each grade. For data analysis, the total distance (in meters) of the 6 min endurance run and the test duration (in seconds) of the 20m shuttle run were taken into account.

RESULTS: The mean overall VO₂max, relative to body weight (ml/min/kg) during the progressive treadmill test was 49.8 ± 6.4, with boys (50.5 ± 4.4) achieving a slightly higher VO₂max than girls (49.2 ± 6.4). The boys achieved 67 more meters in the 6 min endurance run compared to the girls (boys: 1123±76.8; girls 1056±131.4m ). In the 20m shuttle run, the boys kept the pace 47 seconds longer than the girls (boys: 434 ± 60.7; girls: 387 ± 111.1).

The results of the 6 min endurance run showed higher correlations with VO₂max (r=0.69; p<0.01) compared to the results of the 20m shuttle run (r=0.52; p>0.05). The gender-specific analyses showed significantly lower correlations of the 20m shuttle run and VO₂max for the boys (r=0.29; p>0.05) compared to the girls (r=0.58; p<0.05).

CONCLUSION: In this study, the 6 min endurance run proved to be more valid to assess aerobic fitness in 9 to 11-year-old children than the 20m shuttle run.

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**1969 Board #15 MAY 31 9:00 AM - 10:30 AM**

**Cardiovascular Fitness Improvements From High Intensity Training In Children**

Brian K. Sanborn, Pratik Patel, Christian Larson, Bryan S. Heinrich, Nathaniel Fehl, Katie M. Heinrich. Kansas State University, Manhattan, KS. (Sponsor: Craig Harms, FACSM)

(No relationships reported)

High intensity exercise improves cardiovascular fitness in children; research has shown significant improvements in cardiovascular fitness for adults who spent <3 hours a week engaging in high intensity exercise. Data show many children do not meet the weekly physical activity recommendations of the ACSM. With high intensity training, cardiovascular fitness and body composition can be improved while spending significantly less time exercising.

**1970 Board #16 MAY 31 9:00 AM - 10:30 AM**

**Fitness Gains from a Summer Youth Conditioning Camp**

Pratik M. Patel, Brian Sanborn, Christian Larson, Bryan S. Heinrich, Nathaniel Fehl, Katie M. Heinrich. Kansas State University, Manhattan, KS. (Sponsor: Craig Harms, FACSM)

(No relationships reported)

High intensity (HI), low volume exercise may improve fitness better than low intensity, high volume training. Children struggling to achieve the recommended 60 minutes of daily exercise could benefit from exercising more intensely for less time.

**1971 Board #17 MAY 31 9:00 AM - 10:30 AM**

**Influence Of Resistive Load On Oxygen Uptake During Repeated Sprints In Prepubertal Boys And Men.**

Apostolos Theos, Gregory Bogdanis, Anastasios Philippou, Maria Maridaki. National & Kapodistrian University of Athens, Greece, Athens, Greece.

(No relationships reported)

Oxygen uptake (VO₂) during repeated sprinting differs significantly between different resistive loads in adults. Furthermore in two consecutive Wingate tests children produce energy more aerobically in comparison to adults.

**PURPOSE:** To examine the influence of two different resistive loads on VO₂ during repeated sprints and in men and boys.

**METHODS:** Nine men (21.7 ± 0.8 yrs) and twelve prepubertal boys (11.8 ± 0.2 yrs) performed a force-velocity test on a friction-loaded cycle ergometer to determine the load corresponding to the optimal pedal rate (Fopt). On two separate occasions, ten 6 s sprints interspersed with 24 s recovery intervals were performed, against a load equal to Fopt or 50%Fopt in random order. Power output was recorded at 200Hz and VO₂ was continuously monitored. Comparisons between the two conditions of repeated sprints were made using two-way ANOVA with repeated measures. Results are presented as mean ± standard error.

**RESULTS:** VO₂ for all sprints in men was higher in the Fopt compared with the 50%Fopt condition (37.1 ± 1.0 vs. 34.0 ± 0.9 ml/kg/min for the Fopt and 50%Fopt, respectively, p<0.01), while VO₂ in the two conditions was similar in boys (35.7 ± 1.8 vs. 34.0 ± 1.9 ml/kg/min for the Fopt and 50%Fopt respectively, p=0.42). Scaling of VO₂ per unit of power output (i.e. per Watt; ml/W/min) revealed significant differences between men and boys (p<0.001). In particular in the both the Fopt and 50%Fopt condition post-hoc analysis indicated that boys had higher values of VO₂ per Watt compared with men from the second to the sixt sprint (average VO₂ per Watt for sprints 2-6 for boys vs. men; Fopt: 3.5 ± 0.3 vs. 4.2 ± 0.2 ml/W/min, p<0.01; 50%Fopt: 1.5 ± 0.3 vs. 4.4 ± 0.2 ml/W/min, p<0.01). From the seventh to the tenth sprint men and boys had similar VO₂ per Watt.

**CONCLUSION:** The results of the present study suggest that boys may generate power mainly through aerobic pathways during the initial part of a repeated sprint protocol compared with men.
1972 Board #18 MAY 31 9:00 AM - 10:30 AM
Association Between Knee Alignment, Body Mass Index And Physical Fitness Among Students
Andrea Souza, Gerson Ferrari, João Pedro Silva Junior, Leonardo Silva, Luis Carlos Oliveira, Victor Matsudo. Center of Studies of the Physical Fitness Research Laboratory from São Caetano do Sul (CELAFISCs), São Caetano do Sul, Brazil.
(No relationships reported)
PURPOSE: To assess the association between malalignment of the knees (genu valgum) and variables of physical fitness among schoolchildren.

METHODS: Sample is part of the Ilhabela Mixed-Longitudinal Project on Growth, Development and Physical Fitness*, which is held since 1978 in the state of São Paulo, Brazil. Data were selected from a database of 16,000 schoolchildren measured from 1978 to 2010. We analyzed data collected between the years 2000 to 2009. Sample comprised 1141 schoolchildren of both sexes aged 06 to 18 years, who reached the following criteria: age between 6 and 18 years, and a full assessment of physical fitness, including measurement of genu valgus in at least one of the semester assessments. Postural evaluation (valgus) was determined by the intermalleolar distance, in centimeters. Body Mass Index (BMI) was determined through the growth curves of the World Health Organization. Physical fitness variables (strength of upper and lower limbs and velocity), were taken according to CELAFISCs standardization Statistics: Analysis of prevalence

CONCLUSION: There was a positive association between malalignment of the knees and body mass index among schoolchildren. No association was observed among genu valgum and physical fitness.

*Supported by FAPESP process number 2010/20749-8

1973 Board #19 MAY 31 9:00 AM - 10:30 AM
Effects of Summer School and Exercise on Physical Fitness and Weight Gain in Hispanic Adolescents
Jessica S. Zamarripa1, Kyung-Shin Park1, Noemi Ramirez2, David Martinez2, 1Texas A&M International University, Laredo, TX. 2IB Alexander High School, Laredo, TX. (No relationships reported)

Youth overweight and obesity prevalence rates have increased in the last 30 years becoming a significant public health concern particularly among low-income communities and ethnic minorities. Evidence indicates that weight gain and physical fitness declines are a result of physical inactivity and increased food intake during summer break.

PURPOSE: The purpose of this study was to determine if the effect of a 5 week summer school program, including 12 hours/week of physical activity, on physical fitness and weight gain prevention in Hispanic adolescents.

METHODS: 89 high school students participated in this study and 62 (29 males and 33 females) completed three tests, before and after summer school program, and after summer break. For each test, physical characteristics such as height, body weight, BMI, waist and hip circumference, and fitness levels including push-up, sit-up, sit and reach, and Queens’ college step test were measured. Variables were analyzed using one way (time) repeated measures analysis of variance (ANOVA) and Tukey post hoc tests.

RESULTS: No significant changes were found in height, body weight, BMI, waist and hip circumference, and sit and reach (flexibility) through summer break. Indices of muscular strength such as push-up (P<0.01), sit-up (P<0.05) and cardiopulmonary fitness (P<0.05) were significantly improved through summer school program, but returned to baseline at the end of summer break. Data collected before and after summer program, and after summer break are as follows: push-up (20.6±1.2→28.9±1.2→24.6±0.8, Mean±SE), Sit-up (26.9±1.3→32.4±1.5→30.4±1.5) and estimated VO2max (46.1±1.2 ml·kg⁻¹·min⁻¹→49.1±1.2→47.3±1.3).

CONCLUSIONS: Data analysis corroborates the initial hypothesis that summer school effectively prevents summer weight gain among Hispanic adolescents. Muscular strength and cardiopulmonary fitness were significantly enhanced during the 5-week summer school program, yet declined through the rest of the summer break. Results indicate that a long summer break may increase summer weight gain among Hispanic youth due to the lack of structure and unrestricted food access, which they would otherwise receive during the school year, thus encouraging physical inactivity and binge eating.

1974 Board #20 MAY 31 9:00 AM - 10:30 AM
Effects of Obesity and Fitness Levels on Academic performance in Hispanic Male and Female Adolescents
Joseph Lee1, Briana Rodriguez2, Blas D. Salinas3, Arturo Limon1, Kyung-Shin Park1, 1Harmony Science Academy, Laredo, TX. 2United South High School, Laredo, TX. 3Texas A&M International University, Laredo, TX. (No relationships reported)

Adolescents experience many changes in body structure and psycho-social functioning. Perceived obesity status and lower physical fitness are negatively associated with academic performance and the impact of these variables in academic performance may be different in males and females.

PURPOSE: The purpose of this study was to investigate whether levels of obesity and physical fitness have an influence on academic performance in Hispanic male and female adolescents.

METHODS: Body mass index (BMI), one-mile run and curl-up scores from 1,401 Hispanic adolescents in grades 9-11 were collected (746 males, 655 females). Students were classified into three groups for BMI score using CDC weight status cut point (normal, overweight, and obese) and three groups for aerobic fitness (one mile run) and muscular strength (curl-up) using FITNESSGRAM standards (ES: exceed standard, MS: meet standard, and US: under standard). Reading and Mathematics scores in Texas Assessment of Knowledge and Skills (TAKS) test was obtained from the South Texas school district. Variables were analyzed using two way (gender x group) analysis of variance (ANOVA) with Tukey post hoc test.

RESULTS: Obese male students showed lower scores in both Reading (31.6±1.7, Mean±SE vs. 36.6±0.6 and 36.9±1.1 for normal and overweight, P<0.05) and Math (29.1±1.7 vs. 34.5±0.7 and 34.6±1.2, P<0.05). However, there was no relation between the level of obesity and TAKS scores in female students. US males in curl-up (27.5±1.0) received significantly lower score in Math than NS and ES (32.7±0.9, 37.2±0.8, Pc. 0.01) and US females in curl-up showed lower scores in both Reading (34.0±0.9 vs. 41.1±0.8 and 41.7±0.8, P<0.01) and Math (29.1±0.9 vs. 35.5±0.9 and 36.9±1.0, P<0.01). TAKS scores were not affected by levels of aerobic fitness (one-mile run).

CONCLUSIONS: Results indicate that academic achievement in Hispanic high school students is associated with level of muscular strength, but not affected by aerobic fitness. Gender difference is visible in the relation between obesity levels and academic achievement in Hispanic adolescents. Academic success in male students is more sensitively affected by level of obesity (body shape) than females.

1975 Board #21 MAY 31 9:00 AM - 10:30 AM
Factors Relating to VO2 Peak in Healthy-Weight Versus Obese Young Children
Elizabeth A. Easley, Linnie Toney, Jody L. Clasey, FACSM. University of Kentucky, Lexington, KY. (No relationships reported)

Despite concerted efforts to prevent and combat childhood obesity, the high prevalence remains and continues to adversely impact both the present and future health and well-being of these children. Aerobic fitness determined by measures of peak oxygen consumption relative to body weight (VO2 peak; ml/kg/min) have been demonstrated to be related to both cardiovascular and body composition measures in adults.

PURPOSE: To determine the relationships between VO2 peak and resting measures of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), rate pressure product (RPP), and percent body fat (%Fat) in healthy-weight (HW) and obese (OB) children; and to examine whether group mean differences exist among these measures in HW versus OB children.

METHODS: HW (n=27; 9 girls and 18 boys) and OB (n=16; 6 girls and 10 boys) children ages 7-11 yr old completed a multistage maximal treadmill graded exercise test (GXT). Prior to the GXT, resting HR, SBP, MAP, and RPP were recorded and/or calculated. %Fat was measured using total body DXA scans. Simple regression was used to determine the strength of the relationships; and unpaired t-tests were used to determine the group mean differences between the HW and OB children.

RESULTS: In the HW children VO2 peak (40.6 ± 8.2 ml/kg/min) was significantly (p<0.05) related to HR (86.0 ± 15.0 bpm; r = -0.50) and RPP (8677.7 ± 1742.1; r = -0.44); but not to SBP
The dramatic increase in the prevalence of overweight and obese children over the past several decades poses a significant public health concern, especially among low-income communities and ethnic minorities. Some evidence suggests that physical fitness declines during the summer months and that children gain most of their extra weight during this period due to physical inactivity and an increase in food intake.

**PURPOSE:** The purpose of this study is to investigate whether attending a 5-week summer physical education program for Hispanic high school students is beneficial for maintaining body weight and physical fitness through the summer break.

**METHODS:** Total of 132 students participated in measurements at the beginning and end of summer break such as height, body weight, BMI, muscular strength, and cardiorespiratory fitness. Only 62 students (treatment) attended a 5-week summer physical education program, which included 12 hours/week of physical activity. Variables were analyzed using two way (group×time) repeated measures analysis of variance (ANOVA) with Bonferroni’s correction.

**RESULTS:** Non-summer school attendants gained body weight ([63.6±1.9kg; r=65.6±1.9, P<0.01, Mean±SE]) and BMI (24.4±7→24.9±7, P<0.05) without significant change in height. Estimated cardiorespiratory fitness via step test also significantly decreased (43.4±1.0ml/kg/min→41.7±0.9, P<0.05). Summer school attendants showed no significant changes in variables during summer break.

**CONCLUSIONS:** Results of study correspond with previous findings that adolescent weight gain during summer break may be due to physical inactivity and easy access to food. It is proposed that school districts incorporate a structured physical activity program throughout the summer break to prevent the prevalence of obesity.
RESULTS: Interactions were found in VO2peak (p=0.025), vocabulary (p=0.002), figure perception (p=0.047), space perception (p=0.011) and space inference (p=0.003). After the training, VO2peak increased all three groups (PA_warm 7.8±4.6 kg/ml/min; PA_cold 9.7±4.3 kg/ml/min; CON 2.8±3.1 kg/ml/min). BMI was not changed after the training. In cognition, after the training vocabulary (3.3±4.2), space perception (6.5±9.2) and space inference (6.5±6.5) was increased in PA_cold, only space perception (7.6±7.3) was increased in PA_warm while none was changed in the control.

CONCLUSION: The accumulation of PA improved cardiopulmonary fitness although BMI was not changed in obese and overweight male adolescents. The PA_cold also improved cognitive functions such as vocabulary, space perception and inference. Accumulating short bouts of PA might be adopted to school in lunch break or recess to improve fitness and cognitive function in adolescents.

1980 Board #26 MAY 31 9:00 AM - 10:30 AM Associations Between High-intensity Training, Body Composition And Fitness In Youth
Katie M. Heinrich, Pratik M. Patel, Brian K. Sanborn, Nathaniel Fehl, Bryan S. Heinrich, Christopher R. Larson. Kansas State University, Manhattan, KS. (Sponsor: Craig Harms, FACSM)

(No relationships reported)

Fitness is protective against childhood obesity. In particular, greater cardiorespiratory (CR) fitness is associated with less total and abdominal adiposity. High-intensity (HI) exercise is associated with greater CR fitness levels in youth, and is an overall key to improving fitness.

PURPOSE: This pilot study examined the relationship between changes in body composition and fitness for youth participating in a HI intervention as compared to active youth.

METHODS: The intervention group (IG; n=9, 8m, 1f) were ages 10-13 (mean=10.78y) and the comparison group (CG; n=6m) were ages 10-12 (mean=11.17y). The IG participated in 4 weeks of HI exercise (2d/wk, 45m/session). Pre- and posttest assessments included measured body composition (height and weight for body mass index-BMI, waist circumference-WC, dual X-ray absorptiometry for bodyfat percentage-BF%) and fitness (power-Margaria-Kalamen step test, vertical and horizontal jumps; speed-40m dash; muscular endurance- curlups and pushups; balance-Stork Balance Test; accuracy-wall toss test; agility-Illinois agility test; CR endurance-Fitnesgram Pacer).

RESULTS: Based on BMI %iles, 2 IG and 1 CG participants were overweight and 1 CG participant was obese. Based on WC %iles, 3 IG and 2CG participants were overweight. Based on BF% %iles, 1 CG participant was overweight and 1 CG participant was obese. After 4 weeks, both groups averaged lower BMIs (IG = -0.38±4.4; CG = -2.34±1.21) and increased WC (IG = 0.49±1.89; CG = 1.04±77). Significant differences existed between groups for change in BF% (CG = -4.3, IG = .83; p=0.021). For the IG, BMI was negatively associated with speed; BF% was negatively associated speed (p=0.008); and WC was positively associated with BF% (p=0.018), but negatively with pushups (p=0.014). For the CG, BMI was positively associated with lower vertical jump (p=0.03).

CONCLUSIONS: Despite high activity levels, 33% of the IG and CG participants were overweight or obese. Children participating in the HI intervention did not see gains in CR fitness. Overall the IG improved BMI, but had increased WC and BF%. The increased BF%, despite lower BMI, resulted in decreased speed, while the increased WC resulted in greater agility, but lower muscular endurance for the IG. Lower BMI in the CG decreased power.

1981 Board #27 MAY 31 9:00 AM - 10:30 AM Sex Differences in Childhood Athletic Performance
Joel M. Stager 1, Andrew Cornett 2, 1 Indiana University, Bloomington, IN; 2Indiana University/Eastern Michigan University, Bloomington, IN.

(No relationships reported)

INTRODUCTION: Growth and motor development literature suggests a two-way (age by sex) interaction for maturational traits and motor performance variables (Beunen & Malina, 1988). Much of the research in this area, however, focuses on sex differences around the adolescent growth spurt with little documentation of performance differences throughout childhood.

PURPOSE: The purpose of this study was to test for the presence of an age by sex interaction for a complex motor performance task and to determine whether or not sex differences exist for the performance of this task during childhood.

METHODS: The data for this project were provided by USA Swimming (USAS) and consisted of the best 50-yard Freestyle performance for all USAS registered male and female swimmers from 6-19 years of age that competed in the event from 2005-2010 (N = 1,193,362). The distribution location was determined for each combination of age, sex and competition year using methods previously described (Hoaglin, 2006). ANOVA was then utilized to test the significance of the age by sex interaction.

RESULTS: ANOVA revealed a significant age by sex interaction effect (F(13, 65) = 136.2, p < .001). Simple effects analysis indicated that the location parameter was significantly lower (i.e., times were faster) for boys than girls for 8-10 and 13-19 year olds (p < .001) while there was no difference in the location parameter between boys and girls 6-7 and 11-12 years old. The mean difference in the location parameter between boys and girls was significantly greater (p < .05) for 13-19 year olds (2.64) than for 6-12 year olds (0.44).

CONCLUSIONS: The age by sex interaction for 50-yard Freestyle performance parallels the reported maturational changes. The marked acceleration in height, weight, and strength in boys beginning around 13 years magnifies the relatively small preadolescent sex differences. These traits play a crucial role in the increased performance difference between boys and girls from 12 to 13 years. While maturational traits play a role in adolescent performance differences, their role in childhood performance differences is unclear. Additional research is needed to determine whether or not the superior performance of boys relates to physiological parameters and/or sex differences in participation and selection bias.

1982 Board #28 MAY 31 9:00 AM - 10:30 AM Sex Specific Effects Of Integrative Neuromuscular Training On Fitness Performance In 7 Year Old Children
Avery D. Fagenheim, FACSM 1, Gregory D. Myer, FACSM 2, Anne Farrell 3, Tracy Radler 1, Marc Fabiano 1, Jie Kang, FACSM 3, Nicholas Ratamess 1, Timothy E. Hewett, FACSM 1, 1The College of New Jersey, Ewing, NJ; 2Cincinnati Childrens Hospital Medical Center, Cincinnati, OH; 3Love Elementary School, Ewing, NJ.

(No relationships reported)

PURPOSE: To evaluate sex-specific effects of integrated neuromuscular training (INT) on selected health- and skill-related fitness components in children implemented during physical education (PE) classes.

METHODS: Forty children (7.6 ± 0.3 years) from two 2nd grade PE classes participated in this study. Classes were cluster randomized into PE plus INT (INT; 10 male, 11 female) or the control group (CON; 6 male, 13 female) who participated in traditional PE. INT was performed 2x/wk for the first approximately 15 min of each PE class and consisted of body weight exercises that focused on enhancing muscular strength, muscular power and fundamental movement skills. Main outcome measures were 8 health- and skill-related fitness tests.

RESULTS: At baseline, the male students demonstrated higher levels of performance in multiple fitness measurements as evidenced by significantly greater performance on the push-up, 0.8 km run, long jump, single-leg hop and shuttle run tests (p<0.05). Significant time by group interactions were noted in INT females due to enhanced INT-induced gains in performance relative to CON on the curl-up, push-up, 0.8 km run, long jump, and single-leg hop (p<0.05). Males did not demonstrate any interaction effects of training, but both INT and CON improved similarly in the 0.8 km run, long jump, single-leg hop and shuttle run post-training (p<0.05).

CONCLUSIONS: These findings indicate that INT is an effective and time-efficient addition to PE to enhance motor skills and promote physical activity in children. The 2nd grade females in the current study showed greater sensitivity to the effects of INT.
(n=42, 14.8±0.1 yrs, 161±1 cm, 52.8±1.1 kg). Participants performed one-leg and two-leg counter movement jumps without arm swing on a contact mat. The bilateral jump deficit index was used to test the utility of the various combinations to predict self-reported LBP.

RESULTS: Girls classified “with LBP” (n=11) had Z-scores below average on all the tests (-0.60 to -0.12). Z-scores for girls that reported “No LBP” (n=19) ranged from -0.07 to 0.05. The static curl-up and the lateral plank tests combined were the best indicator of LBP in girls (AUC=0.69; Sensitivity=90.9, Specificity=52.6). The same analyses for males were inconsistent and revealed that males “with LBP” and males with “No LBP” did not differ on their performance tests.

CONCLUSIONS: The ROC properties indicate that these tests can identify adolescents’ girls with LBP (Sensitivity) however, the low value for Specificity indicate that girls with “No LBP” can be misclassified as being at risk for LBP. The same approach for males had mixed findings and therefore requires further testing.

It has been reported that power output per leg is less in two-leg jumps than in single leg jumps. This phenomenon has been termed bilateral deficit and has been attributed to a reduced neural drive that may be lower in pre-pubertal children compared with post-pubertal teenagers and adults. However, it is not certain that a bilateral deficit exists in children and especially in young females.

PURPOSE: To examine bilateral deficit in vertical jumping in male and female children and adolescent athletes.

METHODS: One hundred and seventy children with at least 2 years of training experience in track and field were divided into four groups according to age and gender: (pre-pubertal boys: n=45; age: 10.1±0.1 yrs, 141±1 cm, 36±0.9 kg; pre-pubertal girls: n=42; 10.1±0.1 yrs, 140±1 cm, 37±1.2 kg; adolescent boys: n=41, 15±0.1 yrs, 171±1 cm, 61±1.4 kg; adolescent girls: n=42, 14±0.1 yrs, 161±1 cm, 52±1.1 kg). Participants performed one-leg and two-leg counter movement jumps without arm swing on a contact mat. The bilateral jump deficit index was calculated as: (1-right/leg jump height)/two-leg jump height x 100. Peak leg power output during jumping was also calculated and was scaled with body mass. Differences between boys and girls and the two age groups were analyzed using two way ANOVA.

RESULTS: Jump height and leg peak power were similar in pre-pubertal boys and girls (24.8±0.7 vs. 24.2±0.7 cm and 30.0±1.1 vs. 29.2±1.2 W, respectively). However, jump height and leg peak power were higher in adolescent boys compared to girls (37.8±0.8 vs. 29.3±0.9 cm and 49.0±0.8 vs. 40.2±1.0 W, respectively, p<0.01). The bilateral index was positive for males in both age groups (2.0±1.3% and 1.9±1.2%) indicating lack of bilateral deficit. This was also the case for the pre-pubertal girls (bilateral index: 0.1±1.2%). However, adolescent females showed a negative bilateral index (-3.3±1.5%), with the sum of the single leg jumps being significantly greater than the two-leg jump (30.3±1.0 vs. 29.3±0.9 cm, P<0.05).

CONCLUSION: There was a lack of bilateral deficit in vertical jumping in pre-pubertal boys and girls and also in adolescent boys. The manifestation of bilateral deficit only in adolescent girls may be explained by superior motor skill ability (i.e. balance on one leg and jump) of girls over boys in that age.

PURPOSE: To examine the effect of the All 4 Kids preschool physical activity intervention on boys.

METHODS: 321 preschool children in Head Start centers across southern Nevada participated in this study. They were divided into intervention and comparison groups. All children completed a movement assessment that evaluated fundamental, spatial, and temporal movement patterns. After the initial assessments the children in the intervention group participated in the 9-week All 4 Kids program while the comparison group continued with standard Head Start curriculum. The program utilized dances with a wide range of movement skills as recommended in Pre-Kindergarten physical development standards. Post assessments were conducted on both groups at the end of 9 weeks.

RESULTS: Using an ANCOVA, children’s combined movement skills in the intervention group demonstrated a significantly higher composite score than the control group (n=179, p<0.001) and a significantly greater ability to cross the midline of the body (n=321, p=0.014). The intervention group also demonstrated a significant increase (p=0.022) towards meeting the state’s balance standard of 5 seconds, as compared to the comparison group (p<0.01). Preschoolers in the intervention group showed a significant increase (n=179, p<0.001) in the number of hops for 15 seconds.

CONCLUSIONS: Provision of music and movement skills that focus on skill development with intended outcomes for learning are critical to maintaining an active lifestyle beyond the preschool years. Preschool interventions should involve a wide range of antecedent movements such as those mentioned in national and state Pre-K standards. This study demonstrates that the All 4 Kids program is a viable teaching tool that can improve a child’s movement skills.

The purpose of this study was to test utility of different fitness field tests to predict self-reported LBP in high school adolescents.

METHODS: A sample of 100 high school (9th and 10th grade) students participated in the project as part of a supplemental school physical fitness evaluation. Participants first completed a survey instrument designed to assess the presence (and degree of) low back pain. On subsequent days, participants completed a battery of different physical fitness tests including: trunk extension test (in inches), dynamic curl-up (in number of repetitions), static curl-up (in seconds), plank (in seconds), lateral plank (in seconds), and the sit-and-reach test (in cm). The performance on the fitness tests were converted into z-scores and sums were then computed for all possible combinations of Z-scores from 2 and 3 tests. Receiver operator characteristic curves (ROC) were used to test the utility of the various combinations to predict self-reported LBP.

CONCLUSIONS: The ROC properties indicate that these tests can identify adolescents’ girls with LBP (Sensitivity) however, the low value for Specificity indicate that girls with “No LBP” can be misclassified as being at risk for LBP. The same approach for males had mixed findings and therefore requires further testing.
the effect of PA and other variables on achieving the FITNESSGRAM® Healthy Fitness Zone (HFZ) for FAT and AF. All significance tests were done at p < 0.05 level.

RESULTS: Boys and girls were found to be significantly different on the PACER test (M = 29.21, SD = 11.59 vs. M =21.5 laps respectively), r(43.5) = 2.62, p = .012, and PAQ (M = 3.15, SD = .72; vs. M = 2.75, SD = .60 respectively), r(48) = 2.10, p = .041. The logistic regression model with gender (GEN), AGE, BMI and PAQ for achieving the HFZ was significant for FAT but not for AF. The model was significant, $X^2 (4, N = 50) = 38.30, p < .05$; explained between 53% and 71% of the variance and correctly classified 86% of the cases. However, only BMI and GEN made significant contributions to the model.

CONCLUSIONS: Results show a difference between the important variables of AF and PA for boys and girls. Although PA has been found to be related to both BMI and AF; in this case it does not appear to have an important contribution to predicting the likelihood of achieving the corresponding HFZ. The lack of a significant relationship in the present group may suggest that PA’s effect is confounded by other factors. It could be speculated that the young age of the subjects may not allow for the level of variability on the trait to ascertain differences. Additionally, self report PA has been found to have low levels of reliability in children who may have affected these results.

1987 Board #33  MAY 31 9:00 AM - 10:30 AM
Adolescents Engaged In At Least Five Hours Of Physical Activity Weekly Show Numerous Health Benefits

(Purpose: No relationships reported)

PURPOSE: To determine if scores on the Oswestry-Disability Index (ODI), body composition, back health or fitness indicators were significantly different in healthy adolescents based on the number of minutes per week they spend engaged in physical activity.

METHODS: A convenience sample of 152 healthy adolescents (age 14-18 years; 68 males and 84 females) provided written informed consent to participate in this study. Measured variables included hip flexion active range of motion (AROM), v-sit, lumbar lateral flexion AROM, a trunk extension hold, number of sit-ups in a minute and 90/90 hamstring length. Additionally, subjects completed the International Physical Activity Questionnaire (IPAQ) focused on organized physical activity participation and the Oswestry-Disability Index (ODI). Subjects were divided into 3 groups based on the number of minutes per week they spent in physical activities PA Group 1: 120 minutes or less , PA Group 2: 121 - 300 minutes , and PA Group 3: more than 300 minutes. One-way ANOVA and univariate general linear model (GLM) tests were completed.

RESULTS: ANOVA tests revealed that for PA Groups 1, 2 and 3 the means and associated p values were respectively, BMI , 25.61, 23.31, 23.03 p = 0.026; sit-ups in one minute 33.87, 39.00, 41.48 p = 0.001; and ODI scores 12.40, 17.29, 10.10 p = 0.003. Because, on average, females scored higher than males on the ODI (15 vs 9.8, respectively p = 0.011), a Univariate GLM test was completed with both gender and PA Group entered as factors and ODI as the dependent variable. With gender statistically controlled, PA Groups 1 and 3 still had significantly lower ODI scores compared to PA Group 2. Based on the ODI scores, twenty four percent of the adolescents were classified as having clinically significant back disability (ODI score > 20%). Lastly the ODI scores for adolescents were better correlated with weekly PA than any of the other common clinical measurements for back motion.

CONCLUSIONS: The level of physical activity that approximates the Surgeon General’s Vision for a Healthy and Fit Nation 2010 recommendation of 60 minutes per day, appears to promote healthy back function, body composition and fitness indicators which are all associated with overall improved health status.

1988 Board #34  MAY 31 9:00 AM - 10:30 AM
Are Aerobic and Anaerobic Capacities in CUSSA Junior Alpine Ski Racers Improving? A Seven Year Follow-up.
Kelley Holmes¹, Emily Willaert¹, Mark Blegen, FACSM², David Bacharach, FACSM². ¹St. Cloud State University, St. Cloud, MN. ²University of St. Catherine, St. Paul, MN.

(Purpose: No relationships reported)

INTRODUCTION: Central Region 1 of the US Ski and Snowboard Association (USSA) encourages athletes to participate in fitness evaluations as part of the selection process for Team Central. Over the past seven years, the 20m pacer test (aerobic) and 40cm box jump test (anaerobic) have been used to estimate individual capacities. Normative data have been used to provide feedback to athletes for the last three years as a motivational tool to encourage improvement.

PURPOSE: To determine if providing normative data to athletes would help them achieve higher levels of fitness on the aerobic 20m pacer test and anaerobic 40cm box test.

METHODS: Subjects (N=121) were junior alpine skiers age 10-19 and members of the Central USSA. Data were collected from 2005 to 2011 on skiers who where able to complete both the aerobic and anaerobic portions of the test. Subjects performed a 20m pacer test to determine VO2max and a 60s 40cm box jump test. Minimum values from norms generated by Stielow and Bacharach (2010) were used to compare average values for each age and gender group over the seven years.

RESULTS: Recommended minimum values for each age and gender were compared to actual values from predicted aerobic capacity (VO2 mill/kg/min) and 60s box jump scores recorded each year. Paired t-tests were performed with a Bonferroni adjustment to account for potential Type I errors and P<0.008 was used to determine significance. No differences were noted for any group. A trend toward a decrease in aerobic capacity for female subjects age 15-19 yrs over this seven year period was observed (P<0.009).

CONCLUSIONS: Although annual fitness assessments have been able to provide recommended levels and quartile rankings for athletes to achieve on aerobic and anaerobic capacity tests, no improvements have been seen in these athletes. Perhaps maintaining fitness levels could be considered better than the downward trend seen in non-athletes of this age range over a similar time period (Science Daily, 2006); however, it appears clear that fitness parameters are not an area of great focus for these aspiring athletes. If athletes from Central Region 1 of USSA want to be competitive at a national level, they will have to address the deficit seen in these data.

The authors want to acknowledge and thank Region 1 coaches and parent-volunteers who assisted with data collection.

1989 Board #35  MAY 31 9:00 AM - 10:30 AM
Acute Effects of Static and Dynamic Stretching on Agility Performance with a Skill Component in Elite, Youth Soccer Players
Ajit Korgaokar, J. Bradley Jordan, Richard S. Farley, Jennifer L. Caputo. Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don Morgan, FACSM)

(Purpose: No relationships reported)

Static stretching has been shown to decrease maximal force production and negatively affect explosive actions such as agility movements. Minimal research has been conducted using a skill component, such as dribbling a ball in soccer, to compare static vs. dynamic stretching on agility performance.

PURPOSE: To examine and compare the effects of static and dynamic stretching on agility performance while dribbling a ball through the Balsom agility course in elite youth soccer players.

METHODS: Elite, male soccer players (N = 14), completed 4 trials of the Balsom agility test while dribbling a soccer ball. Height, age, and body mass were recorded and participants were familiarized with the Balsom agility test during the first trial. Randomized and counterbalanced trials of the Balsom agility test preceded by static or dynamic stretching were administered after a standardized warm-up (control condition). Standardized warm-up consisted of 3 minutes of self-paced light jogging and 2 minutes of passing and running with a ball. The muscles targeted for both the static and dynamic treatments were the hamstrings, quadriceps, and the Gastrocnemius and Solei. Differences between the control condition and each treatment were calculated.

RESULTS: The mean difference between the control condition and the stretching trials was 0.34 sec for the static stretching protocol and 0.15 sec for the dynamic stretching protocol. No statistically significant difference was found between the effects of static and dynamic stretching on agility performance, F(1,13) = 0.61, MSE = .426, p = .45. A high mean square error (.426) indicated large within-group differences on agility performance.

CONCLUSION: The results do not support the preferential use of a static or a dynamic stretching protocol over a general warm-up prior to sport-specific agility tasks in youth soccer players. The addition of a sport-specific skill component, dribbling a ball, to an agility test may increase within-subject variance in trials involving youth soccer players.
1990  Board #36  MAY 31  9:00 AM - 10:30 AM  
High Intensity Interval Training Versus Traditional Preseason Training in High School Football Athletes  
Fred Hale, Christine Lo Bue-Estes, Timothy N. Harvey, Anthony Spencer. Mercyhurst College, Erie, PA. 
(No relationships reported) 

Sport specific training is central to implementing proper exercise protocols to achieve maximal performance outcomes. In many sports coaches will not employ training based on appropriate metabolic specificity. 

PURPOSE: To assess improvement in anaerobic capacity via measuring: 40yd dash, vertical jump, and agility based on, intervention specificity in varsity football athletes, with a minimum of 2 years previous playing experience. 

METHODS: A convenience sample of 50 athletes (aged 17-18 years) was identified to participate in the project. Athletes were randomly assigned to two groups: an Aerobic group (n=25) or a High Intensity Interval Training (HIIT) group (n=25) and stratified by position type. Over the course of 10 weeks in preseason the additional training consisted of approximately 20 minutes of work, for both groups, with aerobic group running at 65-85% of RPE based capacity at a 1:2 work/rest ratio (WRR), and the HIIT group working at >85% of RPE based capacity at 1:2 WRR for weeks 0-6, and 1:1 WRR for weeks 7-10. 40yd dash, vertical jump, and shuttle run were assessed before and after completion of 10-week aerobic or HIIT intervention. Change scores were calculated for each group before and after the 10 week training period. One-tailed paired t-tests were used to compare change scores across both exercise interventions. 

RESULTS: Both groups improved over the course of 10 weeks, with no difference between groups for the shuttle run (HIIT = 2.69, Aerobic = 2.84). The HIIT group, however, showed a greater improvement than the aerobic group for: 40 yard dash (3.90, 2.03; p=0.001), and vertical jump (9.05, 4.09; p=0.001). 

CONCLUSIONS: Implementing a high intensity training protocol in adolescent varsity football athletes translates into greater improvements for speed and vertical jump, compared to aerobic intervention of a similar duration. Improvements in these variables will hopefully translate into greater on-field successes based on improved metabolic capability, due to sport specific HIIT. 

1991  Board #37  MAY 31  9:00 AM - 10:30 AM  
Gender-Based Differences in Sprint and Acceleration Capacities in Very Young Athletes  
Daniel H. Serravite1, Brian Biagio1, Charnaine DeFrancesco1, Joseph White2, Joseph F. Signorile2. 1Florida International University, Miami, FL. 2University of Miami, Coral Gables, FL. (Sponsor: Arlette Perry, FACS) 
(No relationships reported) 

Sport performance is determined to a large extent by the acceleration capacity of the athlete. This is especially true for team sports like soccer where field dynamics rapidly change. Even though sprinting and acceleration seem to be crucial to soccer, little is known about the gender-specific sprinting and acceleration characteristics of very young soccer players. 

PURPOSE: The purpose of this study was to investigate the gender-related differences in sprint speed, acceleration and lower body power in 8 to 10 year old soccer players. 

METHODS: 57 boys and 66 girls from 8 to 9 (U9) and from 9 to 10 (U10) years of age were evaluated (28 U9 boys [8.6 yr ± 0.4], 29 U10 boys [9.6 yr ± 0.3], 31 U9 girls [8.6 yr ± 0.3] and 37 U10 girls [9.6 yr ± 0.3]) in sprint and jump performance. Split times at 5m, 10m, 20m and 30m to allow the analysis of partial velocities (V5m, V10m, V20m and V30m) and accelerations (A0-5m; A5-10m; A0-10m; A10-20m) were evaluated during a 30m sprint using electronic timing gates. To assess leg power each subject performed 3 countermovement jumps (CMJ) on a pressure-sensitive mat. Leg power was computed using the best and mean CMJ heights and body weight. 

RESULTS: Multivariate ANOVA analysis revealed a gender by age group interaction for V5m, A0-5m and A5-10m. Separate analyses of V5m by age showed that at U9 boys were faster than girls, but at U10 girls were faster than boys. This interaction was also reflected in the A0-5m, where boys had a greater acceleration than girls at U9 (p= 0.007), but girls showed a greater acceleration than boys at U10 (p= 0.001). Interestingly, although the analysis of V10m only showed main effects of age, with U10 faster than U9, the analysis of the A5-10m interaction revealed that U10 boys had a greater acceleration than girls (p < 0.005). There was a significant main effect of age for height, weight, and leg power showing increments with age, U10 were taller, heavier and more powerful than the U9. 

CONCLUSION: Both gender and age uniquely contribute to velocity and acceleration in linear fashion in very young athletes. This is especially true in short sprints up to 10 meters. However, these differences were not explained by weight or power. 

1992  Board #38  MAY 31  9:00 AM - 10:30 AM  
Association Between Suspected Fatty Liver, Obesity, Inflammation And Cardiorespiratory Fitness In Portuguese Youth  
Clarice Martins, Andriéa Pizzarro, Luísa Aires, Gustavo Silva, Jorge Mota, Maria Paula Santos. Faculty of Sports, Porto, Portugal. 
(No relationships reported) 

Nonalcoholic fatty liver disease (NAFLD) is one of the most frequent complications associated with excess adiposity and a number of variables, similar to current risk factors, have been associated to NAFLD in the pediatric population. However, few studies have addressed the association between suspected fatty liver, obesity, inflammation and fitness in children, as a possible diagnostic for predicting future NAFLD. 

PURPOSE: To analyze the association between serum aminotransferase (ALT), waist circumference (WC), C-reactive protein (CRP), and cardiorespiratory fitness (CRF) in school children. 

METHODS: A total of 79 obese students (40 girls and 39 boys), 10-11-year-olds (±0.60), with abnormal serum ALT from Porto public schools comprised the sample. Measurements included CRF (20-min Shuttle Run Test), WC (NHANES protocol), CRP and ALT (Cholestech LDX® analyser). Pearson correlation and general linear model with Bonferroni’s adjustments for multiple comparisons were used to examine the differences in the measured variables, adjusting for CRF and gender. 

RESULTS: The analysis showed negative correlations between fitness and the measured variables. Significant correlations were observed for WC (p<0.02), CRP (p=0.012) and ALT (p=0.04). Data showed a significant main effect for CRF in ALT (p=0.008) but not in WC (p=0.057) nor PCR (p=0.223). The gender main effect and the gender*CRF group interaction were not significant (p=0.05) for WC, PCR and ALT.

CONCLUSIONS: CRF is negatively associated to WC, PCR and ALT, and present a significant effect in ALT values in obese children. 

Supported by grants PTDC/DES/099018/2008, FCT/FCOMP-01-0124-FEDER-099573 and SFRH/BPD/66441/2009 

1993  Board #39  MAY 31  9:00 AM - 10:30 AM  
The Influence Of Wrist-worn Accelerometer Wear Location On Free-living Physical Activity In Adolescents  
Edward M. Davila, Daniel P. Heil, FACSFM. Montana State University, Bozeman, MT. 
(No relationships reported) 

The use of accelerometer-based wrist-worn activity monitors (AM) to measure free-living physical activity (PA) is popular in research settings. Although previously evaluated in adults, no research has investigated the impact of wrist-worn AM location (dominant [D] vs non-dominant [ND] or left [L] vs right [R]) on measurements of free-living PA in adolescents. 

PURPOSE: The aim of this study was to evaluate the influence of wrist-worn AM wear location (D vs ND and L vs R) on measures of free-living PA in adolescents 12-17 years old. 

METHODS: Eight boys (Mean±SD: 14±2 yrs, 53.9±13.6 kg, 160.5±14.5 cm, 20.6±2.3 body mass index [BMI]) and 12 girls (14±2 yrs, 56.1±9.9 kg, 160.3±7.4 cm, 21.4±2.6 BMI) participated in the study. Subjects wore two AMs for 7 consecutive days (24 hr/day), with one AM attached to the dorsal side of each wrist using locking plastic wrist bands. Subjects were instructed to engage in their usual daily activities. After downloading the raw AM data to a computer, previously validated regression algorithms were used to transform and summarize the data into counts (counts/day), activity energy expenditure (AEE, kcal/day), and duration of time (T; minutes/day) for 1, 5, and 10 minute bout durations (BDs) within light (L) and moderate-to-vigorous (MV) intensity categories for each AM. Dependent variables (CST, AEE, T) for each BD within L and MV intensity between each AM (D vs ND and between L vs R) were compared using two-factor (AM Location x BD) multivariate repeated measures ANOVA (α=0.05), Scheffe’s post-hoc analyses (α=0.01) were performed for all pairwise comparisons when indicated by the ANOVA. Pearson’s correlation was used to analyze the relationship between dependent variables for all BDs within L and MV intensities between AMs (D vs ND and L vs R) (α = 0.05).
RESULTS: No significant differences were found amongst all dependent variables for any BD within L or MV intensity between AMs. There were high correlations (r = > 0.85, p-value < 0.0001) between dependent variables for all BDs within L and MV intensities between AMs.

CONCLUSION: These data indicate that wrist-worn AM location has no significant influence on PA outcome variables in adolescents under free-living conditions. Researchers can now give participants the option to choose which wrist they would prefer the monitor to be placed when being assessed.

1994 Board #40 MAY 31 9:00 AM - 10:30 AM
The Effect of High School Sports Participation on Collegiate Level Physical Fitness and Physical Activity
Patrick Schneider1, Jeanne Sowers1, Sarah Adams1, Christine Manville3, Lynne Shores3, Mary Dietrich1. 1Belmont University, Nashville, TN. 2Vanderbilt University, Nashville, TN. (No relationships reported)

PURPOSE: The purpose of this study was to assess the effect of high school (HS) sports participation on physical fitness (PF) and physical activity (PA) levels in college among males and females.

METHODS: 113 students (50 males, 63 females) enrolled in a university level wellness class participated in the study. Participants completed a PF battery consisting of cardiorespiratory fitness (CRF), muscular endurance (ME), body composition (BC) and flexibility (FX) assessments. In addition, they completed a survey to determine HS sports participation (collegiate athletes were excluded). Self-reported PA levels were assessed to determine current PA status. Normally distributed values (CRF, BC, FX) are summarized as mean±SD; skewed values (ME) are summarized using median values (25th,75th IQR). ANOVA was used to compare main and interaction effects of gender and HS sports participation (CRF, BC, and FX) on PA and CRF, BC, and FX; a Kruskal-Wallis test was used for ME. Activity levels by gender and HS sports participation were compared using Chi-Square Tests of Independence.

RESULTS: There were no statistically significant differences in PF measures between HS athletes and non-athletes among genders.

<table>
<thead>
<tr>
<th></th>
<th>Female HS athletes</th>
<th>Female HS non-athletes</th>
<th>Male HS athletes</th>
<th>Male HS non-athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRF (ml/kg/min)</td>
<td>46.7±4.8</td>
<td>46.6±4.0</td>
<td>53.9±4.8</td>
<td>51.3±6.7</td>
</tr>
<tr>
<td>ME (reps)</td>
<td>50 (23,34)</td>
<td>25 (21,31)</td>
<td>80 (25,40)</td>
<td>80 (21,34)</td>
</tr>
<tr>
<td>BC (% fat)</td>
<td>32.4±7.4</td>
<td>30.7±7.0</td>
<td>18.7±6.9</td>
<td>14.8±4.4</td>
</tr>
<tr>
<td>FX (cm)</td>
<td>56.8±7.6</td>
<td>55.0±7.3</td>
<td>80.6±8.3</td>
<td>28.3±9.0</td>
</tr>
</tbody>
</table>

Statistically significant gender differences were observed for each PF measure except ME (males > CRF; females > BC, FX, each p < .001) and males tended to be less active than females in this study (p = .006). Furthermore, it appeared that male HS non-athletes tended to be less active than either female HS athletes or non-athletes, as well as male HS athletes (p = .024).

CONCLUSION: The lack of statistically significant differences between PF measures of HS athletes and non-athletes in college may be due to the relatively homogeneous fitness levels of students in this study.

C-26 Free Communication/Poster - Chronic Disease
MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

1995 Board #41 MAY 31 8:00 AM - 9:30 AM
Physical Activity Change And Its Relationship With Change In Insulin Resistance (HOMA-IR)
Kristi L. Storti1, Marquis S. Hawkins1, Jennifer N. Cooper1, Kelley Petee Gabriel2, Kim Sutton-Tyrrell1, Andrea M. Kriska, FACSM1. 1University of Pittsburgh, Pittsburgh, PA. 2University of Texas Health Science Center at Houston, Austin, TX. (No relationships reported)

PURPOSE: To determine the impact of PA change, as measured by accelerometer, on insulin sensitivity in overweight, sedentary adults aged 20-45 years, involved in a lifestyle intervention, which included a PA component.

METHODS: The Slow Adverse Vascular Effects of excess weight (SAVE) trial evaluated relationships between weight loss, dietary sodium, and vascular health. Subjects were randomly assigned to a regular or reduced sodium diet, and all received a one-year nutrition and PA intervention. PA data were collected at baseline and 12 months using an AM7164 ActiGraph accelerometer. Freedson threshold values were applied to describe time in different intensity levels. Total body movement was assessed via total counts per day (CTS). Homeostatis model of assessment of insulin resistance (HOMA-IR) was computed using fasting insulin and glucose measures. Linear mixed models were used to examine the impact of change (baseline to 12 months) in total time spent (min/d) being sedentary (SED), in light intensity PA (LPA), moderate to vigorous intensity PA (MVPA) and change in HOMA-IR. Model 1 adjusted for time (yrs) since baseline, age, sex, race, current smoking status, wear-time, and randomization group. Models 2, 3, and 4 additionally controlled for BMI; baseline MVPA; and change in MVPA, respectively.

RESULTS: From baseline to 12 months, MVPA and SED significantly increased, LPA significantly decreased. Improvements in HOMA-IR score were noted from baseline to 12 months [mean (SD)] since baseline (1.9±0.6 vs. 2.2±0.7 L/min, p<0.001, respectively) after adjusting for BMI and MVPA change (p < 0.05).

CONCLUSIONS: LPA and CTS were related to HOMA-IR rather than MVPA alone, likely reflecting the small amount of time spent in the latter. Interventions should focus on total movement rather than just increasing high intensity movement for insulin sensitivity.

1996 Board #42 MAY 31 8:00 AM - 9:30 AM
How Much Exercise Is Needed To Improve Insulin Sensitivity In Sedentary Adults?
Francesca Amati1, John J. Dubé2, Katelyn Fleishman Allison2, Valentin Rousson1, Brett H. Goodpaster1. 1University of Lausanne, Lausanne, Switzerland. 2University of Pittsburgh, Pittsburgh, PA. (No relationships reported)

PURPOSE: Exercise improves insulin sensitivity (IS) and is a first line for the prevention and treatment of type 2 diabetes. The extent to which IS response is dose-dependent is not known. The purpose of this study was to examine whether or not exercise dose was associated with improvements in IS following four months of exercise training in previously sedentary adults.

METHODS: Fifty-five healthy volunteers (F=34, M=21, mean age 54±15) participated in a 16-week supervised endurance exercise intervention with a pre/post intervention design. IS was assessed by euglycemic hyperinsulinemic clamp, VOpeak by a GXT and body composition by DXA. Exercise dose, expressed as average kcal expended/week, was computed as the product of exercise intensity, duration and frequency. Paired T-tests, correlations and multivariate regression models were used.

RESULTS: At baseline 20% of the volunteers had class II obesity, 35% class I obesity, 33% were overweight and 13% were in the normal range. Improvements with intervention were observed for BMI (30.5±4.4 vs. 29.5±3.9, P<0.001), VOpeak (1.9±0.6 vs. 2.2±0.7 L/min, P<0.001) and IS (367±112 vs. 450±130 mg/min, P<0.001). Average exercise frequency was...
METHODS:
Exercise training typically increases peripheral insulin sensitivity, which may reduce insulin secretion. Whether interventions designed to reduce sedentary time result in similar changes in insulin secretion has not been established.

PURPOSE:
To determine changes in fasting insulin secretion, hepatic extraction (HE) and HOMA2-%B following exercise training (EX), an intervention designed to reduce sedentary time (rST), or combined exercise training and reduced sedentary time (EX+rST).

METHODS:
48 sedentary, overweight subjects were randomized to 12 weeks of: 1) EX (n=13), 5 days/wk at 50-60% heart rate reserve, 2) rST (n=13), targeted instruction designed to increase steps/day and reduce sedentary time, 3) EX+rST (n=14) exercise training plus reductions in sedentary time or 4) control (CON, n=8). Sedentary time and steps/day were assessed using an activPAL wearable monitor. Glucose, C-peptide and insulin concentrations were determined using the glucose oxidase method and radioimmunoassay. HOMA2-%B was calculated using the HOMA2 calculator. Differences across conditions in C-peptide, fasting hepatic extraction (Insulin/C-peptide) and HOMA-%B were determined using paired t-tests and one-way ANOVA.

RESULTS:
Both exercise groups increased VO2max (EX=9%, EX+rST=12%) indicating improved cardiovascular fitness. Sedentary time was significantly lower in the rST (14%) and EX+rST (7%), did not change in EX group, and increased in CON (4%). Steps/day significantly increased in EX, rST and EX+rST but not in CON. There were no pre- to post differences in fasting C-peptide concentrations (F=0.86 ±0.39 vs 0.76 ±0.32, rST=1.33 ±0.72 vs 1.34 ±0.66, EX+rST=0.87 ±0.39 vs 0.87 ±0.33, CON=1.19 ±0.45 vs 1.24 ±0.43) However there was a decrease in HE in the rST group (13%±8%[pre] vs 11%±8% [post], p=.04). There were no differences in HOMA-%B in any group.

CONCLUSIONS:
Exercise training and/or sedentary behavior reduction interventions did not alter fasting insulin secretion, however the rST intervention decreased hepatic insulin extraction, indicating that adaptations to reduced sedentary time may occur at the liver.

Funded by NIH RC HL099557

1997
Board #43  MAY 31  8:00 AM - 9:30 AM
Effects Of A 12-week Exercise Training And Sedentary Time Reduction Program On Fasting Insulin Secretion
Richard Viskochil, Sarah Kozev-Keadle, Corianne Oliver, Barry S. Braun, FACSM, Patty S. Freedson, FACSM. University of Massachusetts-Amherst, Amherst, MA.
(No relationships reported)

Exercise training typically increases peripheral insulin sensitivity, which may reduce insulin secretion. Whether interventions designed to reduce sedentary time result in similar changes in insulin secretion has not been established.

PURPOSE:
To determine changes in fasting insulin secretion, hepatic extraction (HE) and HOMA2-%B following exercise training (EX), an intervention designed to reduce sedentary time (rST), or combined exercise training and reduced sedentary time (EX+rST).

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CONCLUSIONS:
Exercise training and/or sedentary behavior reduction interventions did not alter fasting insulin secretion, however the rST intervention decreased hepatic insulin extraction, indicating that adaptations to reduced sedentary time may occur at the liver.

Funded by NIH RC HL099557

1998
Board #44  MAY 31  8:00 AM - 9:30 AM
Prevalence of Cardiovascular Risk Factors in Indians with Coronary Artery Disease
Shradha M. Khialani, Hetal D. Poptani, Priyanka M. Mehat, Anjali S. Zende, Aashish S. Contractor. Asian Heart Institute, Mumbai, India.
(No relationships reported)

PURPOSE:
To assess and compare the change in the prevalence of the metabolic syndrome and its components over time (2001-2007) and to determine whether changes in stress affect the metabolic health risk among police officers.

METHODS:
Perceived Stress and metabolic risk factors were assessed in 171 police officers in 2001 and again in 2007.

RESULTS:
The perceived stress score (PSS) and the metabolic syndrome score (zMS) were not meaningfully different from 2001 to 2007. The prevalence of high body mass index, hypertension, and elevated triglycerides increased from 2001 to 2007. Overall, the prevalence of the metabolic syndrome increased from 17.5% in 2001 to 28.7% in 2007. The PSS in 2007 was highly correlated with the PSS in 2001 (r = 0.44) and zMS in 2007 was strongly correlated with zMS in 2001 (r = 0.68). Neither the change in perceived stress over time nor baseline perceived stress predicted the development of the metabolic syndrome in 2007 among police officers.

CONCLUSIONS:
The prevalence of the metabolic syndrome and its several individual components increased over 6 years among LEOs. Stress as assessed by the PSS does not contribute to the development of metabolic health risk after a 6 year follow-up.

1999
Board #45  MAY 31  8:00 AM - 9:30 AM
Prevalence of Coronary Artery Disease (CAD) in adults with diabetes in India
Sriram P. V. Khialani, Hetal D. Poptani, Priyanka M. Mehat, Anjali S. Zende, Aashish S. Contractor. Asian Heart Institute, Mumbai, India.
(No relationships reported)

PURPOSE:
The prevalence of Coronary Artery Disease (CAD) has progressively increased in India during the latter half of the last century. Although there are studies available from West regarding prevalence of conventional cardiovascular risk factors (CVRF) in patients been diagnosed to have heart disease there is limited information on the same in Indian patients. This is vital as these risk factors do have an implication on the progression of the disease. Therefore the aim of the paper is to assess the risk factors in Indian patients diagnosed to have CAD.

METHODS & RESULTS:
In this cross-sectional study, five hundred consecutive patients with CAD were included and data on major CVRFs was obtained in them. Mean age of male patients was 52.4 +/- 9.2 years while that of females was 61.8 +/- 6.9 years. However 30.1% of males (142/472) were below the age of 45 years. 68.4% of patients had a positive family history. The mean BMI was 26.7 +/- 3.9 kg/m². 32.6% were normal weight while 67.4% had BMI > 25 kg/m². 83.6% of patients had dyslipidemia. The mean lipid profile of patients (144/470) not on lipid lowering drugs was Total cholesterol - 195.6 +/- 44.3 mg/dl, LDL - 125.7 +/- 36.2 mg/dl, HDL - 37.8 +/- 7.5 mg/dl, Triglycerides- 160 +/- 71.6 mg/dl. 59.8% patients were hypertensives, while the mean blood pressure of normotensives was 113.8/70.6 mm Hg. 35.6% reported history of smoking. 54.8% of patients had pre-diabetes or diabetes. The average fasting blood sugar of patients not on any drugs for diabetes was 106.7 +/- 22.7 mg/dl. 44.8% patients reported that they were sedentary while 55.2% patients reported moderate physical activity.

CONCLUSIONS:
The present study shows high prevalence of most of the conventional risk factors especially family history, obesity, dyslipidemia, hypertension, diabetes and lack of physical activity.

2000
Board #46  MAY 31  8:00 AM - 9:30 AM
Regional Differences In Physical Activity And Chronic Diseases In The United States
David R. Bassett, FACSM, Scott Conger, Eugene Fitzhugh. University of Tennessee, Knoxville, TN.
(No relationships reported)

PURPOSE:
To examine whether there are regional disparities in physical activity, that might contribute to the high rates of chronic disease in the Southern US.

METHODS:
Behavioral Risk Factor Surveillance System (BRFSS) data were used to determine adult physical activity, obesity, diabetes, and hypertension prevalence in 50 states. American Community Survey (ACS) data were used to determine the percentage of workers who commute on foot or by bicycle. Each state was placed into 1 of 4 regions, as defined by the U.S. Census Bureau. Data were analyzed using one-way ANOVAs to test for significant differences among regions.
RESULTS:

<table>
<thead>
<tr>
<th></th>
<th>South</th>
<th>Midwest</th>
<th>Northeast</th>
<th>West</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Walk to Work</td>
<td>1.9</td>
<td>0.1</td>
<td>2.2</td>
<td>0.6</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>% Bike to Work</td>
<td>0.2</td>
<td>0.5</td>
<td>0.4</td>
<td>1.0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Physically Active</td>
<td>44.9(3.5)a,b,c</td>
<td>49.9(3.5)d,c</td>
<td>52.1(3.2)d</td>
<td>54.5(3.3)a,d</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Inactive (no LTPA)</td>
<td>27.1(3.4)a,b</td>
<td>22.2(2.4)d</td>
<td>21.8(2.7)d</td>
<td>20.2(2.3)d</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Obesity %</td>
<td>28.8(2.2)a,c</td>
<td>27.1(1.0)c,d</td>
<td>23.9(2.2)a,d</td>
<td>24.2(2.3)a,d</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Diabetes %</td>
<td>9.8(1.0)a,b,c</td>
<td>7.5(1.2)d,c</td>
<td>7.8(0.8)d,c</td>
<td>7.1(0.9)d,c</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hypert %</td>
<td>30.6(2.2)a,b,c</td>
<td>26.8(2.1)d,c</td>
<td>27.1(1.3)d,c</td>
<td>25.0(2.3)d,c</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

* = sig. different from Midwest; a = sig. different from Northeast; b = sig. different from West; c = sig. different from South

At the state level, physical inactivity is positively related to rates of obesity (r=0.7440) and diabetes (r = 0.8613). Southern states have the highest rates of physical inactivity, and the highest rates of obesity and diabetes.

CONCLUSION: The South has higher rates of physical inactivity, and lower rates of active commuting, than other regions. In addition, the South has higher rates of obesity, diabetes, hypertension, and coronary heart disease.

2001  Board #47  MAY 31  8:00 AM - 9:30 AM
The Awareness, Treatment, And Control Of Hypertension In A Supervised Wellness Program
Miriam E. Pearman, Diana Gilliland, Daniel Bonner, David Donley, James Thomas, Randy Bryner. West Virginia University, Morgantown, WV. (Sponsor: Stephen Alway, FACSM)
(No relationships reported)

Though awareness, treatment, and control for hypertension (HT) have improved, the current control rates (34%) are still far below the Healthy People 2010 goal of 50%.

PURPOSE: To determine, in a supervised wellness program, a) the percent of individuals with uncontrolled HT (SBP ≥140mmHg or DBP ≥90mmHg) at baseline and b) the affects of 12 months of supervised exercise in the following subpopulations: 1) not diagnosed with HT 2) medicated HT ≥50 years old with medicated HT.

METHODS: Data were collected on 455 individuals, (mean age 52.72 ± 0.7 SE) including self reported HT diagnoses, HT medications, and measured BP. Monthly resting BPs were collected for the first year of participation. Paired sample t-tests determined significance for changes over time.

RESULTS:

<table>
<thead>
<tr>
<th></th>
<th>1)Not Diagnosed w/HT</th>
<th>2) Medicated HT</th>
<th>1)≥50 w/Medicated HT</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Uncontrolled</td>
<td>21.3%</td>
<td>41.5%</td>
<td>58.2%</td>
</tr>
<tr>
<td>% Time effect</td>
<td>12 mo.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP</td>
<td>133.85 v. 126.85, p =0.001</td>
<td>DBP: 79.78 v.</td>
<td>DBP: 87.77 v.</td>
</tr>
<tr>
<td>74.47 v.</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
</tr>
</tbody>
</table>

CONCLUSION: In a wellness program, the percent of individuals unaware of HT (21.3%) is below the national average (30%); the percent of uncontrolled treated HT in the total (41.5%) and ≥50 population (58.2%) are also below the national average (64%). With a year’s participation in a supervised wellness program, there is a statistically significant decline in BP to healthy norms.

DISCUSSION: Individuals joining a wellness program have better awareness and control of BP than the general population; those that are uncontrolled benefit from a year’s participation.

2002  Board #48  MAY 31  8:00 AM - 9:30 AM
Physical Activity: An Extra Minute a Day May Keep the Doctor Away
Elena Boiarskaia. University of Illinois Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)
(No relationships reported)

It has been shown that regular physical activity (PA) decreases the risk of metabolic syndrome; yet, it is unclear how the effects of PA differ at various points of the distribution of a particular measure. Quartile regression (QR) (Koenker & Basset, 1978) provides this insight by describing the effect of an input variable at any quantile of the distribution of the outcome variable.

PURPOSE: To examine differences in effect of accelerometer-determined moderate intensity PA in minutes per day on measures associated with metabolic syndrome using QR.

METHOD: PA data and outcome measures were obtained from the National Health and Nutrition Examination Survey (NHANES) 2003-2004 data for 3,199 adults aged 18-85, 49% male, with an average age of 50 (SD = 19.93) and average BMI of 27.88 (SD = 5.69). Determined using an Actigraph monitor, moderate intensity PA was defined as ≥102 intensity counts per minute for adults. Controlling for age, gender and BMI, the effects of moderate intensity PA on waist circumference (WC), blood pressure (BP) and plasma glucose levels (GLU) were analyzed using QR.

RESULTS: QR revealed that the effect of each additional minute of moderate intensity PA on WC was significant (p < .05) for all quintiles, but increasingly stronger for men above 60th percentiles (WC ≥102 cm). On average the reduction of WC was .11 cm (SD = .01), but men at the 95th percentile (WC = 123 cm) benefited by reductions of .19 cm (SD = .05). Similar results were found for women. Moderate intensity PA had a significant negative effect on GLU, but only above 40th percentiles (GLU ≥ 91 mg/dL). The strongest reductions of .07 mg/dL (SD = .02) were experienced above 85th percentiles (GLU ≥ 108 mg/dL). On average, PA did not appear to have an effect on systolic BP; however, QR showed that there were significant reductions of about .02 mmHg between 15th and 70th quintiles (101 ≤ SBP < 128 mmHg) for each additional minute of PA.

CONCLUSION: Differences in impact of moderate intensity PA on the various outcome measures across quintiles were found. Individuals considered at risk according to their WC and GLU benefited more from each additional minute of moderate intensity PA than those who were relatively healthy. On the other hand, those who were within the healthy range of systolic BP experienced significant benefits from PA, while those at the extreme ranges did not.

2003  Board #49  MAY 31  8:00 AM - 9:30 AM
Interrelationships Between Depression, Physical Activity, Homocysteine And Metabolic Syndrome
Paul D. Loprinzi1, Bradley J. Cardinal, FACSM2, Bellarmine University, Louisville, KY. 3Oregon State University, Corvallis, OR.
(No relationships reported)

Since studies have demonstrated a link between metabolic syndrome and cardiovascular disease, understanding factors that may influence metabolic syndrome is of great interest. Although inconclusive, studies have reported an association between depression and metabolic syndrome, with additional findings indicating that endothelial function, as measured by homocysteine levels, may be an important marker of metabolic syndrome.

PURPOSE: Given that previous studies have demonstrated links between physical activity and depression, endothelial function and metabolic syndrome, the purpose of the present study was to simultaneously examine the interrelationships among these variables in a nationally representative sample of the U.S. adult population.

METHODS: Data from the 2005-2006 National Health and Nutrition Examination Survey were used. After exclusions, 1,100 participants were included in the analyses. Physical activity was
objective measured using accelerometry; demographic variables and depression were assessed using a questionnaire; and the biological variables were evaluated from blood samples. Multivariate linear and logistic regression was used to assess the interrelationships while controlling for potential confounders. Having metabolic syndrome was coded as 0.

RESULTS: The odds ratios between depression and metabolic syndrome, moderate-to-vigorous physical activity (MVPA) and metabolic syndrome, and homocysteine and metabolic syndrome were 0.91 (P = 0.36), 1.28 (P < 0.001), and 0.007 (P ≤ 0.06), respectively. The beta coefficients between depression and MVPA and MVPA and homocysteine were -0.33 (P < 0.001) and 0.001 (P = 0.11), respectively.

CONCLUSIONS: Depression was not associated with metabolic syndrome nor was homocysteine associated with MVPA or metabolic syndrome; however, depression was significantly inversely associated with MVPA, which in turn, was inversely associated with metabolic syndrome. Although future prospective studies are needed to better characterize the direction of these relationships, the present findings suggest that physical activity may directly influence metabolic syndrome as well as indirectly through reductions in depression symptoms.

DISCUSSION: Blood pressure comparisons did not result in a statistically significant difference although it did approach a contribution to the regression equation.

PURPOSE: to characterize physical activity levels, amount of body fat and glycemic control of a type 2 diabetic sample.

METHODS: Data was obtained from 104 previously sedentary Portuguese type 2 diabetic mellitus patients (mean age 65.8±6.7 years; 68 women and 36 men). Circulating levels of A1c were evaluated using blood sample analysis. Daily steps were assessed by accelerometer during one week (GT1M, Actigraph, LLC). Body composition was measured with DXA (Hologic QDR) and subjects were classified as underfat, healthy (H), overfat (O) and obese (OB) in accordance with Gallagher et al. guidelines.

RESULTS: The prevalence of O+OB was high, with more than 92% of the subjects being considered O+OB. The number of daily steps for H, O and OB was 9480±3169, 7995±3087 and 7401±2723, respectively (p=0.05); subjects spent an average of 48±25 min/day (H), 37±23 min/day (O) and 32±21 min/day (OB) in moderate to vigorous physical activities (p=0.05). A1c was similar among H, O and OB, with 7.0±1.5, 6.6±1.2 and 6.6±1.4%, respectively (p=0.05).

CONCLUSIONS: Although there were differences in the considered variables among H, O and OB groups, these did not reach statistical significance. Leaner subjects showed a trend towards a higher number of daily steps and increased time spent on moderate to vigorous activities, but not in A1c levels. These results may be due to the relatively small sample size and diabetes related pharmacological therapy used by all subjects, which may attenuate differences among groups. Supported by PTDC/DES/104518/2008 (FCOMP-01-1124-FEDER-009599) and SFRH/PROTEC/50008/2009 grants.

The purpose of this study was to evaluate six month s of a corporate wellness program in a rural plant of a major manufacturing company. Based on the results reported to the manufacturing plant, more new participants are joining the initiative. This may provide the opportunity to have a greater impact on employee health of the plant as a whole. Consideration should be made to encourage participation in both individual and group activities to facilitate improvement in overall health.

2005

Board #51

MAY 31 8:00 AM - 9:30 AM
Adiposity, Blood Pressure, And Glucose Metabolism Correlate Favorably With Higher Peak 30-minute Cadence
Catrine Tudor-Locke, FACSM, Meghan M. Brashear, William D. Johnson. Pennington Biomedical Research Center, Baton Rouge, LA.

PURPOSE: Peak 30-minute cadence (defined as the average steps/min for the best 30, not necessarily consecutive, minutes in a day) has been introduced as an informative approach to describe accelerometer-determined intensity of best effort under free-living conditions. The purpose of this analysis of the 2005-2006 National Health and Nutrition Examination Survey (NHANES) accelerometer and health data was to determine the relationship between this objectively measured intensity parameter and directly measured indicators of adiposity (BMI, waist circumference), blood pressure (systolic and diastolic), and glucose metabolism (fasting glucose and insulin, HbA1c, and HOMA-IR).

METHODS: Accelerometer data were processed for 3522 NHANES adult participants (age 47.5 (0.7), 47.7% male) who supplied 1-7 days of valid data (i.e., ≥10 hours of wear time/day). Minute-by-minute cadence data were ranked to identify and average the top 30 minutes each day, and then these were averaged across valid days. Spearman correlations were calculated to evaluate the relationships between peak 30-minute cadence and the specified health parameters.

RESULTS: All correlations with peak 30-minute cadence were statistically significant: BMI (r=0.18), waist circumference (r=0.25), systolic blood pressure (r=0.21), diastolic blood pressure (0.05), glucose (r=-0.22), insulin (r=0.18), HbA1c (r=0.24), HOMA-IR (r=0.22). Relationships were attenuated but still significant (p<0.05) when adjusted for age.

CONCLUSIONS: An indicator of natural best ambulatory effort in a day is significantly associated with measures of adiposity, blood pressure, and glucose metabolism. Peak 30-minute cadence is a continuous variable indicative of habitual intensity that may serve to expand upon volume-based estimates of ambulatory activity expressed only as steps/day.

2006

Board #52

MAY 31 8:00 AM - 9:30 AM
The Efficacy of a Six Month Corporate Health Initiative Program
Bethany Garner, Jennifer Patrick, John C. Garner, Melinda W. Valliant. The University of Mississippi, University, MS. (Sponsor: Mark Loftin, FACSM)

The fast-paced lifestyle of today’s society often allows little time for attention to personal health and wellness. As a result, rising medical costs, insurance rates, and employee absenteeism leave employers searching for ways to improve the health of their workforce and company. Employers often struggle to find an affordable program for their employees. A well-designed worksite wellness program has the capacity to greatly improve the health and well-being of participants, thus improving their productivity.

PURPOSE: The purpose of this study was to evaluate six months of a corporate wellness program in a rural plant of a major manufacturing company.

METHODS: Data from program participants collected in January 2011 and July 2011 were compared to data from non participants collected during the same times. Data evaluated included waist circumference (WC), blood glucose (BG), triglycerides (TG), high density lipoprotein cholesterol (HDL), low density lipoprotein (LDL) and blood pressure (BP). To test for statistical significance of differences in biometrical outcomes, parametric t-tests between pre and post assessments for both groups were utilized.

RESULTS: Data comparisons resulted in a statistically significant improvement (p ≤ 0.01) in WC, BG, TG, HDL, LDL of participants (individual coaching and group fitness) compared to non participants (p = 0.18). Further evaluation of participation revealed that those who attended individual coaching sessions more frequently showed the greatest improvement in the analyzed biometrics (correlation 0.91) compared to group fitness participation (0.82). However, those who participated in both showed the greatest improvement and strongest correlation (0.95). Blood pressure comparisons did not result in a statistically significant difference although it did approach contribution to the regression equation.

DISCUSSION: Based on the results reported to the manufacturing plant, more new participants are joining the initiative. This may provide the opportunity to have a greater impact on employee health of the plant as a whole. Consideration should be made to encourage participation in both individual and group activities to facilitate improvement in overall health.

2007

Board #53

MAY 31 8:00 AM - 9:30 AM
Food Consumption, Serum Vitamins, and Metabolic Syndrome Risk by Daily Steps in Middle Aged Men
Jihyun E Choi, Barbara E Ainsworth, FACSM. Arizona State University, Phoenix, AZ.

The purpose of this study was to examine metabolic syndrome risk and to find differences in food consumption and levels of serum vitamins by steps/day on the basis of data obtained from the 2005-2006 NHANES. The subjects were 948 men aged 40-70 years old. They were divided into three groups by tertiles of accelerometer-determined steps/day: G1 (n=313, ≤6,802 steps), G2 (n=322, 6,802 – 10,698 steps), and G3 (n=313, ≥10,699). Metabolic syndrome was defined as the presence of three or more of the following five components: waist circumference ≥40 inches; TG ≥150 mg/dL, glucose level ≥100 mg/dL (NCEP ATP III). Logistic regression was used to test the odds ratios (ORs) and the 95% confidence intervals for the metabolic syndrome risk after adjustment for age. Univariate general linear model analysis of covariance (GLM-ANCOVA) adjusted for age and BMI,
and Bonferroni post-hoc test was used for multiple comparisons. G3 consumed significantly more “Fruits” and “Vegetables” than other groups, whereas G1 consumed significantly more “Milk and Milk Products” and less “Fruits” and “Vegetables” than other groups. The ratio of (Fruits+Vegetables) / (Eggs+Meats) was the highest in the G3 (2.46) and the lowest in the G1 (1.55).

### RESULTS:

There was a high prevalence of overweight and obesity among senior staff of the Lagos State civil service. Majority of the workers were pre-hypertensive and a fair number of them were hypertensive. This study suggests that majority of the workers are at risk of cardiovascular diseases and other health related diseases. There is an urgent need for a public awareness on overweight, obesity and hypertension and appropriate measures for intervention and prevention in the studied population.

### CONCLUSION:

Even though there was a great variation in sitting time within the group of individuals who did not participate in endurance training, and the most active individuals, there were no significant correlations between metabolic health and sitting time. Activity level is according to our findings, a better indicator of metabolic health.

<table>
<thead>
<tr>
<th>Table 1. VO&lt;sub&gt;2&lt;/sub&gt; max in different physical activity-levels.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of times with moderate PA - minimum 30 min day-1 wk-1</strong></td>
</tr>
<tr>
<td>2 (N=258)</td>
</tr>
<tr>
<td>&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>31</td>
</tr>
</tbody>
</table>

<sup>1</sup> Different from other PA-levels (p<0.001).
<sup>**</sup> Different from the least active (p<0.001).

### 2008 Board #54 May 31 8:00 AM - 9:30 AM

**Relationship Between Physical Activity, Sitting Time and Metabolic Health**

Ketil Ostrem<sup>1</sup>, Sigurd Vik<sup>2</sup>, Sindre Mikael Dyrdstad<sup>3</sup>. *University of Stavanger, Stavanger, Norway.*

**PURPOSE:** To study the relationship between sitting time and the metabolic health factors: total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglycerides (TG) and blood glucose (GLU) in physically active and inactive individuals.

**METHODS:** Maximal oxygen uptake (VO<sub>2</sub> max) was measured in a cycle ergometer test (Astrand-Rhyming test). Level of GLU, cholesterol and TG was measured by Choletech LDX system. Activity habits and daily sitting time was self-reported. A sample of 1404 individuals (917 men), with a mean age of 41.8 (SD 11.0) participated in the study. A total of 1114 individuals completed all tests.

### RESULTS:

The participants were divided in six groups according to PA-level. VO<sub>2</sub> max increased according to PA (Tab 1). It was also found that the least active individuals had lower level of HDL (16.2%) and higher level of TG (34.3%), GLU (8.4%) and sitting time (31.5%) compared to the most active (p<.01). Among the physically inactive and among individuals who reported at least 90 min wk<sup>-1</sup> with endurance training, there was a great variation in sitting time. However it was not found any significant correlations between sitting time and the metabolic health factors nor in the physically inactive or most active group.

### CONCLUSION:

Even though there was a great variation in sitting time within the group of individuals who did not participate in endurance training, and the most active individuals, there were no significant correlations between metabolic health and sitting time. Activity level is according to our findings, a better indicator of metabolic health.

<table>
<thead>
<tr>
<th>Number of times with moderate PA - minimum 30 min day-1 wk-1</th>
<th>2 (N=258)</th>
<th>3 (N=62)</th>
<th>4 (N=197)</th>
<th>5 (N=279)</th>
<th>6 (N=204)</th>
<th>7 (N=103)</th>
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</thead>
<tbody>
<tr>
<td>31</td>
<td>32</td>
<td>35**</td>
<td>38*</td>
<td>40*</td>
<td>48*</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Different from other PA-levels (p<0.001).
<sup>**</sup> Different from the least active (p<0.001).

### 2009 Board #55 May 31 8:00 AM - 9:30 AM

**Prevalence Of Obesity And Hypertension Among Senior Civil Servants In Lagos, Nigeria**

Oluwatoyosi Owoeye<sup>1</sup>, Oluwoseyi Osho<sup>2</sup>, Yejide Adeniyi<sup>3</sup>, Adegoke Akindele<sup>4</sup>, Oluwatosi Durowoju<sup>1</sup>, Oluwatosin Akinsola<sup>1</sup>. *College of Medicine, University of Lagos, Lagos, Nigeria. Lagos University Teaching Hospital, Lagos, Nigeria.*

**METHODS:** A cross sectional cohort study of 305 (163 men, 142 women) senior civil servants in five ministries of the Lagos State civil service. Participants were aged 43.20 ± 7.37 years (range 25 to 65 years). The body mass index (BMI) and blood pressure (BP) of all participants were measured. The BMI and BP were stratified using acceptable international standards and data were analysed using descriptive statistics and Chi square. Level of significance was set at P < 0.05.

### RESULTS:

A prevalence of 47.9% and 30.8% were recorded for overweight and obesity respectively. Three (1.0%) participants were underweight while 62 (20.3%) had normal weight. Seventy-one (23.3%) of participants had hypertension (systolic blood pressure (SBP) >140 mmHg) while 161 (52.8%) had pre-hypertension (SBP of 120 - 139 mmHg) and 73 (23.9%) had normal BP (SBP ≤ 120 mmHg). Gender and cadre were strongly significantly associated with BMI and SBP respectively (p < 0.000).

### CONCLUSIONS:

There is a high prevalence of overweight and obesity among senior staff of the Lagos State civil service. Majority of the workers were pre-hypertensive and a fair number of them were hypertensive. This study suggests that majority of the workers are at risk of cardiovascular diseases and other health related diseases. There is an urgent need for a public awareness on overweight, obesity and hypertension and appropriate measures for intervention and prevention in the studied population.

### 2010 Board #56 May 31 8:00 AM - 9:30 AM

**Diabetes & Selected Components From Nhanes: Food Security, Ethnicity, Ses, Consumer Behavior, And Physical Activity**

M. Dot Fullwood, Pam Howard, Mi-Sook Kim, Marialice Kern, FACSM. *San Francisco State University, San Francisco, CA.* (Sponsor: Dr. Marialice Kern, FACSM)

**METHODS:** Data from the 2007-2008 wave of NHANES was used for this study (n= 9,657 who responded to diabetes). Only selected NHANES instruments were used and select questions within the instruments were modified to capture consumer behavior, food security, and physical activity in relation to diabetes. Questions from the consumer behavior instrument were scaled and food security, physical activity, and CES markers were categorized into groups based on the literature.

### RESULTS:

Spearman’s Rho correlations between all observed variables were not significant for the first hypothesis. No statistical relationship was identified at the p > 0.05 between the independent variables and the dependent diabetes. Ethnic group differences were found among four study variables using the Wilks Lambda at Λ = .746, F(20, 500) = 3.95, p < .000. The main effects were found in EatCook (F(2, 261) = 3.55, p = .030); Mexican American and Other Hispanic participants were different from the other two groups, HowOften (F(2, 261) = 14.43, p = .000); Mexican American and Other Hispanic non-White participants were different for non-Hispanic Black participants, LeVOff (F(2, 261) = 13.91, p = .000); Mexican American and Other non-White Hispanic participants were different from the other two groups and PR (F(2, 261) = 3.99, p = .020); Mexican American and Other non-White Hispanic participants were different from the other two groups.

### CONCLUSION:

Non-Hispanic Black and non-Hispanic White groups were more closely related for consumer behaviors in comparison to Mexican American and Other Hispanics. The current study’s findings are in agreement with the breadth of knowledge suggesting that Mexican American and Other Hispanic, non-Hispanic White and non-Hispanic Black populations behave and operate in different manners with regard to the antecedents of T2D, this study could not demonstrate an association with the incidence of T2D.
2011 Board #57 MAY 31 8:00 AM - 9:30 AM
A Pareto Principle (20-80 Rule) Analysis of Daily Physical Activity and Diabetes Impact
WeiMing Zhu, FACSMM, Elena Boiarskaia. Univ. of Illinois, Urbana, IL.
(No relationships reported)

Invented by Vilfredo Pareto, an Italian economist, the Pareto principle refers to a small number of causes is responsible for a large percentage of the effect and often a 20-percent to 80-percent ratio. While the principle has been applied to many different areas, the field of physical activity (PA) and health has not taken the advantage of this theory.

PURPOSE: To examine the most effective daily moderate and vigorous PA (MVPA) minutes (min) that may impact the diabetes population in the US according to the Pareto principle analysis.

METHOD: The National Health and Nutrition Examination Survey (NHANES) 2003-2004 data (N = 4,876, male = 2415 (mean age = 38 yr., SD = 24.32 yr.), female = 2451 (mean age = 38.3 yr., SD = 24.26 yr.)), were used for the analysis, in which diabetes were defined by subjects’ responses to the question of “Doctor told you have diabetes” and plasma glucose levels using the cutoff “≥110 mg/dL.” Daily MVPA min were determined using ActiGraph data (cutoff “≥2010 intensity counts per min”). Pareto diagrams, as well as corresponding statistics, were computed for both self-reported and glucose level-based diabetes rates by gender.

RESULTS: The impact of daily MVPA min on the US diabetes population (P = % of people who had diabetes and cumulative P by gender (M/F)) is summarized in the table below.

CONCLUSION: The increase in MVPA min at different levels had a nonlinear impact on the diabetes population. For males, the most effective minutes are between 30 and 60 min and for females, the most effective ones were between 20 and 30 min. Since these min were consistent to the recommended one by the US PA guideline, PA promotion, therefore, should focus on these min.

<table>
<thead>
<tr>
<th>Impact of daily MVPA min on the US Diabetes Population</th>
<th>≤10</th>
<th>11-20 min</th>
<th>21-30 min</th>
<th>31-40 min</th>
<th>41-50 min</th>
<th>51-60 min</th>
<th>≥61 min</th>
</tr>
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<tbody>
<tr>
<td>M-Self-report</td>
<td>22.98</td>
<td>16.03</td>
<td>11.74</td>
<td>11.39</td>
<td>9.84</td>
<td>7.75</td>
<td>4.75</td>
</tr>
<tr>
<td>F-Self-report</td>
<td>22.98</td>
<td>19.01</td>
<td>12.75</td>
<td>9.14</td>
<td>7.03</td>
<td>6.83</td>
<td>4.58</td>
</tr>
<tr>
<td>M-Glucose</td>
<td>25.81</td>
<td>15.86</td>
<td>16.36</td>
<td>12.41</td>
<td>9.36</td>
<td>6.99</td>
<td>4.73</td>
</tr>
<tr>
<td>F-Glucose</td>
<td>25.81</td>
<td>21.77</td>
<td>18.13</td>
<td>10.54</td>
<td>9.90</td>
<td>6.99</td>
<td>2.73</td>
</tr>
<tr>
<td>M-Self-report</td>
<td>41.09</td>
<td>19.58</td>
<td>14.16</td>
<td>8.27</td>
<td>4.74</td>
<td>3.35</td>
<td>1.53</td>
</tr>
<tr>
<td>F-Self-report</td>
<td>41.09</td>
<td>16.67</td>
<td>7.83</td>
<td>8.10</td>
<td>8.74</td>
<td>1.19</td>
<td>1.72</td>
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<tr>
<td>M-Glucose</td>
<td>45.93</td>
<td>22.11</td>
<td>16.18</td>
<td>7.64</td>
<td>3.82</td>
<td>1.91</td>
<td>2.11</td>
</tr>
<tr>
<td>F-Glucose</td>
<td>45.93</td>
<td>28.04</td>
<td>24.22</td>
<td>9.86</td>
<td>9.58</td>
<td>7.59</td>
<td>8.70</td>
</tr>
</tbody>
</table>

2012 Board #58 MAY 31 8:00 AM - 9:30 AM
Alcohol Consumption Patterns And Metabolic Syndrome Criteria: 1999-2004 NHANES
James R. Churilla, Tammie M. Johnson, Rebecca C. Curls. University of North Florida, Jacksonville, FL. (Sponsor: Scott Crouter, FACSM)
(No relationships reported)

Several studies have examined the association between alcohol consumption patterns and metabolic syndrome (MetS) criteria, most of which used categorical dependent variables. Few studies have focused on the specific associations between alcohol consumption patterns and MetS criteria using linear modeling.

PURPOSE: To examine the linear relationship between alcohol consumption patterns and MetS criteria.

METHODS: Study sample (N=5,618) included adults, 21 years and older that participated in the 1999-2004 National Health and Nutrition Examination Survey.

RESULTS: The associations between moderate and above moderate alcohol consumption and MetS indicators varied by age group and indicator. The following findings control for race/ethnicity, gender, poverty level, smoking status, family history of diabetes, family history of heart disease, and physical activity level and use non-drinkers as the referent group. All reported findings have a p-value <0.05. Above moderate alcohol consumption was negatively associated with waist circumference among those in the 21-30 age group (β = -6.82). Moderate alcohol consumption was negatively associated with waist circumference among those in the 31-40 and 41-50 age groups (β = -7.12 and β = -7.27, respectively). Above moderate consumption was negatively associated with triglyceride levels among those in the 71-80 and 81+ age groups (β = -34.26 and β = -49.89, respectively) and moderate consumption was negatively associated among those in the 41-50 and 61-70 age groups (β = -15.86, respectively). Above moderate consumption was positively associated with HDL levels in all age groups (β range 9.44-14.98) except 61+ where it is negatively associated (β=-49.89). Moderate consumption is positively associated with HDL in the age groups spanning 21-70 years (β range 3.86-6.03). Some statistically significant associations were observed between alcohol consumption level and blood pressure measures (systolic and diastolic), but these effects do not appear to be clinically relevant.

CONCLUSION: Moderate and above moderate alcohol consumption may favorable impact metabolic health risk, however, these finding need to be interpreted with caution.

2013 Board #59 MAY 31 8:00 AM - 9:30 AM
Effects of Kettlebell Training on Metabolic Syndrome in Women
Karen L. Moreno, Peggy A. Plato. San Jose State University, San Jose, CA. (Sponsor: Craig Cisar, FACSM)
(No relationships reported)

Metabolic syndrome (MetS) is a compilation of interrelated risk factors with the potential to significantly increase incidence of type 2 diabetes and cardiovascular disease. The prevalence of MetS is growing, with more women affected than men. Decreased physical activity and increased adiposity are contributing factors. Data support physical activity, primarily aerobic exercise, in the prevention of MetS. However, the prevalence of MetS in women increases with age, even among women with high cardiorespiratory fitness (Farrell et al., 2004). Thus, age-related physiological changes seem to result in unfavorable metabolic repercussions. Jurca et al. (2004) reported an independent and inverse relationship between muscular fitness and prevalence of MetS in men. The effect of increasing muscular fitness on MetS has not been explored in women.

PURPOSE: To examine the effects of a community-based, kettlebell resistance training program on the core components of MetS in women.

METHODS: Six physically inactive women (48.8 ± 2.9 years) with a BMI of 31.8 ± 2.4 kg/m2 and meeting at least two other components of MetS completed the training program. Strength and aerobic fitness, body composition, and risk factors for MetS were measured before and after the twice weekly, 10 week kettlebell program.

RESULTS: Upper and lower body muscular fitness increased 42% and 10%, respectively. Aerobic fitness increased 12%. Before training, fasting glucose was 101.7 ± 2.7 mg/dl compared to 94.4 ± 1.3 mg/dl after training. Body weight decreased 1 kg, but body fat decreased 3.8 kg (43.3 ± 3.1% pre vs. 39.6 ± 2.7% post). Waist circumference decreased 2.1 ± 1.9 cm. Systolic and diastolic pressures decreased 1.8 ± 2.4 and 1.2 ± 2.1 mm Hg, respectively. The training program did not favorably change triglycerides or HDL-C. Compliance was high; all participants completed 90-100% of the exercise sessions.

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CONCLUSION: Although group changes were not statistically significant, individual improvements were encouraging, particularly in fasting glucose and body fat, and suggest that kettlebell training has potential for improving components of MetS in middle-aged women. Response to the training program was positive, indicating potential for kettlebell training to be effective within a community-based program.

2014 Board #60  MAY 31  8:00 AM - 9:30 AM
Supervised Exercise Interventions for Women at Risk for Heart Disease: Relationship Between Compliance and Outcomes
Megan Donnelly, Scott S. Billecke, Pamela Marcovitz, Elizabeth Brown, Barry Franklin, FACSM. William Beaumont Hospital, Royal Oak, MI.

BACKGROUND: Structured exercise programs improve cardiovascular risk factors and quality of life (QOL) in men with and without cardiovascular disease (CVD). Few data are available regarding the responses and compliance to exercise interventions among women, and what quantity of exercise is necessary to elicit beneficial outcomes.

PURPOSE: To determine the cardiovascular and QOL benefits of a structured exercise program for women, with specific reference to the modulating impact of exercise compliance and/or concomitant dietary changes.

METHODS: Women age ≥18 years without known CVD and with ≥ 1 coronary risk factors were enrolled in a 6-month structured exercise program. Relationships between compliance (percent of weeks achieving target attendance, ≥ 3 times/wk for 30 min/session) and changes in anthropometric measures (weight, BMI waist circumference), cardiorespiratory fitness (serial BP, heart rate, rating of perceived exertion during standardized submaximal exercise workload) and QOL (depression [PHQ-9], dietary fat intake [Fat Screener], self-reported physical activity [Duke Activity Status Index], sleepiness [Epworth]) were evaluated.

RESULTS: The program enrolled 117 women whose mean ± SD age, weight and BMI were 57 ± 9 years, 202 ± 48 pounds and 35 ± 8 kg/m², respectively. Compliance (n = 49) was 63 ± 19% and participants demonstrated significant improvements in all parameters tested after 6 months (P < 0.0001). Those in the top compliance tertile (mean 82 ± 19%, 130 ± 22 min/wk) experienced significant reductions in weight, BMI and systolic BP and heart rate during standard submaximal exercise workloads (P < 0.05) compared with the middle tertile (63 ± 6%, 100 ± 19 min/wk). No such improvements were observed when comparing top and bottom (42 ± 12%, 82 ± 20 min/wk) tertiles, possibly due to the latter demonstrating significantly greater dietary fat restriction (Fat Screener 8 ± 7 vs 3 ± 5; P = 0.038). Only reductions in exercise systolic BP were significantly associated with compliance (Spearman correlation, r = 0.34, P = 0.026).

CONCLUSIONS: Women at risk for CVD demonstrated improvements in anthropometric measures, cardiorespiratory fitness and QOL following a 6-month exercise intervention. Improvements were influenced by exercise compliance but may have been modulated by reduced dietary fat intake.

2015 Board #61  MAY 31  8:00 AM - 9:30 AM
The Effect Of Weight Loss And Exercise On Cardiovascular Structure And Function In Class II And III Obese Women
Steven D. Verbal¹, Blake D. Justice², Lori Portzer³, Renee Ingle⁴, John M. Jakicic, FACSM⁵, Slippery Rock University, Slippery Rock, PA. ⁶Pfeiffer University, Misenheimer, NC. ⁷University of Pittsburgh, Pittsburgh, PA.

PURPOSE: The purpose of this study was to examine effect of diet-induced or diet plus exercise-induced weight loss on cardiac structure and function in Class II and III obese women.

METHODS: 24 healthy, sedentary, obese women (BMI: 35.0 to <45 kg/m²; Age: 45.4 ± 6.9yrs.) underwent a 12-week diet and exercise intervention: caloric restriction alone (Diet), caloric restriction plus aerobic training (Diet+AT), and caloric restriction plus resistance training (Diet+RT). Subjects reported to UPMC Presbyterian Hospital to undergo Cardiac MRI to measure left ventricular mass (LVM), myocardial fibrosis (Ve), end diastolic volume (EDV), end systolic volume (ESV), and ejection fraction (EF).

RESULTS: 18 out of 24 subjects completed the intervention. 16 out of 24 completed 12 week Cardiac MRI at UPMC Presbyterian. Body weight significantly decreased across all treatment groups (~5.4kg lost; p=0.001). Subjects in the DIET group had significantly greater reduction in LVM (~7.2 ± 3.9g) than the DIET+AT (2.3 ± 4.7g) and DIET+RT (~0.2 ± 3.5g) groups (p=0.007). Subjects in the DIET+RT group had a significantly higher Ve score at 12 weeks (27.9 ± 1.5%) than subjects in the DIET+AT (26.5 ± 1.4%) and DIET (24.0 ± 0.8%) groups (p=0.010). There were no significant changes in EDV, ESV, or EF at 12 weeks between groups (p=0.159).

CONCLUSIONS: In conclusion, only LVM in the DIET group and Ve in the DIET+RT showed statistical changes from baseline. Further investigations into the effect of weight loss and exercise on cardiac structure and function in Class II and III obese adults are warranted to expand upon the results of this investigation.

2016 Board #62  MAY 31  8:00 AM - 9:30 AM
Chronic Physical Training Modulates Inflammatory Response In Healthy Adults Rats
Luciana - Nishimura, João Pedroso, Emidio Matos-Neto, Michele Trindade, Julio Tirapegui. University of São Paulo, São Paulo, Brazil.

PURPOSE: Several studies have shown the effect of exercise in reducing the risk of developing chronic degenerative diseases and cardiovascular diseases. Although it is unclear in the literature, several authors suggest that this benefit is due to changes in the inflammatory responses caused by exercise.

METHODS: Purpose of this study was to investigate the effect of endurance exercise training on inflammatory proteins.

RESULTS: Fourteen (14) adult male Sprague Dawley rats were assigned into two groups: sedentary (SED) (n = 6) and trained group (Training) (n = 8), which was subjected to 1-hour training per day on a treadmill for 8 weeks, 50-70% VO2max. Cytokine levels were measured by multiplex immunoassay using rat serum adipokines (panel kit 7 LINCOplex) for simultaneous measurement of TNF-a, IL-1, IL-6, MCP1 and leptin, in the automatic Lincoplex 200.

RESULTS: Trained group showed a higher concentration of IL-6 (880.36 276.09 pg/µl and 194.31 76.97 pg/µl) and IL-1α (203.47 49.16 pg/µl, 31.29 4.7 pg/µl) compared to SED group (p = 0.05). There was no statistically significant difference on MCP1 and TNF-alpha levels between groups. We observed a higher leptin concentration in SED group (17.03 4.46 ng/ml) compared to trained group (6.44 1.06 ng/ml) (p = 0.05).

CONCLUSIONS: The results suggest that eight weeks of aerobic training was able to alter the production of some inflammatory proteins, exerting anti-inflammatory effects, and can provide several metabolic and hormonal improvements in different tissues, thus providing a powerful tool to control and/or reduce the risk of developing chronic degenerative disorders. Financial support: FAEPESP and CNPq.

2017 Board #63  MAY 31  8:00 AM - 9:30 AM
Associations of Current Activity Level and Foot Peripheral Neuropathy (PN): The Framingham Foot Study (FFS)
Jody L. Riskowski¹, Alyssa B. Dufoeur², Hylton B. Menz³, Virginia A. Casey⁴, Thomas J. Hagedorn⁵, Marian T. Hannan⁶. ¹Institute for Aging Research, Harvard Medical School, Boston, MA. ²Institute for Aging Research, Boston University, Boston, MA. ³Institute for Aging Research, Harvard Medical School Lahey University, Burlington, Australia. ⁴Institute for Aging Research, Boston, MA.

PURPOSE: To determine associations between current activity level and foot PN in the FFS by diabetes status.

METHODS: FFS members evaluated between 2002-08 for current activity level, foot PN and diabetes status were included. Individuals classified as having diabetes if fasting glucose ≥126 mg/dL or if taking oral hypoglycemic agent or insulin. A 128-Hz tuning fork assessed PN at: 1st and 5th metatarsal head and medial and lateral malleoli. Loss of vibrotactile sense at two or more sites on a foot defined foot PN. Current activity level computed by multiplying metabolic equivalent-hour (MET-hr) by self-reported hours sleeping (MET-hr: 0.9), sitting (1.0) and participating in light (3.0), moderate (4.5) and heavy (7.0) activity in a typical day. By tertile of METs, participants categorized as: high, low or moderate (referent) activity. Crude and adjusted (age, sex, body mass index [BMI], smoking, depression) logistic regression evaluated current activity level and foot PN associations.

CONCLUSION: Although group changes were not statistically significant, individual improvements were encouraging, particularly in fasting glucose and body fat, and suggest that kettlebell training has potential for improving components of MetS in middle-aged women. Response to the training program was positive, indicating potential for kettlebell training to be effective within a community-based program.
RESULTS: There were 2090 FFS members included (Table 1). In individuals without diabetes, foot PN decreased 41% and increased 51% in the high and low activity groups, respectively, relative to the referent. With adjustment, associations persisted with wider confidence intervals. No significant associations noted between activity and foot PN in those with diabetes.

Table 1. Demographic information (reported as mean ± standard deviation, unless otherwise noted) and odds ratios (OR) with 95% confidence intervals (95% CI) for current activity level and foot PN

<table>
<thead>
<tr>
<th></th>
<th>FFS  (N=2090)</th>
<th>No Diabetes  (N=1948)</th>
<th>Diabetes  (N=142)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>66.1 ± 8.9</td>
<td>64.9 ± 8.9</td>
<td>69.9 ± 8.6</td>
</tr>
<tr>
<td>Females (%)</td>
<td>1190 (55.6)</td>
<td>1127 (57.9)</td>
<td>63 (44.4)</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>28.3 ± 5.4</td>
<td>27.9 ± 5.0</td>
<td>30.6 ± 6.2</td>
</tr>
<tr>
<td>Foot PN cases (%)</td>
<td>133 (6.4)</td>
<td>110 (5.6)</td>
<td>23 (16.2)</td>
</tr>
<tr>
<td>Crude OR</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Age, years</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>1.49</td>
<td>1.49</td>
<td>1.49</td>
</tr>
<tr>
<td>Foot PN cases (%)</td>
<td>1.51</td>
<td>1.51</td>
<td>1.51</td>
</tr>
<tr>
<td>Adjusted OR</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Age, years</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Foot PN cases (%)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>High Activity</td>
<td>0.99</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>Low Activity</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

CONCLUSION: In older adults without diabetes, activity level is an independent idiopathic foot PN risk factor but not in those with diabetes. Future work investigating mechanisms linking activity level and idiopathic foot PN is needed.

SUPPORT: RO1-AR047853; T32-AG023480

2018 Board #64 MAY 31 8:00 AM - 9:30 AM
A Prospective Population Study Of Resting Heart Rate And Peak Oxygen Uptake (the Hunt Study, Norway)
Javaid Nauman1, Stian Thoresen Aspnes1, Tom Ivar Lund Nilsen1, Lars Johan Vatten1, Ulrik Wisløff1. The K. G. Jelosen Center of Exercise in Medicine, Trondheim, Norway. The human movement science programme, NTNU, Trondheim, Norway. The K. G. Jelosen Center of Exercise in Medicine, and Department of Public Health, Faculty of Medicine, Trondheim, Norway.
(No relationships reported)

PURPOSE: Resting heart rate (RHR) and peak oxygen uptake (VO2peak) are strong and independent predictors of cardiovascular morbidity and mortality. Physical activity (PA) could modify the association of RHR with VO2peak. However, the prospective association of RHR with VO2peak, and combined effects of RHR and self-reported PA on later VO2peak has not been assessed in population studies.

METHODS: In a prospective population study of 807 men and 810 women free from cardiovascular disease both at baseline (1984-86) and follow-up 23 years later, RHR was recorded at both occasions, and VO2peak was measured by ergospirometry at follow-up. We used Generalized Linear Models to assess the association of baseline RHR with VO2peak, and to study combined effects of baseline RHR and self-reported PA on VO2peak at follow-up.

RESULTS: There was an inverse association of RHR at baseline with VO2peak (p<0.01). Men and women with baseline RHR of 80 bpm or higher had 4.6 mL·kg⁻¹·min⁻¹ (95% confidence interval [CI], 2.8 to 6.3) and 1.4 mL·kg⁻¹·min⁻¹ (95% CI, 0.4 to 3.1) lower VO2peak at follow-up compared to men and women with RHR below 60 bpm at baseline. Participants with relatively high RHR and high PA at baseline had a VO2peak of 0.7 mL·kg⁻¹·min⁻¹ (95% CI, −3.3 to 4.8) that was similar to inactive people with relatively low RHR (reference group). A combination of high PA and low RHR yielded highest VO2peak.

CONCLUSION: A low RHR at baseline was a strong predictor of high VO2peak 23 years later. The results suggest that high levels of PA may compensate for the lower VO2peak associated with a high RHR.

C-27 Free Communication/Poster - Clinical Exercise Physiology Obesity/Diabetes (Clinical Exercise Physiology Association)
MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2019 Board #65 MAY 31 9:00 AM - 10:30 AM
Use of Heart Rate Index to Predict Maximal Oxygen Utilization Before and After Exercise Therapy in Pediatric Obese Patients
Yvette M.Gerdes, Wayne Mays, Michelle Amos, Sandra Knecht, Randal Claytor, Timothy Knilans. Cincinnati Children’s Hospital, Cincinnati, OH.
(No relationships reported)

PURPOSE: To evaluate the utility of heart rate index (HRindex) as a predictor of maximal oxygen utilization in pediatric obesity patients.

METHODS: We evaluated 299 pediatric obesity patients (mean age 12.0 ± 2.8 years, 109 males) with a modified Balke treadmill protocol before and after a 16 week exercise program. HRindex was calculated by dividing the maximal heart rate by the sitting heart rate at rest. Predicted maximal METS (PMMETS) was generated by the line equation: 6 times HRindex minus 5.

RESULTS: There was a significant decrease in weight (88.4 ± 28.6 vs 86.3 ± 27.9 kilograms, p<0.001), a significant increase in absolute (MVO2) and indexed (MIVO2) maximal oxygen consumption, (2244 ± 605 vs 2476 ± 647 ml/min, p<0.001, 26.0 ± 4.7 vs 27.6 ± 5.4 ml/kg/min, p<0.001) and a significant increase in maximal METS (MMETS) and energy expenditure (EE) (7.4 ± 1.7 vs 8.5 ± 1.6 p<0.001, 25.0 ± 4.1 vs 27.6 ± 11.0 kcal, p<0.001) after exercise therapy. There was a significant correlation between MMETS and PMMETS before and after exercise therapy (7.4 ± 1.4 vs 7.3 ± 2.0 r=0.29, p<0.001, 8.5 ± 1.6 vs 8.1 ± 2.1 r=0.22, p=0.01). However, METS and PMMETS were significantly different (p<0.01). Before and after exercise therapy HRindex was significantly correlated to MVO2 (r=0.13, p<0.01 and r=0.12, p<0.01), MIVO2 (r=0.29, p<0.001 and r=0.22, p<0.001) and MMETS (r=0.29, p<0.001 and r=0.22, p<0.001).

DISCUSSION: There is a significant correlation between HR index and MVO2, MIVO2 and MMETS before and after exercise therapy. However, the correlation is weak and provides little
predictive value for MVO2, MIV02 and MMETs. This lack of predictive robustness is demonstrated by the significant difference seen in MMETs and PMMETs before and after exercise therapy.

CONCLUSION: The predictive power of the heart rate index is limited in pediatric obesity patients. Future research should focus on a multivariable predictive model that may include heart rate index.

2020 Board #66 MAY 31 9:00 AM - 10:30 AM
Obesity Paradox and Cardiorespiratory Fitness in Women from the Veterans Exercise Testing Study (VETS)

RESULTS: Patients with Type 2 diabetes are often overweight and may experience accompanying health conditions such as diminished cardiovascular health, lower skeletal muscle strength, and osteoarthritis. While aquatic therapy enables endurance and resistance exercise to be performed simultaneously while generating reduced ground reaction forces, relatively little is known concerning the health benefits of water walking in this patient population.

PURPOSE: To document cardiovascular and strength adaptations in adults with Type 2 diabetes following an 8-week program of underwater treadmill training (UTT).

METHODS: Seven adults with physician-diagnosed Type 2 diabetes (age = 55 ± 8 yrs) completed 8 weeks of UTT. Before and after UTT, measures of seated resting heart rate (Polar heart rate monitor), estimated VO2max (single-stage, land-based treadmill protocol), and concentric peak torque of the dominant leg hamstrings and quadriceps at 60°/sec and 90°/sec (Biodesz System 3) were obtained. During UTT, participants completed three training sessions per week, with each session featuring three walking bouts separated by 4 to 5 minutes of rest. Starting at a relative intensity of 40% of heart rate reserve (HRR), walking speed was gradually increased so that participants were exercising at 70% of HRR by the end of the training program. Likewise, the duration of each walking bout was systematically increased from 10 to 20 minutes as training progressed. Water height was maintained at 10 cm below the xyphoid process throughout the study.

RESULTS: Paired t-tests revealed that resting heart rate was lower (83 ± 14 vs. 75 ± 13 bpm) and estimated VO2max was higher (28.8 ± 3.9 vs. 31.0 ± 4.0 ml/kg/min) following UTT (p < .05). Moreover, peak torque of the hamstrings at 60°/sec (58.0 ± 21.0 vs. 67.0 ± 15.2 lb-ft) and 90°/sec (48.1 ± 19.3 vs. 56.4 ± 13.3 lb-ft, p < .05) was greater after training.

CONCLUSION: Underwater treadmill training featuring progressive increments in walking speed and duration appears to be a safe and effective training modality to improve cardiovascular fitness and leg strength in adults with Type 2 diabetes.

2021 Board #67 MAY 31 9:00 AM - 10:30 AM
Underwater Treadmill Training, Aerobic Fitness, and Leg Strength in Adults with Type 2 Diabetes
Ryan T. Conners, Christina L. Aquila, Don W. Morgan, FACSM, Jennifer L. Caputo. Middle Tennessee State University, Murfreesboro, TN.

CONCLUSION: Although BMI was not predictive of mortality in this population of female veterans, our findings indicate that CRF is a more important predictor of outcomes than obesity in women.

2022 Board #68 MAY 31 9:00 AM - 10:30 AM
Cardiopulmonary Exercise Testing Predicts Hospital Length of Stay in Patients Undergoing Gastric Bypass Surgery
Philip J. Hennis1, Paula M. Meale1, Rachael A. Hurst1, Alasdair F. O'Dohery1, James M. Otto1, Hugh E. Montgomery1, Martin Kuper1, Nick Harper4, Pratik Sufi2, Dugal Heath2, Michael P. W. Grocott4.

CONCLUSION: Exertional peak oxygen consumption (Peak VO2) and anaerobic threshold (AT), determined by Cardiopulmonary Exercise Testing (CPET), can identify individuals at increased perioperative risk from non-cardiac surgery. In one study, this appears true for treadmill exercise-derived peak VO2 in patients undergoing gastric bypass. We sought to confirm these findings, and to extend them to other exercise physiological variables using electronically-braked bicycle ergometry.

PURPOSE: To determine whether pre-operative physiological variables derived from CPET are associated with increased postoperative length of stay (LOS) following gastric bypass surgery.

METHODS: The study was approved by the hospital’s audit department. All participants who completed CPET and underwent elective gastric bypass surgery at the Whittington Hospital NHS Trust between 01/09/09 - 25/02/11 were included in analysis. Subject age, sex, height, weight, and Revised Cardiac Risk Index (RCRI) were recorded. From CPET, peak VO2, AT, and ventilatory equivalent for CO2 (VE/VO2) were derived. The primary outcome variables were hospital LOS (LOS) and critical care unit (CCU) LOS. CPET and non-CPET variables were separated according to postoperative LOS duration (LOS ≤ 3 vs LOS > 3, CCU LOS ≤ 1 vs CCU > 1) and compared using independent t tests. The capacity of CPET markers to predict LOS was determined using receiver operating characteristic (ROC) curves.

RESULTS: 106 patients (mean weight = 126 kg) were included in the study, 83 of whom were admitted to a CCU following surgery. Median LOS was 3 days and median CCU LOS was 1 day. AT was lower in patients with a LOS > 3 days compared to LOS ≤ 3 days (10.4 ± 1.4 vs 11.3 ± 1.8 ml·kg⁻¹·min⁻¹, p = 0.025). ROC curve analysis identified AT as a significant predictor of LOS > 3 day (AUC 0.640, P = 0.030), with an optimal AT to predict increased LOS of 11.4 ml·kg⁻¹·min⁻¹ (sensitivity = 76%, specificity = 53%). AT was not different between those with a CCU LOS > 1 and those with a CCU LOS ≤ 1 day. Peak VO2, VE/VO2, CCU LOS and BMI were not different between patients with a LOS ≤ 3 days compared to those with LOS > 3 days or between those with a CCU LOS ≤ 1 day compared to > 1 day.

CONCLUSION: In patients undergoing gastric bypass surgery, CPET-derived AT is predictive of prolonged hospital LOS.

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PURPOSE: To examine whether the blood glucose response to aerobic exercise differs between T1D individuals using CSII versus those receiving insulin by multiple daily injection (MDI).

METHODS: 19 active T1D individuals (10 CSII, 9 MDI) performed 45 minutes of aerobic exercise (either cycling or treadmill running) at 65% of their pre-determined VO\textsubscript{2peak}. Interstitial glucose levels were monitored during and after exercise by continuous glucose monitoring (CGM) in a double-blinded fashion. Data are reported as mean±SD.

RESULTS: HbA\textsubscript{1c} (CSII=7.3±1.1; MDI=7.2±1.2, %), VO\textsubscript{2peak} (CSII=48±8; MDI=46±10, ml·kg\textsuperscript{-1}·min\textsuperscript{-1}) and pre-exercise interstitial glucose (CSII=8.9±2.9; MDI=8.4±3.5, mmol/L) did not differ between groups. Although glucose levels decreased similarly in both groups during exercise (CSII=3.0±2.0, MDI=3.3±2.7, mmol/L), post-exercise increases in glucose concentration were significantly greater in MDI than in CSII from 90 minutes post-exercise (CSII=0.7±2.5; MDI=3.0±2.2 mmol/L, p=0.037) to 270 minutes post-exercise (CSII=0.8±1.3, MDI=4.9±4.8 mmol/L, p=0.020) resulting in hyperglycemia (interstitial glucose > 10 mmol/L) in 6 out of 9 MDI participants.

CONCLUSION: The use of CSII is associated with a lower risk of post-exercise hyperglycemia compared to MDI in active individuals with T1D. Future exercise intervention strategies in this population should consider insulin delivery methods in their design and analysis.

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CONCLUSION: OUES enhances CPX assessment as it provides perspective on performance capacity as well as body composition. OUES may better reflect peripheral contributors to functional capacity than standard CPX measures. Further analysis of OUES is warranted as it augments CPX assessment with unique diagnostic and management information.

Sponsored by: Rehabilitation Research and Development, Department of Veterans Affairs F4726R

Regular and continuous aerobic exercise is one of the most important nonpharmacologic methods in improving serum lipid concentrations, sex hormone-binding globulin (SHBG), and metabolic syndrome factors.

PURPOSE: We investigated the influence of aerobic exercise on metabolic syndrome factors in obese postmenopausal Korean women.

METHODS: Twenty-six healthy postmenopausal, women aged 53.46 ± 2.74 years and with over 32 % body fat, were randomly assigned to an aerobic exercise group (EX; n = 13) or to a “non-exercise” control (Con; n = 13) group. The variables of body composition, visceral fat area, serum SHBG, lipid profiles, insulin levels, HOMA-IR, and metabolic syndrome factors were measured in all the participants before and after the 16-week study.

RESULTS: Post-training body weight and visceral fat area (p<0.05), TC, glucose, and insulin levels (p<0.01), and HOMA-IR (p<0.001) decreased, whereas SHBG (p<0.001) and metabolic syndrome factors (p<0.01) increased in the exercise group but not in the control group. SHBG levels also showed a significant positive correlation with HDL-C and significant negative correlations with glucose, fat mass, and %BF (p<0.05).

CONCLUSION: Our findings indicate that aerobic exercise improves body composition, SHBG, insulin levels, and metabolic syndrome factors. These findings suggest that in obese postmenopausal Korean women, 16 weeks of aerobic exercise is effective for preventing the metabolic syndrome caused by obesity.

### Table 1a: Comparison of CPX Variables (expressed as mean±SD)

<table>
<thead>
<tr>
<th></th>
<th>HF Controls</th>
<th>HF Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak VO2 (mL/kg/min)</td>
<td>35.3±4.3</td>
<td>23±6.6</td>
</tr>
<tr>
<td>VO2/VE</td>
<td>38.1±8.9</td>
<td>31.3±4.5</td>
</tr>
<tr>
<td>R-values are indicated, * p&lt;0.05, **p&lt;0.01, *** p&lt;0.001</td>
<td></td>
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</tbody>
</table>

### Table 1b: Comparison of Body Composition (expressed as mean±SD)

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<thead>
<tr>
<th></th>
<th>HF Controls</th>
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</thead>
<tbody>
<tr>
<td>Total Lean (kg)</td>
<td>54 ± 10</td>
<td>56.2 ± 7.7</td>
</tr>
<tr>
<td>Legs Lean (kg)</td>
<td>17.8 ± 4.0</td>
<td>19.3 ± 6.0</td>
</tr>
<tr>
<td>Total Fat (kg)</td>
<td>29.3 ± 17.5</td>
<td>28 ± 9.1</td>
</tr>
<tr>
<td>Legs Fat (kg)</td>
<td>8 ± 5.1</td>
<td>9.7 ± 14.0</td>
</tr>
<tr>
<td>R-values are indicated, * p&lt;0.05, **p&lt;0.01, *** p&lt;0.001</td>
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</table>

### Table 1c: Correlations between OUES, VO2, VE/VO2 and DXA Variables

<table>
<thead>
<tr>
<th></th>
<th>OUES</th>
<th>VO2</th>
<th>VE/VO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Lean Mass</td>
<td>0.63***</td>
<td>0.61***</td>
<td>0.17</td>
</tr>
<tr>
<td>Legs Lean Mass</td>
<td>0.65***</td>
<td>0.60***</td>
<td>0.12</td>
</tr>
<tr>
<td>Total Fat</td>
<td>0.67***</td>
<td>0.19</td>
<td>0.19</td>
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<tr>
<td>Legs Fat</td>
<td>0.62***</td>
<td>0.14</td>
<td>0.21</td>
</tr>
</tbody>
</table>

CONCLUSION: Effects of Aerobic Exercise on Serum Sex Hormone Binding Globulin and Metabolic Syndrome Factors in Obese Postmenopausal Women

Byung-Kon Yoon, Se-Jung Park, Hye-Rym Cha. Dong-Eui University, Busan, Korea, Republic of.

Objectively Quantifying Physical Activity And Sedentary Behavior 10 Years Following Bariatric Surgery

Olivier Babineau1, Tamara Carver3, Dr. Nicolas V. Christou2, Dr. Ross E. Andersen, FACSM1. McGill University, Montreal, QC, Canada. 2McGill University Health Center, Montreal, QC, Canada.

Bariatric surgery is currently the preferred treatment for severe obesity. Little is known about long-term physical activity patterns in patients who have had surgery. The purpose of this investigation was to characterize the patterns of physical activity and hours spent sitting in 19 patients who underwent bariatric surgery 10 or more years earlier. ActiVPal™-3-dimensional accelerometers were attached to the patient’s upper leg and were instructed to wear the device for 7 consecutive days. Mean steps per day, transitions from sitting to standing and minutes of sitting per day were measured. Patients were also asked to quantify the number of bouts of vigorous exercise performed weekly. At baseline, 72% of the patients were female, weighed 149±25 kg with a BMI of 35±8 kg/m2. They had surgery on average 13.3 years earlier and had lost 45.5±24 kg. Patients took on average 6,522±139 steps per day, made 53±20 transitions from sitting.
Body composition (BC), particularly central body fat (BF), is a major issue in Non-alcoholic Fatty Liver Disease (NAFLD). Decreased vagal activity is known to be a marker of imbalanced cardiac autonomic control (CAC) and a risk factor for death. It has been shown that BC, as well as BF distribution, are significantly related to CAC. To our knowledge this is the first study to address the relationship between BC or BF distribution and CAC in NAFLD patients.

**PURPOSE:** To determine if, and to what extent, specific markers of BC and BF distribution, are related to CAC, as assessed by heart rate recovery (HRR), in NAFLD patients.

**METHODS:** Total and regional BC were assessed with Dual Energy X-ray Densitometry (DXA) in 25 NAFLD patients (17 males, 50.0 ± 13.2 yrs, and 8 females, 47.2 ± 13.0 yrs), who were diagnosed through liver biopsy or ultrasound, after exclusion of other causes of liver disease. Ratios between specific BF depots were calculated to assess BF distribution. All subjects underwent a maximum graded exercise test (GXT) on a treadmill monitored by 12 lead ECG. HRR was measured as the difference between peak exercise heart rate and the heart rate recorded 1 (HRR1) and 2 minutes (HRR2) immediately after GXT end.

**RESULTS:** Simple linear regressions between BC or BF distribution and HRR showed that Trunk BF and Abdominal BF were the only BF depots significantly correlated with HRR (r=0.47 and r=0.48, respectively; p<0.05). Trunk BF/Limbs BF ratio and Abdominal BF/Total BF ratio were the only BF distribution markers significantly correlated with HRR1 (r=0.70 and r=0.47; p<0.001 and p=0.05; respectively). Only Trunk BF/Limbs BF ratio was related with HRR2 (r=0.74; p<0.001). Total BF, as well as all fat free mass variables, was not correlated with HRR1 or HRR2. Step-wise multiple regressions with all BC and fat distribution markers, as independent variables to predict HRR1 and HRR2, displayed only one model for each dependent variable, using solely trunk BF/Limbs BF ratio as predictor for both HRR1 and HRR2.

**CONCLUSIONS:** Body fat distribution, more than body composition, seems to be related to CAC as assessed by HRR in NAFLD patients. Trunk BF/Limbs BF ratio was the best predictor of both HRR1 and HRR2 and may be a useful indicator in clinical setting.

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**Board #75 MAY 31 9:00 AM - 10:30 AM**

**Body Composition and Body Fat Distribution are Related With Cardiac Autonomic Control in NAFLD Patients**

Nuno M. Pimenta, Helena Santa-Clara, Helena Cortez-Pinto, José Silva-Nunes, Maria L. Rosado, Pedro J. Sousa, Rita Caké, Xavier Melo, Luis B. Sardinha, Bo Fernhall, FACSM, ESDRM - IPS, Rio Maior, Portugal, Faculty of Human Kinetics - Technical University of Lisbon, Lisbon, Portugal, Hospital de Santa Maria, Lisbon, Portugal, Hospital Curry Cabral, Lisbon, Portugal, Hospital de Santa Cruz, Lisbon, Portugal, University of Illinois - Chicago, Chicago, IL. (No relationships reported)

Body composition, particularly central body fat (BF), is a major issue in Non-alcoholic Fatty Liver Disease (NAFLD). Decreased vagal activity is known to be a marker of imbalanced cardiac autonomic control (CAC) and a risk factor for death. It has been shown that BC, as well as BF distribution, are significantly related to CAC. To our knowledge this is the first study to address the relationship between BC or BF distribution and CAC in NAFLD patients.

**PURPOSE:** To determine if, and to what extent, specific markers of BC and BF distribution, are related to CAC, as assessed by heart rate recovery (HRR), in NAFLD patients.

**METHODS:** Total and regional BC were assessed with Dual Energy X-ray Densitometry (DXA) in 25 NAFLD patients (17 males, 50.0 ± 13.2 yrs, and 8 females, 47.2 ± 13.0 yrs), who were diagnosed through liver biopsy or ultrasound, after exclusion of other causes of liver disease. Ratios between specific BF depots were calculated to assess BF distribution. All subjects underwent a maximum graded exercise test (GXT) on a treadmill monitored by 12 lead ECG. HRR was measured as the difference between peak exercise heart rate and the heart rate recorded 1 (HRR1) and 2 minutes (HRR2) immediately after GXT end.

**RESULTS:** Simple linear regressions between BC or BF distribution and HRR showed that Trunk BF and Abdominal BF were the only BF depots significantly correlated with HRR (r=0.47 and r=0.48, respectively; p<0.05). Trunk BF/Limbs BF ratio and Abdominal BF/Total BF ratio were the only BF distribution markers significantly correlated with HRR1 (r=0.70 and r=0.47; p<0.001 and p=0.05; respectively). Only Trunk BF/Limbs BF ratio was related with HRR2 (r=0.74; p<0.001). Total BF, as well as all fat free mass variables, was not correlated with HRR1 or HRR2. Step-wise multiple regressions with all BC and fat distribution markers, as independent variables to predict HRR1 and HRR2, displayed only one model for each dependent variable, using solely trunk BF/Limbs BF ratio as predictor for both HRR1 and HRR2.

**CONCLUSIONS:** Body fat distribution, more than body composition, seems to be related to CAC as assessed by HRR in NAFLD patients. Trunk BF/Limbs BF ratio was the best predictor of both HRR1 and HRR2 and may be a useful indicator in clinical setting.

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**Board #76 MAY 31 9:00 AM - 10:30 AM**

**Improving Body Composition With Taiji Quan: Differences Between Beginners And Experienced Post Menopausal Women**

Marie-Eve Ringuet, Sébastien Barbat-Artigas, Marie-Eve Filion, Sophie Dupontgand, Karellis Antony, Mylène Aubertin-Leheudre. Université du Québec à Montréal, Montréal, QC, Canada. (Sponsor: Jean P. Boucher, FACSM) (No relationships reported)

**INTRODUCTION:** The physiological aging process leads to a loss of physical function. In women, aging, and especially the transition of menopause, leads to changes in the hormonal profile that generate body composition changes, more specifically an increased body weight, abdominal fat accumulation and decreased skeletal muscle mass and bone density. The feasibility and accessibility of Taiji training, as well as its beneficial health benefits recently attracted some attention in the scientific community. However, this new type of physical activity intervention still needs to be explored. Indeed, Taiji training has shown to be effective in improving health status in beginners, but we don’t know to what extend this activity benefits to experienced individuals.

**OBJECTIVES:** Therefore, the aim of the present study was to investigate the effectiveness of a 12 weeks intervention in Taiji according to the participant’s experience (beginners vs.experienced) on functional capacity and body composition.

**METHODS:** Sixty-two postmenopausal women were recrutied and divided in two groups (beginners (BE) and intermediates (EX) in Taiji practice). Body composition and functional capacity were measured pre and post intervention.

**RESULTS:** Significant improvements were observed in the chair test score for both groups (BE: p<0.001; EX: p=0.003) and the perception of fatigue (BE: p=0.002; EX: p=0.03). Only the EX group showed a statistically significant improvement for the stair test (p=0.004). Only the BE group demonstrated significant strength increases (Kincorn: p=0.02). Finally, we observed a significant decrease in BMI (p=0.03) and waist circumference (p=0.007) for the EX group.

**CONCLUSION:** Taiji training seems to be effective in improving body composition and functional capacity in postmenopausal women. Even if it is a soft method, and in spite of past experience in this practice, Taiji interventions still may lead to improvements in functional capacity and body composition. Therefore, it could be considered as an avenue in sports medicine for postmenopausal women in order to accomplish a successful aging.

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**Board #77 MAY 31 9:00 AM - 10:30 AM**

**Low Back Strength Adversely Affects Exercise Capacity in Obese, Older Adults with Chronic Back Pain**


Obese adults benefit from participation in regular exercise for weight loss and improved health. In older persons with chronic low back pain, however, avoidance of exercise may induce lumbar muscle weakness and subsequent lower exercise capacity.

**PURPOSE:** To determine the contribution of lumbar strength on maximal and functional exercise tolerance and physical function in obese older adults with chronic low back pain.

**METHODS:** Obese men and women (N=52; 67±11 yrs, 65% women, body mass index [BMI] 32.2 ± 4.7 kg/m2) completed graded walking endurance treadmill tests, chair rise and stair climbing tests and maximal strength testing of the lumbar muscles (MedX®, lumbar extension). Pain severity was assessed using a 0-10 numerical pain rating scale (NRS-pain) at rest and during each test. Fear of movement may impair exercise ability, and was measured with the Tampa Scale of Kinesiophobia (TSK). Hierarchical regression analysis was performed to determine the contribution of lumbar strength values on maximal and functional exercise capacity. In three separate models, treadmill endurance time, chair rise time and stair climb times were the dependent variables.

**RESULTS:** Mean back pain was 4.7±1.9 points, and lumbar extension strength was 199±115 Nm. Average endurance test time was 12.7±4.3 min, and chair rise and stair climb times averaged 1.1±0.5 sec and 5.9±2.2 sec, respectively. TSK scores averaged 23.4±6.5 points (range 13-40). After accounting for age, sex, BMI, pain and TSK scores, lumbar strength was a significant contributor to the variance in the model of walking endurance time (model R2=0.501, R2 change .091) but not chair rise or stair climb.

**CONCLUSION:** Lumbar strength appears more important for walking endurance than some specific functional exercise. Targeted lumbar exercise for strength improvement may facilitate longer participation in walking exercise, which is a critical component in weight loss and management in the obese older adult. Supported by NIH NIAMS R03 AR057552-01A1 and the US Bone and Joint Decade Scholar Program.
CONCLUSIONS:
organized physical activity and screen time)
with physical function and fitness variables
than their counterparts without MS. These data
highlight the potential value of weight management
and exercise interventions to prevent and treat MS.

RESULTS:
linear regression, BMI z-score had the strongest
association with 6MWD (R
had lower flexibility than females and older children
had worse balance and flexibility than younger children.
Screen time was associated with both 6MWD and hamstring
flexibility. Using linear regression, BMI z-score had
the strongest association with 6MWD (R² change of 0.30).
From logistic regression, BMI z-score was significantly
associated with balance with an odds ratio of 4.86, such
that for each unit increase in BMI z-score there is nearly
a 5 fold increase in risk for an abnormal balance assessment.

CONCLUSIONS:
These data show that obesity and low amounts of participation
in organized physical activity and high amounts of sedentary
behaviors negatively impacts physical function in
obese children. These findings highlight factors pediatric
weight management interventions should target to maximize
patient improvements in mobility disability.

PURPOSE:
To investigate the effect of yoga practice on anxiety, psychological
stress, and cortisol levels of T2DM patients.
METHODS:
Ten non-insulin dependent diabetes mellitus patients
(mean ± SD age: 61.4 ± 6.7 y; BMI: 36.3 ± 7.6 kg/m²; years since
diagnosis: 6.1 ± 6.3 y) underwent a 6-week yoga
program (3d/week) with a registered yoga teacher. Psychological stress was
assessed with the perceived stress scale (PSS) and anxiety with the State-Trait
Anxiety Inventory (STAI). Physiological stress was estimated by salivary cortisol
content at midnight. All data were obtained at baseline and post-intervention.
A one-way within-subjects ANOVA model with Bonferroni adjusted post hoc
analyses was used to analyze the yoga effect on psychological measures. Due to
dual-normality, changes in cortisol were assessed with the Wilcoxon Signed
Rank Test.

RESULTS: Perceived stress scores (22.8 ± 8.0 vs. 17.5 ± 7.1, P = 0.03),
state anxiety scores (39.8 ± 13.3 vs. 29.2 ± 8.6, P = 0.01), and salivary cortisol
values (6.9 ± 7.7 vs. 2.8 ± 1.7 nmol/L; P = 0.04) significantly decreased following
the intervention. Trait anxiety scores (36.8 ± 11.2 vs. 31.1 ± 8.1, P = 0.09) improved,
but the change was non-significant

CONCLUSION: Yoga practice appears to be an effective alternative
therapy to reduce symptoms of stress and anxiety among T2DM patients. The observed
decrease in circulating cortisol levels likely resulted from the positive impact of
yoga on stress and anxiety. Further studies are needed to determine the influence of
cortisol reductions in glucose metabolism of T2DM and subsequent and
psychological control.

This study was partially supported by: TACSM, UTEP CHS Graduate
Enhancement Funds, and UTEP Graduate School.
METHODS: One-hundred and thirteen obese southern women between the ages of 20 and 65 years participated in this hospital based study. All women were measured for blood pressure (BP), cholesterol (total (TC), HDL-C and LDL-C), triglyceride (TG), body mass index (BMI) percent %fat, waist circumference and glucose (Glu). Metabolic risk levels (example SBP ≥ 140 mmHg) of each condition were used to select subsamples and the subsamples were evaluated for abnormal values and subsequently MetS clustering. Analyses were completed using descriptive statistics and correlations.

RESULTS: The women were obese as their %fat was 40.6 ± 8.7% and their BMI was 31.2 ± 7.8 kg/m2 and obesity was the only risk condition. When risk values of each MetS condition were used for subsample selection and the subsample was evaluated for MetS, only when Glu (≥ 110 mg/dL) was the reference did the subsample have MetS (%fat 44.8; Glu 122.4; TG 206.0; HDL-C 41.5). No subsample for the other conditions had more than two abnormal MetS conditions and one of those was obesity.

CONCLUSIONS: These findings suggests that elevated glucose or insulin resistance is a more severe MetS condition as it is more likely to be clustered with two or more MetS conditions in southern women. This may partially explain why those living in the southern parts of the US are reported to have a higher prevalence of CVD.

2036 Board #82 MAY 31 9:00 AM - 10:30 AM Impairment of Skeletal Muscle Oxidative Metabolism during Knee-Extension Exercise in Severely Obese Women Stefano Lazzere1, Desy Salvediego1, Simone Porcelli1, Enrico Rej1, Carlo Bisti1, Raffaella Galli1, Fiorenza Agosti1, Alessandro Sartorio2, Bruno Grassi1. 1University of Udine, Udine, Italy. 2National Research Council, Segrate (MI), Italy. Italian Institute for Aulxology, IRCCS, Piancavallo (VB), Italy.

PURPOSE: During dynamic knee extension exercise the recruitment of a relatively small muscle mass, i.e. the quadriceps femoris of one leg, significantly reduces constraints to oxidative function deriving from cardiovascular O2 delivery. We hypothesized, in a group of severely obese women (OB), a significant impairment of oxidative metabolism during KE, lending support to the role of skeletal muscles in limiting exercise tolerance in OB.

METHODS: 11 OB (age 29.5±5.5 yr, body mass 112.9±17.7 kg and body mass index 43.2±5.4 kg·m-2) and 10 non-obese (NOB) women were tested. Fat free mass (FFM) of a lower limb was assessed by a densitometer. Heart rate (HR) and O2 uptake (VO2) were determined during an incremental exercise test to voluntary exhaustion on a custom-built KE ergometer.

RESULTS: Maximal isometric force of KE muscles was higher (p<0.05) in OB (522.3 ± 149.4 N) vs. NOB (357.2 ± 66.9 N). Peak HR was 125±4 b·min-1 in OB and 141.9±7.7 b·min-1 in NOB (p=0.291). Peak VO2 normalized per unit of lower limb FFM was lower (p<0.001) in OB (99.2±6.7 mL·min-1·kg·FFM-1) vs. NOB (141.1±10.9 mL·min-1·kg·FFM-1), whereas peak work rate values were not different (p=1.000) in the two groups (24.0±3.1 W in OB vs. 25.0±2.0 W in NOB). The slope of the VO2·FFM-1 vs. work rate relationship was lower (p<0.001) in OB (0.209 mL·min-1·kg·FFM-watt-1) vs. NOB (0.34 mL·min-1·kg·FFM-watt-1).

CONCLUSIONS: After eliminating or significantly reducing, by the adopted KE exercise protocol, constraints related to cardiovascular O2 delivery, skeletal muscle oxidative function at peak exercise was impaired in OB. On the other hand, at submaximal work rates an increased efficiency of contractions was observed in OB, which could be related to their higher maximal force, possibly deriving from the chronic “strength training” associated with the excessive body mass bearing.

Supported by Italian Institute for Aulxology (Milan).

2037 Board #83 MAY 31 9:00 AM - 10:30 AM Effect Of A Structured Exercise Program On Attitudes Toward Exercise In Post-bariatric Surgery Patients Paul G. Davis, FACSM1, Diane L. Gill1, Jeaneanne C. Wilson2, Cody L. Sipe1, Maggie L. Roe1, Nicholas W. Justus2, Ryan W. Lepper1. 1The University of North Carolina at Greensboro, Greensboro, NC. 2Cone Health, Greensboro, NC.

PURPOSE: Although exercise is generally recommended to assist patients with weight maintenance after bariatric surgery, little research on exercise adherence in this population. The purpose of this study was to examine the effects of a structured exercise program on factors related to exercise adherence in persons having undergone bariatric surgery.

METHODS: Eleven women (n=9) and men (n=2) (age: 43±3 y, BMI: 38±2 kg/m2; mean±SE) having bariatric surgery in the past 6 weeks to 6 months were randomized to a 12-week group exercise program or a “usual care” (i.e., exercise encouraged with no formal instruction) wait list control group. The exercise program included three 1-hour exercise sessions per week (endurance and resistance exercise) and biweekly educational sessions (exercise, diet, and behavior change strategies). Participants completed a physical activity (PA) enjoyment Likert scale (1=“I enjoy it”, 5=“I hate it”) and a self-efficacy for exercise scale (possible scores range from 0 (lower self-efficacy) to 90 (higher self-efficacy)) at 0, 6, and 12 weeks. Since this was a pilot study, alpha was set at 0.10. Large effect sizes were defined by a partial eta squared (η2) >0.10.

RESULTS: Age was related to lack of PA enjoyment at baseline (r=0.807, p=0.003). A 2 (treatment) x 3 (time) ANCOVA with age entered as the covariate showed a significant time effect (p=0.007, η2=0.463) for PA enjoyment (Control - Pre: 4.9±1.0, Mid: 4.5±0.8, Post:2.6±0.5; Exercise - Pre:3.9±0.4, Mid:3.4±0.7, Post:2.0±0.5) with slightly greater improvement in the exercise group (p=0.5, η2=0.183).

CONCLUSIONS: Results from this pilot study indicate that a 12-week structured exercise program may lead to enhanced physical activity enjoyment and exercise self-efficacy in patients recently having undergone bariatric surgery. Follow-up research is needed to determine if these changes can lead to longer-term physical activity adherence in this population.

Supported by a Regular Faculty Grant from UNC-Greensboro.

2038 Board #84 MAY 31 9:00 AM - 10:30 AM Reliability of Paired Reflex Depression Protocol for Assessing Presynaptic Inhibition in Diabetic Neuropathy Patients Shannon J. Palmer, Junggi Hong. Willamette University, Salem, OR. (Sponsor: Peter Harmer, FACSM, FACSM)

PURPOSE: To assess the intra- and inter-day reliability of the PRD protocol in assessing PI of DPN patients.

METHODS: Eight participants (58 ± 6 yrs.) diagnosed with either type I or II diabetes and peripheral neuropathy were recruited for the study. PRD values were derived from the average change of the second H-reflex relative to the first following stimulation of the posterior tibial nerve. For the intra-day reliability, PRD was measured an hour after baseline assessment. For the inter-day reliability, PRD was measured 2 weeks after the first day of testing. A total of 10 trials per session were recorded. Reliability was calculated via Intra Class Correlation Coefficients (ICCs) with a 95% confidence interval.

RESULTS: The ICCs for intra- and inter-day reliability were 0.94 and 0.88, respectively.

CONCLUSION: The PRD protocol with the posterior tibial nerve of DPN patients was reliable within and between days. The demonstrated reliability of the PRD protocol observed in the study will assist researchers in clinical intervention studies investigating the efficacy of various treatments for diabetic neuropathy patients.
METHODS: participated 4 sedentary, obese male adolescents (16 years, BMI= 33.81Kg/M²). Previously the participants and their parents signed informed consent. All participants developed a treadmill stress test according Blake protocol, after them they engaged in 12 weeks of aerobic training (50min/3 times per week). Before and after training we taken a vastus lateralis muscle sample by needle biopsy, the specimen were put into a buffer with protease inhibitor and quickly frozen until the proteomic analysis. 2D-PAGE were stained with silver and spots with changes expression after training were compared with different data base to proteins identify.

RESULTS: clinical characteristics are shown in table 1. All participants decreased glucose, insulin, total cholesterol, BMI and waist circumference (pc 0.05 for all). Proteomic differential analysis revealed 9 overexpressed proteins after training, which corresponds to carbonic anhydrase III, beta enolase, creatine kinase, ATP synthase beta subunit, Aldolase A, Glyceraldehyde-3-phosphate dehydrogenase, triosephosphate isomerase, pyruvate kinase and adenyate kinase.

CONCLUSIONS: These proteomic findings suggest that obese adolescent changes their BMI, waist circumference and serum glucose after aerobic training trough to improve protein expression pattern helping especially glucose metabolism.

This research was supported by: CONCYTEG 08-16662-130 and PROMEP/103.5/08/3252.

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2040 Board #86 May 31 9:00 AM - 10:30 AM
Weight Management, Weight Loss and Bariatric Care: A Curricular Approach Model to Therapeutic Exercise
Laura A. Richardson, Judith A. Juvancic-Heltzel. The University of Akron, Akron, OH. (Sponsor: Ellen L. Glickman, FACSM)

BACKGROUND: The importance of implementing effective therapeutic exercise to clients/patients of size has never been more important. Body Mass Index rates nationwide, and across the lifespan, continue to rise. Review of literature is weak in this field. It is evident that caloric expenditure via exercise is a cornerstone but little research identifies specific guidelines, theories, and strategies that should be used with this population. It is paramount that the body of knowledge, guidelines, and resources be expanded. Numerous textbooks were reviewed and none adopted due to the scope of materials not meeting needs of exercise science students. A significant gap exists between current texts and the targeted clinician audience.

PURPOSE: To develop an exercise science curriculum to address the use of exercise as a therapeutic tool in the scope of weight management, weight loss, and bariatric care.

METHODS: A course was developed which included current literature and clinical guidelines regarding weight management, weight loss and bariatric care. The teaching model was created using course modules encompassing: Evolution & Prevalence of Obesity, Classification of Morbidity & Mortality, Pathophysiology of Excess Fat, Fat Metabolism, Assessment of the Obese Client, Exercise Prescription, Obesity Treatment, Genetic Influences on Obesity, Sleep and Weight Management. Modules are formatted to include basic definitions, history, application, clinical examples and questions related to each of the topics. Each semester the course is offered, content is reviewed and revised to reflect new findings.

RESULTS: Feedback from students has been positive. The curriculum has developed a greater awareness and confidence of future clinicians in the application of using exercise as one of the cornerstone therapeutic tools for this clinical population.

CONCLUSION: It is imperative that future exercise science professionals possess the knowledge, skills and abilities to implement current evidence based practices in treating this ever growing population. Future directions of the curriculum will add service learning to include students working with patients at a local bariatric center. Direct interactions with this population would enhance the application of the curricular content.

2041 Board #87 May 31 9:00 AM - 10:30 AM
Effects of Whole Body Vibration on Pain, Hemodynamics and Nerve Conduction in Diabetic Peripheral Neuropathy
Nathan J. Kessler, Michael M. Lackard, Junggi Hong, Willamette University, Salem, OR. (Sponsor: Peter Harner, FACSM)

BACKGROUND: Whole Body Vibration (WBV) is an innovative therapy that preliminary research has indicated may be effective for reducing chronic pain associated with diabetic peripheral neuropathy (DPN), although no mechanism has been identified. Decreased blood flow has been cited as a risk factor for impaired nerve conduction which may be related to pain associated with DPN. Conditioning research has indicated that WBV facilitates blood flow to the leg. Therefore decreased DPN-associated pain may be related to maintaining nerve function through enhancing blood flow.

PURPOSE: To test the efficacy of WBV on pain associated with DPN, blood flow and nerve conduction velocity in the diabetic foot.

METHODS: 20 subjects (9 male, 11 female) with a mean age of 58.51± 10.69 yrs and a mean BMI of 33.60±8.20 kg/m2 were assigned to a control (n=8) or treatment (n=12) group in a pre-post design. Pain was assessed with a 10 point visual analog pain scale (VAS). Motor nerve conduction velocity (MNCV) was measured at the posterior tibial nerve via electromyography using a surface stimulator probe. Blood flow in the foot was assessed via the toe-brachial index (TBI), which compares systolic pressure in the brachial artery and the great toe. Treatment consisted of six vibration sessions over two weeks. Each session consisted of 12 minutes of vibration (4 bouts of 3 minutes). The control protocol was identical but with sham vibration. All variables were analyzed with a 2 (group) x 2 (time) repeated measure ANOVA, alpha 0.05.

RESULTS: VAS scores of the treatment group decreased significantly pre-post (p=0.001; 2.7±1.7 to 1.6 ±1.0) and were significantly different from control at post testing (p= 0.028). No significant differences were found for TBI or MNCV (p> 0.05)

CONCLUSION: WBV is effective for reducing DPN-associated pain. However, the reductions were not associated with changes in peripheral blood flow or in motor nerve conduction velocity as measured in this study. This indicates that the mechanism responsible for DPN-associated pain relief associated with WBV does not appear to involve changes in blood flow or motor nerve conduction to the foot.

Supported by: The Willamette University Center for Sustainability Fred Wett Collaborative Research for Sustainability Grant.
Influence Of Objectively Measured Physical Activity On Change In Fitness In A Weight Loss Intervention

Renee J. Rogers1, Kelli K. Davis1, Deborah F. Tate2, Kristen Poizen2, John M. Jakicic, FACSM1, 1University of Pittsburgh, Pittsburgh, PA. 2University of North Carolina-Chapel Hill, Chapel Hill, NC.

(No relationships reported)

Moderate-to-vigorous physical activity (MVPA) accumulating to at least 1,000 kcal/wk or 150 min/wk is recommended to improve fitness in adults, and activity should be accumulated in bouts of at least 10 minutes. However, little is known about the contribution of shorter duration MVPA or lower intensity activity on change in fitness.

PURPOSE: To examine the pattern and intensity of objectively measured physical activity on change in fitness in obese adults across a behavioral weight loss intervention (BWLI).

METHODS: Subjects were 216 adults (age: 42.8±9.2, BMI: 32.6±3.6 kg/m²) participating in an 18-month BWLI. BWLI includes prescription to decrease energy intake to 1200-1500 kcal/day, and increase PA to 300 min/wk. PA and fitness were assessed at 0, 6, and 18 months. PA was assessed objectively using an armband that provided minute-by-minute data for a period of 7 days (SenseWear Pro Armband™, BodyMedia, Inc.). Fitness was assessed using a graded exercise test, with fitness defined as time to achieve 85% of age-predicted maximal heart rate (85%HRmax). MVPA was defined as bouts that were ≥10 minutes in duration and ≥3.0 METS. MVPA was also defined as total minutes ≥3.0 METS regardless of length of bout (MVPA-MIN). LPA was defined as minutes of activity between 1.5 to 2.9 METS.

RESULTS: Change in time to achieve 85%HRMAX from 0 to 6 months was correlated with MVPA-MIN (r=0.29, p<0.001) and MVPA (r=0.36, p<0.001), with LPA was not associated (r=0.07). In regression analysis, MVPA was a significant predictor (β=0.517, t=3.504, p<0.001) of change in time to 85%HRmax, whereas neither MVPA-MIN nor LPA were not. At 18 months, change in time to 85%HRmax was correlated with LPA (r=0.203, p=0.003), MVPA-MIN (r=0.374, p<0.001) and MVPA (r=0.426, p<0.001). In regression analysis both MVPA (β=0.604, t=4.078, p<0.001) and LPA (β=0.185, t=2.625, p=0.009) were significant predictors of changes in time to 85%HRmax.

CONCLUSIONS: During the initial 6 months of BWLI, total MVPA performed in bouts of at least 10 min in duration is associated with improvement in fitness. However, both MVPA and LPA contribute to improvement in fitness observed at 18 months. These findings suggest that need for BWLI to include strategies to improve participation in both MVPA and LPA for overweight and obese adults.

Supported by the National Institutes of Health (HL008840)
Physical activity (PA) is an important component of health promotion, although most pregnant women do not meet the recommended levels. Consequently, there has been recent interest in developing intervention programs encouraging lifestyle behavior changes among pregnant women. Interventions tailored to an individual’s readiness to change are known to be more effective than traditional approaches to physical activity and researchers have confirmed the application of the Transtheoretical Model of Behavior Change (TTM) to the uptake of physical activity among a variety of populations. However, the model has scarcely been examined among pregnant women in recent literature.

PURPOSE: To examine the relationships among stages of physical activity behavior change and self-reported physical activity behavior, as well as other TTM constructs such as self-efficacy.

METHODS: Participants included 88 women, primarily in the second or third trimester, from the southeastern United States recruited from regional obstetrical offices. Measures modified for pregnancy included stages of exercise adoption (SEA) and self-efficacy for exercise (SEE). PA was also assessed using the short-form of the IPAQ.

RESULTS: Based on the self-selected SEA, women were categorized into early (Precontemplation, Contemplation, and Preparation) or late (Action and Maintenance) stage groups. Results revealed statistically significant differences in PA ($p = 0.03$) when categorized into levels (low, moderate, high) from the IPAQ, such that women in the late stages were more likely to be in the moderate PA category, and women in the early stages were more likely to be in the low physical activity group. Results also reveal significantly higher levels of SEE ($p=0.037$) in the late stage group than the early stage group, as well as significant differences among groups when stratified out to the original 6 SEA ($p=0.028$), with women in the Action stage ($M=41.8$, $SD=5.83$) having higher SEE than women in Precontemplation ($M=35.33$, $SD=5.85$).

CONCLUSIONS: Overall results indicate consistency with current evidence that people at later stages of change are more physically active than those in the earlier stages. Furthermore, those who are more physically active have higher SEE, indicating that prenatal PA interventions ought to focus on improving SEE.
PURPOSE: To assess energy expenditure during and preference for two different postural conditions (seated, standing) while playing two AVGs using the Nintendo Wii, a traditional sedentary video game using the Sony PlayStation 2 (PS2) and a resting condition.

METHODS: Oxygen consumption (VO2) was assessed as the measure of energy expenditure in 25 participants (22.5 ± 2.0 years old, N = 11 females) during four 20-minute conditions; resting, PS2 Madden Football 2011, Wii-Sports Boxing and Wii Madden Football 2011 completed in a random order. These 20-minute conditions were divided into two separate postural conditions (10 minutes seated and 10 minutes standing). After completion of each 20 minute condition, participants indicated if they preferred playing the game seated or standing.

RESULTS: Standing VO2 (4.1 ± 0.7 ml·kg⁻¹·min⁻¹ rest, 4.4 ± 0.2 ml·kg⁻¹·min⁻¹ PS2, 4.6 ± 0.1 ml·kg⁻¹·min⁻¹ Wii Madden, 6.8 ± 0.3 ml·kg⁻¹·min⁻¹ Wii Boxing) was significantly (p < 0.001) greater than seated VO2 (4.0 ± 0.6 ml·kg⁻¹·min⁻¹ rest, 4.0 ± 0.1 ml·kg⁻¹·min⁻¹ PS2, 4.2 ± 0.1 ml·kg⁻¹·min⁻¹ Wii Madden, 6.1 ± 0.3 ml·kg⁻¹·min⁻¹ Wii Boxing) for the resting and gaming conditions. Mean VO2 was greater (p < 0.001) during Wii Boxing (6.5 ± 1.5 ml·kg⁻¹·min⁻¹) than all other conditions. Mean VO2 was greater (p < 0.05) during Wii Madden (4.4 ± 0.6 ml·kg⁻¹·min⁻¹) than PS2 Madden (4.2 ± 0.7 ml·kg⁻¹·min⁻¹) and rest (4.0 ± 0.6 ml·kg⁻¹·min⁻¹). Mean VO2 was not significantly different (p = 0.077) between PS2 Madden and rest. Participants preferred (p < 0.001) to stand while playing Wii Boxing but preferred to sit for all other conditions.

CONCLUSIONS: Playing video games while standing increases energy expenditure to a greater extent than playing the same games in a seated position. Participants preferred to sit for every condition except for Wii Boxing which was also the most physiologically challenging game.

2049 Board #95 MAY 31 8:00 AM - 9:30 AM Determinants of Physical Activity in Physical Education Teacher Education Students Carolyn Albright1, Alex Vigo2, Tabatha Ulrich3, HeatherCrowes.1 Inmacula University, Inmacula, PA.2Towson University, Towson, MD. (No relationships reported)

The National Association of Sports and Physical Education has recently implemented program accreditation standards ensuring physical education teacher education (PETE) majors achieve and maintain healthy fitness standards throughout the program. However college students have found to be vulnerable to weight gain and a decrease in physical activity.

PURPOSE: To provide a descriptive analysis of determinants of physical activity in PETE majors.

METHODS: Seventy-nine PETE majors (22.5±3.8 years) at Towson University completed the Social Support from Family and Friends for Physical Activity and Self-Efficacy for Physical Activity surveys. Students filled out a questionnaire providing demographic information and physical activity barrier and determinant feedback. Height and weight were also measured.

RESULTS: Factors most likely to motivate students to be physically active included improving physical fitness (87%) and enjoyment (74%). Factors least likely to affect motivation included social support (22%) and losing weight (39%). Students with a higher BMI were more motivated by losing weight (r = -0.38, p =.001). Major barriers to exercise included too much homework (53%) and not enough time (60%). Only 18% of students felt that economic inflation had impacted their ability to be physically active. Compared to other factors of self-efficacy, students were least confident they could motivate themselves to be physically active if they had to study less. Higher grade level was associated with being more confident they could study less to exercise (r=0.26, p=0.02). Social support for physical activity was higher from friends than family on questions regarding exercising with them and changing schedules to exercise together. Higher grade level was associated with being more likely to provide information to family and friends about physical activity (r=0.25, p =.028). Students with a lower BMI felt their family was more likely to change their schedule to exercise with them (r=0.23, p=0.04).

CONCLUSIONS: New accreditation standards are making fitness and physical activity a PETE studies a variable to be considered when designing curriculum. The following descriptive analysis was able to provide direction in terms of motivating factors and barriers to increasing physical activity levels in these students.

2050 Board #96 MAY 31 8:00 AM - 9:30 AM Remembered Affect And Leisure Activity: Associations With Gender, Current Activity Level, And Type Of Activity Courtney Stevens1, Tiffany J. Callahan1, Angela D. Bryan2, Rebecca Warner1.1 University of Colorado Boulder, Boulder, CO. 2University of New Hampshire, Durham, NH. (No relationships reported)

Prior work has found affective responses to exercise to be predictive of subsequent physical activity participation. However, the nature of this association has not been thoroughly explored in naturalistic settings.

PURPOSE: To assess the relationship between leisure activity (active vs. passive) and remembered energetic mood change using a modified Day Reconstruction Method. Method: Energetic mood ratings were compared for male (N = 87) and female (N = 397) participants who reported engaging in at least 20 minutes of physically active leisure (N = 201), or at least 20 minutes of passive leisure (N = 284). Participants were asked to rate how energetic they remembered feeling before and after a leisure activity using the energy subscale of the Thayer Activation/Deactivation Adjective Checklist. Participants also reported how frequently they engaged in physical activity using the Godin Leisure Time Questionnaire (GLTQ).

RESULTS: Interactions between type of leisure, GLTQ scores (zero centered), and gender, were explored in multiple regression analysis with change in energy pre- to post-activity as the dependent variable. The set of predictors accounted for a significant proportion of the variability in energy change scores R2 = .101, F(7, 421) = 6.374, p < .001. Individual regression slopes revealed significant main effects of type of leisure, b = .442, t(421) = 3.70, p < .001, and sex, b = -.383, t(421) = 2.13, p = .033; however, these results were qualified by a significant three-way interaction between sex, type of leisure activity, and GLTQ scores, b = .019, t(421) = 2.319, p = .021. The two-way interaction between sex and type of leisure was non-significant at this centered level of the GLTQ. Two additional regression models were calculated to explore the sex by type of leisure interaction at one standard deviation (SD) above and below the mean on the GLTQ. At one SD above the mean on GLTQ, there was a significant sex by type of leisure interaction F(421) = 2.71, p = .007; however this relationship was not significant at one SD below the mean on the GLTQ.

CONCLUSIONS: Among individuals who exercise most frequently the pattern of remembered energy change from pre- to post activity differed across sex and across type of leisure activity. Frequent exercisers remember greater energetic mood boosts compared to those who exercise less.

2051 Board #97 MAY 31 8:00 AM - 9:30 AM Exercise Barriers And Costs For Cancer Survivor: Two Distinct Elements Of Behavioral Change Process Nathalie André. University of Poitiers, Poitiers, France. (Sponsor: Temporowski Phillip, FACSM) (No relationships reported)

Although scientific evidence supports the role of physical activity as an effective intervention for improving health, the majority of cancer survivors do not comply with public health guidelines (i.e. at least 150 minutes per week of moderate-to-vigorous intensity). Among the determinants of non adherence, barriers to participation are a well-known problem (Brawley et al., 2002). However, the lack of consensus in the definitions and measurements of barriers led to puzzling interpretation. For instance, authors indifferently mentioned exercise barriers and exercise costs. Moreover, in a meta-analysis on exercise (Marshall & Biddle, 2001), the authors reported that the patterns of change in costs were more diverse than in pros. This instability can be explained by the conceptualization and methodology used to measure costs.

PURPOSE: The aim of this study was to distinguish between perceived barriers and perceived costs of exercise in cancer survivors.

METHODS: Two hundred and sixty six one cancer survivors completed a series of questionnaires including decisional balance (DB), perceived barriers and stages of change.

RESULTS: Two ANOVAs were carried out with stages of change score as within-subject factor (Precontemplation PC, Contemplation C, Preparation PR, Action/Maintenance A/M) and barriers and costs as dependent variables. For each Anova, significant effect of stages of change was found on barriers and costs. For perceived barriers, post-hoc tests revealed significantly higher mean scores for PC (M = 2.76), C (M = 2.83) and PR (M = 2.46) than for A/M (M = 1.58) stage. For perceived costs, post-hoc tests showed significantly higher mean scores for PC (M = 3.21) than for C (M = 3.82), PR (M = 4.19) and A/M stages (M = 4.26).

CONCLUSION: Perceived barriers remain relatively high and stable from PC to PR compared to perceived costs that significantly decrease from PC to PR. These results suggest that to stimulate from the early stages of change, a greater emphasis may be needed on reducing perceptions of barriers. Whether interventions suggest increasing pros to get people to think about change, followed by decreasing cons to allow the behavior to change, decreasing the perceived barriers should be a first step to allow individuals to considering a given behavior, mainly with sedentary persons.
Parents play an important role in their children’s sedentary behaviors. However, no studies have examined the association between parenting style and preschool children’s sedentary behaviors. Given the reported high levels of sedentary behavior among preschool children, there is a need to examine the potential link between parenting style and sedentary behaviors within this age group.

**PURPOSE:** To examine the association of parenting style on sedentary behaviors among preschool-aged children.

**METHODS:** Two hundred and one parents completed an online survey assessing different parenting styles (i.e., neglectful, permissive, authoritarian, and authoritative) and they estimated the amount of time that their child (mean age: 3.9 yrs) spent in different sedentary activities (i.e., “screen time” and quiet play) during weekdays and weekends. Comparisons between sedentary activities and the four parenting styles were examined using one-way ANOVAs. Significant main effects were followed-up by Scheffe post-hoc tests and effect size (η²) was calculated to estimate the magnitude of the main effect.

**RESULTS:** Parents who employed a permissive parenting style reported that their child engaged in more screen time (i.e., sedentary behaviors; watching TV, playing videogames or on the computer) on weekdays compared to authoritative parents (1.7 hr/d vs. 1.26 hr/d, respectively; p = 0.006). Authoritative parents also reported that their child engaged in less screen time on the weekends in comparison to neglectful and permissive parents (1.61 hr/d vs. 2.29 hr/d, respectively; p < 0.05). The effect sizes for both weekdays and weekends was small (η² = 0.06). Additionally, there were no detectable differences between quiet play and parental style for either weekdays or weekends.

**CONCLUSION:** Although additional research is needed, this set of observations suggests that parenting style may influence the amount of screen time preschool children engage in.

**Board #98**

**MAY 31 8:00 AM - 9:30 AM**

**Parental Style and Sedentary Behavior in Preschool-Aged Children**

David P. Schary¹, Paul D. Loprinzi², Bradley J. Cardinal, FACSM³, ¹Oregon State University, Corvallis, OR. ²Bellarmine University, Louisville, KY. ³(No relationships reported)

**Board #99**

**MAY 31 8:00 AM - 9:30 AM**

**Sports Participation in Young Adult Cancer Survivors**

Lisa J. Belanger¹, Ronald C. Plotnikoff², Alexander M. Clark¹, Kerry S. Courneya¹, ¹University of Alberta, Edmonton, AB, Canada. ²University of Newcastle, Newcastle, Australia. ³(No relationships reported)

Physical activity improves health outcomes in young adult cancer survivors (YACS) but participation rates are low. Is sport an understudied strategy for increasing physical activity in cancer survivors?

**PURPOSE:** To examine the prevalence and correlates of sports participation in YACS.

**METHODS:** A provincial, population-based mailed survey of YACS in Alberta, Canada, was completed in May, 2008 and included measures of sport participation, medical variables, and demographic variables.

**RESULTS:** A total of 588 YACS completed the survey. Almost a third (32.5%) of YACS reported participating in a sport in the past month with the most common sport being golf (40.8%) followed by hockey (8.3%), tennis (7.3%), soccer (5.7%) and swimming (5.2%). YACS reporting sport participation in the past month reported an average frequency of 1.7 hr/d (SD=1.0) days/week and an average duration of 140 minutes (SD=132) per session for a total weekly minutes of sport participation of 279 (SD=379). In multivariate regression analysis, 8.5% (p<0.001) of the variance in sport participation was explained by being male (β=0.06). Additionally, there were no detectable differences between quiet play and parental style for either weekdays or weekends.

**CONCLUSION:** Given the reported high levels of sedentary behavior among preschool children, there is a need to examine the potential link between parenting style and sedentary behaviors within this age group.
were free to participate in the physical and/or sedentary activities as they chose for the entire session. Physical activity intensity was monitored via accelerometer. Average per-minute accelerometer counts were converted to METs. The amount of time allocated to sedentary activity was monitored via observation and stopwatch. Participants reported their liking of each condition via a visual analog scale.

RESULTS: Mixed-model analysis of variance demonstrated a significant ($p < 0.04$) sex (boys, girls) by condition (HC, LC) interaction for average physical activity intensity (METs). Boys increased ($p = 0.002$) average physical activity intensity from the LC (5.8 ± 3.3 METs) to HC (6.9 ± 2.8 METs) condition. Girls did not alter ($p \geq 0.6$) average physical activity intensity across conditions (5.8 ± 4.7 METs LC, 5.5 ± 4.4 METs HC). There were no significant ($p \geq 0.3$) main or interaction effects for differences in time allocated to sedentary activities or liking.

CONCLUSIONS: Increasing the variety of physical activity equipment options in a naturalistic setting increased average physical activity intensity in young boys but not young girls.

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**2056  Board #102  MAY 31  8:00 AM - 9:30 AM**

**Understanding Physical Activity in Kidney Cancer Survivors Using the Theory of Planned Behavior**

Linda Trihn, Ronald C. Plotnikoff, Ryan E. Rhodes, Scott A. North, Kerry S. Courmey, 1 University of Alberta, Edmonton, AB, Canada. 2 University of Newcastle, Callaghan, NSW, Australia. 3 University of Victoria, Victoria, BC, Canada. 4 Cross Cancer Institute, Edmonton, AB, Canada.

(No relationships reported)

Physical activity (PA) improves quality of life, physical functioning, and fatigue in several cancer survivor groups including kidney cancer survivors (KCS). Despite the established benefits of PA, over half of KCS are completely sedentary and only a quarter are meeting PA guidelines. This highlights the need to identify and understand the determinants of PA in this understudied survivor population. To the best of our knowledge, no study to date has examined the determinants of PA in KCS.

PURPOSE: To determine the social cognitive correlates of PA intention and behaviour in KCS using the Theory of Planned Behavior (TPB).

METHODS: All 1,985 KCS diagnosed between 1996 and 2010 identified through a Canadian provincial Registry in Alberta, Canada were mailed a self-report survey that consisted of the Godin Leisure Time Exercise Questionnaire and standard TPB items for intention, perceived behavioural control (PBC), affective and instrumental attitudes, and descriptive and injunctive norms. Standard demographic and medical variables were also collected.

RESULTS: Completed surveys were received from 703 of 1,654 (43%) eligible KCS. Briefly, the mean age was 65.0 ± 11.1, 62.9% were male, mean BMI was 28.5 ± 5.2, and mean number of months since diagnosis was 69.0 ± 55.5. The TPB was tested using structural equation modelling and demonstrated an adequate-to-good fit to the data ($\chi^2$=151.57, $p<0.001; TLI=0.96; CFI=0.98; RMSEA=0.07, 90% CI=0.06-0.08). There were significant model pathways to intention from affective ($\beta$=0.16, $p<0.03$) and instrumental attitude ($\beta$=0.24, $p=0.03$), descriptive norm ($\beta$=0.08, $p=0.01$), and PBC ($\beta$=0.51, $p=0.02$). In addition, there were significant pathways to PA from PBC ($\beta$=0.18, $p=0.01$) and intention ($\beta$=0.49, $p<0.01$). Overall, the TPB accounted for 69% and 41% of the variance in intention and PA behaviour respectively.

CONCLUSION: The TPB appears to be a useful model for explaining PA in KCS. All TPB constructs except injunctive norm were useful for explaining intention with PBC emerging as the largest correlate. As expected, both PBC and intention were significant correlates of PA with intention emerging as the largest correlate. Developing PA behavior change interventions based on the TPB may be effective in promoting PA in KCS and may lead to important improvements in health.

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**2057  Board #103  MAY 31  8:00 AM - 9:30 AM**

**Psychosocial Mediators Of The Association Between Acculturation And Leisure-time Physical Activity Among Korean Americans**

Hyo Lee, Bradley J. Cardinal, FACSM, Sombat Onsiri. Oregon State University, Corvallis, OR.

(No relationships reported)

Ethnic minorities’, including Korean Americans’, leisure-time physical activity (LTPA) participation is less than ideal. Eliminating physical activity disparities in ethnic groups is important. Empirical studies suggested that acculturation may be an important factor explaining physical activity disparity, but there is a scarcity of studies testing psychosocial mediators by which the association between acculturation and leisure-time physical activity can be better understood.

PURPOSE: This study tested: 1) the theory of planned behavior’s (Ajzen, 1991) four psychosocial constructs (attitude, subjective norm, perceived behavioral control, and behavioral intention) as potential mediators of the association between acculturation and LTPA in Korean Americans; and 2) whether the relationships among variables vary by gender.

METHODS: Four hundred forty nine Korean Americans (216 males and 223 females; age 30.42±10.41 years) participated in a survey for this study. A multiple-sample structural equation modeling was used to test gender invariance and associations among the constructs.

RESULTS: Factor structures and associations among the factors were invariant by gender. The final model fit to data well, CFI=.970, TLI=.969, RMSEA=.043. Acculturation was positively associated with perceived behavioral control (PBC; $\beta=.31, p<.001$), but inversely associated with subjective norm ($\beta=.23, p<.001$). In turn, PBC ($\beta=.46, p<.001$), subjective norm ($\beta=.15, p<.001$), and attitude ($\beta=.24, p<.001$) were positively associated with behavioral intention ($R^2=.40$); and intention ($\beta=.42, p<.001$), perceived behavioral control ($\beta=.22, p<.01$), and acculturation ($\beta=.11, p<.05$) were significantly associated with LTPA ($R^2=.33$).

CONCLUSIONS: The association between acculturation and LTPA can be at least partially understood by the meditative effects of PBC, subjective norm, and behavioral intention. Korean Americans’ cultural assimilation to the US mainstream enhance their belief about behavioral controllability and level of confidence, but decrease perception of social pressure to participate in LTPA. Practically, this study suggests that culturally relevant intervention programs to promote Korean Americans’ LTPA should target to mitigate the negative impact of acculturation on subjective norm.

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**2058  Board #104  MAY 31  8:00 AM - 9:30 AM**

**Psychological Needs Mediate The Relationship Between Physical Exertion Barriers And Body Fat Percent In College-Aged Mexican-American Women**

Vanessa Martinez, Jared Montoya, Murat Karabulut, Cody Cox, Alexis Martinez, David Wittenburg. University of Texas Brownsville, Brownsville, TX.

(No relationships reported)

In the last several decades, there has been a wave of interest in the overweight/obese population in the United States. However, little research has focused on the association between exercise barriers and psychological needs in college-aged Mexican-American females.

PURPOSE: To investigate the relationships between exercise barriers, psychological needs for exercise, and obesity among college-aged Mexican-American females.

METHODS: Body fat measures were recorded on 91 female students ($M$ = 22.8±5.1). The Exercise Benefits and Barriers Scale (EBBS) was used to determine perceived barriers. The EBBS examined Exercise Milieu (EM), Time Expenditure (TEB), Physical Exertion (PEB), and Family Discouragement (FDB) for perceived barriers. The EBBS Psychological Need Satisfaction in Exercise Scale (PNSE) was used to examine the degrees of perceived Competence (PCo), Autonomy (PAu), and Relatedness (PR) as they pertain to an individual’s motivation to exercise.

RESULTS: The mean body fat score indicated 28.6 % ($n=26$) of the sample were overweight, and 50.6 % ($n=46$) were obese. There were significant correlations observed between PCo ($r=.35$, $p=.00$) and PAu ($r=.25$, $p=.02$) with reduced BF %. PCo ($r=.22$, $p=.04$) and PAu ($r=.23$, $p=.01$) negatively associated with PEB. PEB ($r=.24$, $p=.02$) significantly correlated with increased BF %. Mediation analysis indicated that PCo and PAu influenced the relationship between PEB and BF % in college-aged Mexican-American females.

CONCLUSIONS: The findings indicate that women who continue to perceive exercise as being strenuous lack intrinsic motivation which may lead to physical inactivity; thus unhealthy accumulation of BF is likely. In order to overcome such perceptions, practitioners should target the enhancement of psychological needs to reduce perceived barriers. Therefore, successful intervention programs need to focus on increasing competence and autonomy for exercise with the actual exercise program in Mexican-American women.
Methods: Twenty-four overweight/obese (N=12) and non-overweight boys (10.4±1.5 years old) completed one experimental session. Children first completed a peer victimization questionnaire that included an overt victimization subscale (OVS) assessing how frequently other students have harmed or threatened to harm their physical well-being and a relational subscale (RS) assessing how often students have attempted to harm peer relationships. Children were then taken to a gymnasium where they had free-choice access to physical activities (e.g. balls and goals) and/or sedentary alternatives (e.g. crossword puzzles and magazines) for a period of 30-minutes. Children could participate in any of these activities, in any sequence they chose, for the entire 20-minute activity session. Physical activity during the activity session was assessed via accelerometry. A stop watch was used to record children's time allocation to sedentary activities.

Results: Overweight/obese children (11.5 ± 3.9 OVS, 11.8 ± 4.7 RS) reported greater (p ≤ 0.04) scores in the OVS and RS subscales of the questionnaire than non-overweight children (7.6 ± 2.6 OVS, 8.2 ± 3.1 RS). Overweight/obese children (9.8e+4 ± 3.9e+4 counts, 7.7 ± 6.6 minutes) also accumulated fewer accelerometer counts and allocated more time (p ≤ 0.01 for all) to sedentary activity than non-overweight children (13.7e+4 ± 4.6e+4 counts, 1.2 ± 3.7 minutes) during the 30-minute activity session. The OVS and RS subscales were significantly and positively (r ≥ 0.41, p ≤ 0.05) correlated to sedentary activity time. There was a trend towards a negative (r ≤ -0.36, p ≤ 0.07) correlation between the two subscales and accelerometer counts.

Conclusions: These results support a potentially harmful link between peer victimization and decreased, objectively-measured physical activity behavior in boys.
**Journal Contributions**

**Board #110** May 31 9:00 AM - 10:30 AM

**Comparison of Physiological Variables During Barefoot and Shod Treadmill Running in Inexperienced Barefoot Runners**

Joel R. De Paoli, Matt Lee, Marialice Kern, FACSM. San Francisco State University, San Francisco, CA.

(No relationships reported)

**PURPOSE:** The purpose of this study was to evaluate the effects of a 4 week familiarisation period of SBR (Vibram Five Fingers, VFF) on running economy (RE) and compare this to running in a traditionally shod (SR) condition.

**METHODS:** 15 male national level middle distance athletes (age: 24 ± 4 yrs; stature: 177.2 ± 6.21 cm; mass: 67.99 ± 7.36 kg and VO2 max 70.2 ± 5.2 ml/kg/min) were recruited to participate in the study. Subjects completed two RE tests; 24 hours apart, in both the VFF or SR condition, in a random order (pre-test) at 11 and 13km/h. Oxygen uptake (VO2), blood lactate (BLA), heart rate (HR), and stride frequency (SF) were measured during each test. Subjects then completed a 4 week familiarisation period of running in VFF’s, before repeating the 2 running economy tests in a random order (post-test).

**RESULTS:** Following the 4 week familiarisation a significant improvement in RE was observed at both velocities in the VFF condition (p=0.006), the improvement in RE was 7.7% between the post-test and the pre-test (46.34 ± 1.29 v 43.02 ± 1.11 ml/kg/min; p=0.006). There was also a non-significant improvement in RE of 2.4% in the SR condition between over time (47.52 ± 0.94 v 46.43 ± 0.88 ml/kg/min; p=0.087). At the pre-test, RE was 2.2% lower in the VFF compared to the SR condition but this was not found to be significant (p=0.231). In contrast, following the familiarisation period (post-test), when compared to shod RE was significantly improved in the VFF condition (p=0.006: 45.884 ± 42.69 v 42.69 ± 1.21 ml/kg/min: 7.5% difference). SF was significantly higher (2.5%) in the VFF condition across both time points (p=0.01).

**CONCLUSIONS:** The results of the current study support previous research suggesting that SBR improves running economy when compared to SR, which may in part be explained by a change in running mechanics associated with an increase in SF and consequent reduction in stride length. The study findings also suggest that being fully habituated to running in VFF’s may further improve RE in the VFF condition and to a lesser extent the SR condition also.

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**Board #111** May 31 9:00 AM - 10:30 AM

**Effect of Minimalist Shoes Versus Bare Feet on Deceleration from a Vertical Jump**

Vanessa L. Casas, James J. Tufano, Joe LaPorta, Jeremy G. Tan, Leah Troup, Lee E. Brown, FACSM. California State University Fullerton, Fullerton, CA.

(No relationships reported)

Females have been shown to have a higher rate of ACL injuries in comparison to males. Newly developed footwear may alter deceleration during jump landings, thereby decreasing the risk of injury.

**PURPOSE:** The purpose of this study was to investigate the effect of minimalist shoes vs. bare feet on deceleration from a vertical jump.

**METHODS:** Twenty-seven recreationally trained females (23±2.2 yrs, 162.9±7.3 cm, and 62±8.7 kg) performed a 5-minute cycling warm-up, then completed three vertical jumps while wearing either minimalist shoes (MS; Fila Skele-toes) or with bare feet (BF). All vertical jumps were performed on a force plate in a counter-movement fashion with hands placed on the hips. Deceleration time (DT), peak deceleration velocity (PDV) and deceleration (PDV/DT), were directly measured on an AMTI force plate sampling at 1000Hz.

**RESULTS:** Paired t-tests showed no significant (p=0.05) differences in deceleration between MS (mean: 11.11 m/s², SD: 4.32) and BF (mean: 11.02 m/s², SD: 4.53) or in DT MS (mean: 0.25 s, SD: 0.14) and BF (mean: 0.23 s, SD: 0.08) or in PDV MS (mean: -2.20 m/s, SD: -0.21) and BF (mean: -2.20 m/s, SD: -0.20).

**CONCLUSION:** Minimalist shoes do not appear to effect deceleration when compared to bare feet. This suggests that wearing minimalist shoes may not decrease the risk of injury when landing from a vertical jump.

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There has been growing interest lately in barefoot running and many runners attempt to run barefoot or in new shoe concepts such as minimalistic footwear. It can be assumed that minimalistic footwear requires adaptation in running style mainly due to lack of cushioning. Especially of interest are effects of running speed, as ground reaction is known to increase with increasing running speed. Different adaptations in muscle activation patterns (EMG) can be expected between runners who are habitually running with a Rear Foot Strike (RFS) or with a Mid Foot or Fore Foot Strike (MFS/FSS).

**PURPOSE:** To investigate speed dependent changes in EMG patterns during running in minimalistic footwear in relation to foot strike pattern.

**METHODS:** Six competitive runners (42 ± 10 years, 183.8 ± 1.2 cm, and 75.4 ± 8.1 kg), 3 of them were running with a RFS and 3 with a MFS/FSS, performed one minute trials at a treadmill at 6 different running speeds (10-15 km/h) while wearing minimal footwear. Surface EMG was measured at 1000 Hz according to the SENIAM protocol on the m. Tensor Fascia Latae (TF), m. Rectus Femoris (RF), m. Semitendinosus (ST), m. Tibialis anterior (TA), m. Peroneus longus (PL), m. Soleus (SL) and m. Gastrocnemius medialis (GM). Raw EMG data was filtered with a 3rd order high-pass filter with a cut-off frequency of 25 Hz. Smooth Rectified EMG (SRE) was filtered with a 3rd order low-pass filter with a cut-off frequency of 20 Hz. SRE was re-sampled to 100 Hz. Data was averaged over 10 gait cycles. SRE was integrated to obtain integrated EMG (iEMG). 3-d Motion capturing was used to determine stance time as the time between initial contact and toe off.

**RESULTS:** Change in stance time will allow for greater absorption of the forces experienced during running, allowing for reduced injury rates in runners. Further research in needed to examine the joint characteristics of the lower extremity in the ZD condition to further illustrate the adaptations made during the running stride.

**CONCLUSIONS:** Speed dependent changes in EMG patterns were found in runners who were novice to running in minimalistic footwear. Adaptation strategies were different between runners habitually running with a RFS or a MFS/FSS.

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high-heeled shoes. We hypothesized that the movement variability of high-heeled walking would be characterized by a more complex and less predictable pattern than barefooted walking.

METHODS: Eleven female subjects (mean (SD): age: 27.5 (5.4) years, height: 1.70 (0.04) m, body mass: 58.1 (5.1) kg) were exposed to two different walking conditions while they walked at 4.0 km/h on a motor driven treadmill. One condition was barefooted walking while the other was high-heeled walking. In each condition the soleus (SO) H-reflex was elicited by stimulating the tibial nerve every two seconds. Surface EMG was recorded from the SO and tibialis anterior (TA) muscles and the ankle joint position was recorded by goniometry. The movement variability of the ankle joint angle was quantified by calculation of the approximate entropy (ApEn) in the ankle joint signal obtained over 60 s of walking.

RESULTS: The ApEn of the ankle joint angle was significantly higher (p<0.01) during high-heeled (0.38±0.08) than barefooted walking (0.28±0.07). During high-heeled walking the EMG results showed increased coactivation between the SO and TA muscles prior to heel strike and the H-reflex was significantly increased prior to toe off and in terminal swing by 40% (p<0.01).

CONCLUSION: The results confirmed that high-heeled walking was characterized by a more complex and less predictable pattern than barefooted walking. The increase in movement variability during high-heeled walking may very likely reflect that the human locomotor system was more dependent on sensory feedback in the high-heeled condition in order to control balance.

2071 Board #117  MAY 31  9:00 AM - 10:30 AM
The Effects of Snowshoe Frame Shape on the Energetics and Kinematics of Snowshoe Walking
Wayne J. Board, David I. Weber, Raymond C. Browning, FACSM, Colorado State University, Fort Collins, CO.

No relationships reported

Snowshoeing is an increasingly popular form of winter physical activity. Modern snowshoes are lightweight and provide traction, flotation and stability. The greater metabolic rate during snowshoeing vs. overground walking may be partly due to altered lower extremity kinematics associated with the extended tail of the snowshoe. Thus, snowshoe frame design may influence metabolic rate and kinematics. However, no studies have simultaneously quantified metabolic rate and biomechanics of snowshoeing to determine the effects of snowshoe frame design.

METHODS: Twelve healthy adult participants, 26.5±5.3 yrs, 1.72±0.07 m, 67.9±10.4 kg, with previous snowshoe experience participated in this study. We measured oxygen consumption via surface electromyography during the transition from double-leg to single-leg stance, performed with eyes open (EO) and with eyes closed (EC). Both legs were tested in 4 experimental conditions: (1) barefoot (BF), (2) shoes only (SO), (3) shoes with standardized FO (SSF0), and (4) shoes with customized FO (SCFO).

RESULTS: Based on a full-factorial (condition-region-leg-vision) linear model for repeated measures, we found a significant condition effect (p<0.0001). Muscle activation onset times in SCFO were significant earlier compared to BF (p=0.0001), SO (p=0.0188) and SSFO (p=0.0191). Differences between conditions did not depend on the leg and/or the vision condition. Based on a two-way (condition-muscle) linear model within each region (ankle-knee-hip), we found significant differences between conditions for peroneus longus (p=0.0001), tibialis anterior (p=0.0048), vastus medialis (p=0.0313) and vastus lateralis (p=0.0018). No significant differences were found for the hip muscles.

CONCLUSIONS: Earlier muscle activation onset times were most apparent in the shoes with customized foot orthoses conditions for ankle and knee muscles, but not for hip muscles. These findings might help to better understand how foot orthoses can improve lower extremity function in subjects with chronic ankle instability.

C-30 Free Communication/Paper - Fitness and Performance Testing II
MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2072 Board #118  MAY 31  8:00 AM - 9:30 AM
Reliability and Validity of the Velotron Racermate™ Cycle Ergometer to Measure Anaerobic Power
Todd A. Astorino, Trisha A. Cottrell. California State University--San Marcos, San Marcos, CA.

No relationships reported

The Wingate Test is frequently used by sport scientists to assess anaerobic power using the Monark mechanically-braked cycle ergometer. However, the advent and popularity of electrically-braked cycle ergometers to administer the Wingate Test merits a comparison of Wingate-derived data across ergometers.

PURPOSE: This study assessed the reliability and validity of the Velotron Racermate™ cycle ergometer to assess anaerobic power.

METHODS: Men (9 cyclists and 13 recreationally-active) and women (17 recreationally-active and 1 cyclist) (age = 24.7 ± 4.2 yr) performed two Wingate tests on the Velotron or three Wingate tests (two on the Velotron and one on the Monark Peak Bike) over a 7 - 14 d period. Peak power, mean power, minimum power, fatigue index, heart rate, and peak and minimum cadence were assessed. Intraclass correlation and coefficient of variation were used to assess test-retest reliability of data obtained on the Velotron, and standard error of measurement and minimum difference were calculated to obtain the typical error. Repeated measures ANOVA was used to identify differences in variables across all trials, and Bland-Altman plots were created to examine measurement agreement between ergometers.

RESULTS: Results revealed significant test-retest reliability for mean power (r =0.90, p<0.01), maximum power (r = 0.79, p<0.05) and peak power (r = 0.70, p<0.05) with repeated bouts on the Velotron. Peak power was significantly higher (p<0.05) on the Velotron (9.95 ± 3.9 W/kg) versus the Monark (9.13 ± 2.6 W/kg); however, mean power was higher (p<0.05) on the Monark (6.95 ± 0.89 W/kg) versus the Velotron (6.11 ± 0.52 W/kg and 6.25 ± 0.89 W/kg). Although peak and minimum cadence differed (p<0.05), no differences (p<0.05) in fatigue index, heart rate, or minimum power were revealed between ergometers.
CONCLUSIONS: Data reveal significant test-retest reliability for Wingate-derived mean and peak power from the Velotron Racermate, yet multiple variables differ between the Velotron and the Monark mechanically-braked cycle ergometer. Overall, determinations of mean or peak power from the Velotron cannot be used interchangeably with those obtained from the Monark mechanically-braked ergometer.

2073  Board #119  MAY 31  8:00 AM - 9:30 AM
Validation of Off-season Physiological Tests with Ski Ranking in Elite Male Junior Cross-Country Skiing
Magnus Carlsson1, Tomas Carlsson1, Daniel Hammarström1, Johan Granath1, Jens Westergren2, Christo Malin3, Michail Tonkonogi1. 1Dalarna University and Umeå University, Falun and Umeå, Sweden. 2Dalarna University, Falun, Sweden. 3Regional Sports Federation of Dalarna, Falun, Sweden. 4Umeå University, Umeå, Sweden. (Sponsor: Carl Foster, FACSM)

No relationships reported

Validated physiological test provides an important feedback for coaches and athletes. This information is of paramount importance for junior cross-country skiers which are in an age-stage where the potential training adaptation is great. Physiological tests performed in sport science laboratories are often expensive and time consuming. Hence, there is a need for inexpensive validated off-season physiological tests which can be performed in the skier’s daily training environment and therefore repeatable during the year.

PURPOSE: To validate off-season physiological test parameters with International Ski Federation’s ranking points for distance (FISdist) and sprint (FISsprint) performances as well as create multiple regression models for FISdist and FISsprint. METHODS: Twenty four elite male Swedish junior cross-country skiers (age: 18.5 ± 0.9 years [mean ± SD]) volunteered to the study. Ranking points FISdist and FISsprint were used as performance data (FISdist: 178 ± 90 points; FISsprint: 242 ± 105 points). During a period of three days (June 5-7th 2011) the subjects completed a test battery consisting of six physiological tests: 3 km flat running time trial (TTRun); 2 min all-out double poling on a ski ergometer (DP120); squat jump (SQJ); general strength (sum of completed repetitions for: chins, vertical sit-ups, and dips) (GS); 2 km moderate uphill double poling roller skiing time trial (TTDP) and 2 km uphill diagonal roller skiing time trial (TTDiag). Correlations were established using Pearson’s correlation analysis with Bonferroni correction. Regression models were created using standard multiple linear regression analysis. Level of statistical significance was set at p < 0.05.

RESULTS: For FISdist and FISsprint significant correlations were found with TTRun, TTDP and TTDiag (all p < 0.05). Regression models found for FISdist and FISsprint consist of TTRun combined with either TTDiag or TTDP explaining from 82 to 73 % of the variance in performance.

CONCLUSIONS: When evaluating junior cross-country skiers’ performance capacity and training status; outside running and roller skiing time trials are adequate off-season tests. The regression models state that the running and roller skiing tests reflect different physiological abilities important for success in junior cross-country skiing.

2074  Board #120  MAY 31  8:00 AM - 9:30 AM
Validation of a Snorkel Prototype for Measuring Gas Exchange Parameters during Swimming
Carlo Baldari, FACSM,1 Ricardo J. Fernandez2, João Ribeiro2, Marco Meucci1, João P. Vilas-Boas2, Laura Guidetti1. 1University of Rome “Foro Italico”, Rome, Italy. 2CIFID, Faculty of Sport, University of Porto, Porto, Portugal.

No relationships reported

To assess VO2 in swimming a snorkel device is needed to convey gasses. Toussaint (1987) validated a snorkel device connected to Douglas bag. Conversely, when a snorkel was connected to K4b2 (Cosmed, Rome, IT), the validation studies (Keskinen 2003, Gayda 2010) reported some low systematic differences versus the use of K4b2 with the standard facemask (Mask).

PURPOSES: To find a possible explanation of these systematic errors, we detected the air temperature at the turbine to validate a snorkel prototype. Also, the snorkel prototype with 2 (SV2) and 4 (SV4) valves was compared with a Mask connected with K4b2.

METHODS: Nine subjects performed trials on a 25m swimming pool and on bike ergometer on separate days at 3 constant loads (low, medium, high). Trials were performed in random order: with SV2 and SV4 while swimming; with Mask, SV4, and Cycling, while swimming. Air temperature at the turbine of the K4b2 system was measured at each condition.

RESULTS: Considering each parameter [VO2, VCO2, VE (table)] and comparing the different conditions [SV4 vs SV2 both in swimming (table) and cycling, Mask vs SV4, Mask vs SV2 (table)] by Passing-Bablok regression analysis, the 95% CI always contained the value 1 for the slope and the 0 for the intercept, thus rejecting the proportional and the systematic difference hypothesis.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>R2</th>
<th>Slope [95% CI]</th>
<th>Intercept [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2 vs SV2 (N = 27, Swimming)</td>
<td>0.991</td>
<td>1.000 [0.995 to 1.005]</td>
<td>0.015 [-0.087 to 0.117]</td>
</tr>
<tr>
<td>CO2 vs SV2 (N = 27, Swimming)</td>
<td>0.996</td>
<td>-0.022 [-0.072 to 0.029]</td>
<td>0.027 [-0.009 to 0.063]</td>
</tr>
<tr>
<td>VE (L.min-1, BTPS) vs SV2</td>
<td>0.992</td>
<td>1.001 [0.997 to 1.005]</td>
<td>0.001 [-0.006 to 0.007]</td>
</tr>
<tr>
<td>Mask vs SV2 (N = 27, Cycling)</td>
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<tr>
<td>VO2 vs SV2 (N = 27, Swimming)</td>
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<td>CO2 vs SV2 (N = 27, Swimming)</td>
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<td>VE (L.min-1, BTPS) vs SV2</td>
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CONCLUSION: Temperature measure at the turbine is needed since, as erroneously believed by others, the turbine do not have any temperature sensors so that the manufacturer recommends adjusting it to the ambient value when a snorkel is used. We prove that data must be adjusted to the real temperature of expired gases in order to have valid gas exchange values. Also, SV2 and SV4 snorkel were both valid, being the SV2 more comfortable.

2075  Board #121  MAY 31  8:00 AM - 9:30 AM
Upper-body Work Capacity Assessed by Bench Press and Push-up Exercises.
Alexander W. Purdy, William F. Brechue, FACSM. United States Military Academy, West Point, NY.

No relationships reported

The bench press (BP) and push-up (PU) exercise are used to assess and develop upper-body muscular strength and work capacity.

PURPOSE: To compare the BP and PU for assessing upper-body work capacity during performance of repetitions-to-failure (RTF) tests.

METHODS: Subjects (n=10; age: 21±2 yr; ht: 177±3.3 cm; wt: 84±18.4 kg) performed BP one-repetition maximum (1RM) and RTF tests were performed at 0.9, 0.8, 0.7, 0.6 and 0.4 of 1RM BP and at 0.7 body mass (M) to simulate the load of the push-up test. Push-up RTF was also conducted; 2-min Army Physical Fitness Test. Work capacity (WC) was calculated as RTF x load.

RESULTS: 1-RM BP was 101±15 kg and 1.8±0.2 kg expressed per M. RTF and WC were 4.5±2.1 and 425±195 (0.9 RM), 9.6±2.5 and 767±215 (0.8 RM), 13.3±1.4 and 940±240 (0.7 RM), 21.4±2.5 and 1296±237 (0.6 RM), and 54.3±8.0 and 2137±327 (0.5 RM). Respectively. At 0.7 M, which corresponded to 0.61±0.09 of 1RM, RTF was 17.3±4.9 kg and WC was 1039±832.1 kg reps. For push-ups, subjects completed 76±14 reps on the 2-min test; WC was 428±1197 kg reps. There was an exponential relationship between BP RTF and %1RM (y=507.1e-0.053x; R2=0.877), WC increased linearly with %RM (y=38.9x+3983; R2=0.772). 1RM BP and push-up RTF were moderately correlated (r=0.783).

CONCLUSIONS: The 2-min push-up test appears to represent upper-body muscular strength determined by the 1RM; however, WC at 40% 1RM BP appears to better indicate push-up WC than the 0.7 M model.
The bench press throw and explosive bench press tests have recently received increased attention; however, both of these tests require specialized apparatus and instrumentation which limits their utilization in many settings. Medicine ball chest pass (MBCP) distance is a field test that also attempts to measure upper extremity power, however the optimal load has not been established.

**PURPOSE:** To determine the relationship between EBP peak power and MBCP test distance using 2kg, 3kg and 4kg loads and to determine the intrasession reliability of both tests.

**METHODS:** Twenty-seven healthy college-level baseball players (20.5±4.5 yrs; 84.7±8.7 kg) performed three MBCP trials using 2kg, 3kg, and 4kg MB loads. Instructions were given to hold medicine ball at shoulder level with feet shoulder width apart and knees straight, and to press the MB for maximal distance without counter movement. Initial impact sites of each trial determined distance. For the EBP trials, a standard 16kg barbell was loaded with and additional 14kg. Each subject was allowed a warm-up of 8 repetitions. Subjects then performed three maximum velocity bench press trials. An electromagnetic sensor (Motion Monitor, IST, Inc) offset from the bar with PVC pipe determined bar displacement. Displacement was then used to determine velocity, when coupled with the bar mass, provided power across each repetition. Both peak power and MBCP distance were averaged across three trials.

**RESULTS:** Strong intrasession reliability was revealed for the bench press and MBCP tests (ICC ranges: 0.933 to 0.977). Although correlation coefficients for 3kg (r=0.67, 95% CI=0.355 to 0.824) and 4kg (r=0.612, 95% CI=0.303 to .804) loads were slightly higher than 2kg (r=0.482, 95% CI=0.115 to .728) there was no significant difference between the three coefficients (P>0.05).

**CONCLUSIONS:** Both the EBP and MBCP tests had strong intrasession reliability. If the EBP test is not feasible, then the slightly stronger relationships support using the 3kg or 4kg loads for the MBCP test as an alternative method of assessing upper extremity power. It should be recognized that although statistically significant, the relationships revealed were only moderate strength, suggesting that the tests may be measuring different aspects of upper extremity power.

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**Board #123**

**MAY 31  8:00 AM - 9:30 AM**

**Determination and Validation of Maximal Aerobic Speed**

Nidhi Gupta1, Govindasamy Balasekaran, FACSM2, Visvasuresh Victor Govindaswamy2, Naveen Agrawal1. 1National Institute of Education, Nanyang Technological University, Singapore, Singapore. 2Texas A&M University, Texarkana, TX. "GE Water & Process Technologies, John F. Welch Technology Centre, Bangalore, India.

(No relationships reported)

Maximal aerobic speed (MAS) is usually determined at the velocity at VO2max (vVO2max). However the accuracy may be questioned since MAS at vVO2max elicits a higher amount of anaerobic energy.

**PURPOSE:** To determine and validate the criteria of MAS at a speed which elicits maximal and minimum contribution of aerobic and anaerobic energy.

**METHODS:** 9 sprint trained (ST) (age = 26.89±4.39 yrs, BMI = 23.09±2.07 kg•m−2) and 12 endurance trained (ET) (age = 31.67±7.24 yrs, BMI = 21.34±1.27 kg•m−2) athletes participated to determine MAS. 19 healthy participants (age = 29.74±8.31 yrs, BMI = 22.01±2.12 kg•m−2) were also selected to validate the criteria of MAS. To determine MAS, athletes performed four to five treadmill sessions as follows: Acrastified running test, submaximal discontinuous test, VO2 till exhaustion (Tlim) test at vVO2max and Vsub%95 (median of vVO2max and velocity at lactate threshold; vLT) or Vsub%50+5vVO2max. To validate the criteria of MAS, participants also performed TlimMAS. Using the hyperbolic non linear relation, MAS was determined at its duration (MASD) which was calculated by eventually adding the Tlim, Vsub%95-(-Tlim) and VO2sub%95 using the following equations: Tlim, Vsub%95 converted=n[Tlim, Vsub%95 * vVO2max]/Vsub%95, MASD=n(Tlim, Vsub%95 * VVO2max converted).

**RESULTS:** The MAS was at 92.45±1.47%vVO2max and 89.27±3.56%vVO2max among ET and ST cohorts, respectively. The ET athletes achieved significantly (p<0.001) higher MAS (16.07±1.81km•h−1) at shorter duration (67.85±16.44s, p<0.05) than ST athletes (MAS=12.77±3.81km•h−1; MASD=80.28±16.97s). To validate the criteria of MAS, the oxygen uptake at MAS (50.60±4.69kg•min−1; 96.08±5.10%VO2max) was not significantly (p>0.05) different from 95%VO2max among all participants. The blood lactate (mmol•L−1) at MAS (7.80±1.52) was significantly (p<0.01) lower than at vVO2max (9.11±2.50) and vLT (8.59±1.62).

**CONCLUSION:** The determination of MAS requires a subtraction of Tlim, VVO2max converted from Tlim, Vsub%95 as it eliminated some anaerobic energy contribution. In addition, MAS may be more accurate if measured at vVO2max and not at vLT. The MAS at 91.08%vVO2max among athletes may be accurate as it represents maximal aerobic energy with minimal contribution from anaerobic energy sources.

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**Board #124**

**MAY 31  8:00 AM - 9:30 AM**

**Specific Critical Interval Test Can Determine The Aerobic Capacity In Karate**

Ramon M. Oliveira1, Cleton A. Libardi2, Fúlvia B. Manchoado-Goobotto3. 1Methodist University of Piracicaba - UNIMEP, Piracicaba, Brazil. 2University of Sao Paulo - USP, Sao Paulo, Brazil. 3Macau University of Science and Technology, Macau.

(No relationships reported)

Karate training consists of many repetitions of short sequences (bursts techniques and hopping movement) interrupted by a recovery periods (Ravier et al., 2009) and depends to aerobic and anaerobic conditioning: The critical power model (Monod & Scherrer, 1965) was adapted for different sports to estimate the aerobic capacity, but still not was used in karate.

**PURPOSE:** To adapt the non-invasive critical power model to karate, using the interval recovery between punch sequences to determine the aerobic capacity of athletes (critical interval - CI) and compare these results to the maximal lactate steady state intensity (MLSSi).

**MATERIAL AND METHODS:** Twelve well trained karate athletes (6 men and 6 women; 26 ± 2 yrs) were submitted to five tests at different intensities, separated by 24 hrs. In each test, the athletes accomplished gyakuza-uki sequence until exhaustion, with active hopping movement, according to the sequences. The intensities were based on interval recovery between punch sequences (2 to 6 seconds) expecting the exhaustion to occur between 1 and 10 min. The linear “interval versus ltime to exhaustion” model was used to determine the CI (y-intercept). In order to predict the MLSS, the athletes were submitted to 30 min of continuous exercise at three random intensities (10% below of CI, 10% above of CI), with blood lactate concentration (BLC) determined at each 5 min.

**RESULTS:** The results are expressed in mean ± SEM. The CI was obtained at 16.7±2.9s, with significant linear fit (R2 = 0.95±0.01). In continuous exercise bellow CI (higher interval), all athletes presented BLC stabilization (2.24 ± 0.36 mM). The same results occurred at CI intensity. In higher intensity (shorter interval), there was a progressive increase in BLC. The MLSS was observed at CI for 75% of athletes, with BLC stable at 3.59 ± 0.44 mM.

**CONCLUSION:** The specific critical interval test can determine the aerobic capacity of karate athletes considering that there was MLSS at this intensity.


METHODOLOGY: 17 men and 18 women (age = 20.9±0.7 yrs., ht. = 176.1±0.9 cm, wt. = 72.6±13.5 kg) served as subjects. Subjects performed counter-movement vertical jumps (CMVJ) standing on a uni-directional force plate (Rough Deck, Rice Lake, WI) sampling at 1000 Hz (BioPac Systems, Goleta, CA), and a VJ mat (Probitos Inc., Huntsville, AL). Each subject reported for a familiarization session followed by one test session. Standing reach was assessed using a one-arm reach with both feet flat on the ground. During VJ testing session, subjects performed three to seven CMVJ, with the best jump recorded for statistical analysis. One-way ANOVAs with Schefe post-hoc tests were used to determine differences between VJ measures (i.e., jump mat, force plate flight time). An independent t-test was used to compare flight times between the force plate and the VJ mat. Linear regression was used to establish explained variances (r^2) and agreement between the VJ mat data and the criterion measures from the force plate (p<0.05).

RESULTS: A significant correlation was observed between flight time measured from the force plate and the VJ mat (r = 0.99). When compared to the force plate, the VJ mat revealed greater values in VJ height (VJ mat = 0.50±0.12 m, force plate = 0.34±0.10 m) and flight time (VJ mat = 0.629±0.078 s, force plate = 0.524±0.077 s).

CONCLUSION: The VJ mat compared favorably with the Vertec but not the force plate. This is to be expected since the force plate determines changes in center of mass, not VJ reach. The resulting regression equations suggest further study on high performance athletes may be warranted since jump height may be underestimated at high performance.

2080 Board #126 MAY 31 8:00 AM - 9:30 AM
Accuracy, Validity And Reliability Of GPS-Technology Within Selected Sprint Running Speeds
Margot Niessen, Elisabeth Hohmann, Vanessa Martinez Lagunas, Mario Hermendorf, Ulrich Hartmann. Faculty of Sport Science, Universität Leipzig, Leipzig, Germany. (Sponsor: Ralph Beneke, FACSM)

No relationships reported.

During the last decade novel innovative technologies provide tools to monitor running velocity (v_mach) continuously. For outdoor running purposes light weight portable global positioning systems (GPS) have been developed.

PURPOSE: The study aimed to assess the accuracy of the GPS device and its reliability and validity under different sprint running speed conditions.

METHODS: Within a study relating GPS technology (n=10 female competitive athletes (S1): 20±5 yrs, 162±5 cm, 59±6 kg; n=10 male competitive athletes (S2): 25±3 yrs, 182±6 cm, 81±6 kg) the physical performance during altered running means on a track (S1: 3.7x0 m & 2x400 m, range v_mach=4.5-7.1 m/s; S2: selected sprints between 20-300 m (n=62), range v_mach=6.4-9.3 m/s) was captured and analysed. Therefore the GPS sensor system, placed in the upper back, operated and collected the position data with 5 Hz, reaching 9.0±1.1 satellites simultaneously.

Additionally a single light beam system and a digital measuring wheel were used as gold standard for completed distance and time. Descriptive and group-specific parametric statistical data analysis was applied.

RESULTS: The mean GPS distance divergence in S1 against reference constant value of the 70 m sprint was 67.8±2.1 m (-3.1; p<0.001), the reliability was good (coefficient of variation 3.1%; p=0.483). Over sprint splits and 400 m in S1 the underestimated of GPS grows up to 3.5% (-14.8 m). The non-linear curve error was less than 0.0003 m into 400 m and therefore negligible. In S2 mean GPS results showed distance deviations for short sprint runs (< 50 m, v_mach=7.5±0.6 m/s) of -0.7±2.2 % (n=20), for sprints between 50 m and < 100 m (< v_mach=8.4±0.4 m/s) of -0.2±1.0 % (n=19) and for sprints ≥ 100 m (v_mach=8.4±0.4 m/s) of -0.1±0.6 % (n=23).

RESULTS: The GPS receivers are a valid and reliable method of measuring distance at sprinting intensities in both studied groups. The GPS device showed a good reproducibility (S1) and accuracy of measured distance for sprinting speeds (> 6 m/s) in S2. Due to some weaknesses (e.g. quality and frequency of signal reception) the GPS-distance was underestimated in short sprints and somewhat less in longer sprints (> 100 m). Within exercise science, the use of GPS can assist field research even at higher movement intensities into exercise physiology, metabolism, and biomechanics.

2081 Board #127 MAY 31 8:00 AM - 9:30 AM
A New Utility Of Breath-holding Maneuver To Determine Resting Heart Rate
Flávio A. Lemos, Vanessa P. Frias, Tony M. Santos. Gama Filho University, Rio de Janeiro, Brazil.

No relationships reported.

PURPOSE: The precise determination of resting heart rate (RHR) is very important for exercise testing and prescription based on reserve method. Traditionally, RHR is determined after a minimum of 5-min rest. Many researchers have investigated the heart rate variability under breath-holding maneuver. However, this procedure has not been used to determine RHR. The aim of this study was to use breath-holding maneuver to predict RHR with and without controlled breathing.

METHODS: Eighteen healthy subjects (nine male) 27.6±5.0 year; 24.2±2.9 kg.m^-2; 43.3±7.5 m.L.kg^-1.min^-1(estimated) performed the breath-holding maneuver twice. The duration of maneuver was 10 s with a 1 min recovery between trials. After that, the subjects had been laying under two experimental situations: a) with respiratory controlled of 7.5 breaths.minute^-1 and b) without respiratory controlled. In both conditions, heart rate (HR) subjects were continuously monitored in milliseconds (POLAR RS800, USA). The lower HR observed at each experimental condition were utilized for further analysis (One-way ANOVA, Bland-Altman plot and regression analysis).

RESULTS: The subject’s HR after breath-holding maneuver (57 ± 7 bpm) and breath-holding maneuver with laying (54 ± 8 bpm) and without (56 ± 8 bpm) respiratory controlled has not been significant different (p < 0.05). The Bland-Altman plot showed a 95% limit of agreement between -9.12 to 4.12 bpm and -8.89 to 8.89 when laying with and without respiratory controlled, respectively. The linear relationship showed the high regression between the higher HR in respiratory controlled to breath-holding maneuver (r^2 = 0.848; CI 95% = 0.684 to 1.080, SEE 3 bpm) and lower relationship between the RHR without in respiratory controlled (r^2 = 0.684; IC 95% = 0.489 to 1.039 in 95%, 4 bpm).

CONCLUSION: Our results support the present approach as a substitute strategy to determine RHR in a procedure with 2 min long.

2082 Board #128 MAY 31 8:00 AM - 9:30 AM
Self- And Observer-rated Talk Test For Exercise Prescription Versus Free Exercise Training
Christian Thiel¹, Carl Foster, FACSM², Lutz Vogt¹, Katharina Schmidt¹, Andreas Bernardi³, Frieder Knuese¹, Winfried Banzer¹.¹Goethe-University, Frankfurt, Germany. ²University of Wisconsin, La Crosse, WI.

No relationships reported.

PURPOSE: Tools for exercise prescription need to be simple, economic and adequately precise to find widespread application. The Talk Test appears to be a simple way of achieving recommended exercise intensities. However, the relationship of Talk Test-based prescription and intuitively selected exercise intensity has not been studied, and it is unclear whether instead of the subject, an outside observer could also rate appropriate intensity. The present study compared exercise intensities derived from an internal and an external rating of the Talk Test with self-selected exercise intensity and a reference intensity at the MaxLass.

METHODS: Fifteen well-trained subjects (5 f, 10 m; 23.9±2.4 yrs; 23.2±2.2 kg/m²; VO2max 50.6±5.6 ml.kg⁻¹.1min⁻¹; 4.5±1.4 hrs of exercise/wk) performed a self-paced training session for 30 minutes, a Talk Test incremental treadmill protocol, and separate MaxLass tests. During the last 20 seconds of each stage of the Talk Test, subjects received a standard text and were asked if they could speak comfortably. Concomitantly, an observer recorded his impression of the subject’s level of speech comfort.

RESULTS: Last positive Talk Test (LP TT), free pace, first equivocal TT (EQ TT) and first negative TT (N TT) equalled 82±14%, 92±10%, 94±13% and 109±14% of MaxLass (12.1±1.4 km/h), based on subject rating. Compared to free pace, 95% CI of differences indicated that LP TT tended to be slower (-19%;0%), while EQ TT was not different (-6%;+12%), and N TT was faster (+10%;+29%). Observer rating did not systematically differ from subject rating at LP TT (95% CI: -14%;+4%) at EQ TT (-11%;+3%) and at N TT (-6%;+4%).

CONCLUSIONS: When non-competitive athletes can speak comfortably, they are running well below exercise intensity with minimal athlete burden. The Talk Test should be further tested in physically active and inactive healthy subjects, as well as in clinical populations.
2083  Board #129  MAY 31  8:00 AM - 9:30 AM
Ability of an Incremental Field Test to Evaluate Aerobic Capacity on Young Male Athletes
Luis M. Gómez-Miranda, Claudia E. Carrasco-Lelegue, Ofelia Uria, Lidia G. De Leon. 1 University of Baja California, Tijuana, B.C., Mexico. 2 University of Chihuahua, Chihuahua, Chih., Mexico.

Field tests have been recognized as an economical, practical and feasible way to determine performance in athletes; however, to be valid in terms of maximal aerobic capacity, workloads should be incremental and progressive, as ergometric tests. Maximal oxygen uptake (VO2max) is a widely used parameter to determine aerobic capacity and specific to validate field tests, but its direct measurement is difficult, impractical and expensive. Heart rate maintains a direct relationship with oxygen uptake, is a very sensitive variable and technically easier and practical to evaluate the effort.

PURPOSE: To determine the ability of the 20-meters Multistage Shuttle Run field test (20mMST) to evaluate the aerobic capacity of elite male athletes, using the heart rate as an indicator of the performance.

METHODS: Ten male athletes 18 to 31 years old, from two elite aerobic sport groups, were measured by height, weight and body mass index (BMI). Each participant performed two different maximal stress tests: a progressive shuttle run field test and an incremental treadmill test. Oxygen uptake (VO2) was directly obtained during treadmill protocol, or calculated from the charts provided by the field test. Heart rate (HR) was measured by a telemetric device in both tests. Parameters were recorded every minute. Descriptive statistics, linear regression and Pearson coefficient correlation at a p<0.05 significance level were used.

RESULTS: Athletes were 22.6 ± 4.3 years old and 21.2 ± 2.2 kg/m2 of BMI. VO2max was higher in treadmill (65.4 ± 6.4 mL·kg·1·min·1) than in 20mMST (54.3 ± 5.9 mL·kg·1·min·1), p=0.002. Maximal HR was similar in ergometric than in field test (188.6 ± 9.3 vs 190.0 ± 9.0 beats/min respectively, p=0.743). Linear regression showed a different but directly proportional relationship of HR to VO2 in treadmill (y = 3.323x + 43.07, R2 = 0.874 P <0.001) compared with 20mMST (y = 1.339 + 115.7, R2 = 0.987 P <0.001), evidencing a higher work in ergometric protocol. A high correlation of HR between tests was observed (r = 0.978, R2 = 0.957, P <0.001).

CONCLUSIONS: 20mMST is a valid test to determine aerobic capacity in athletes demonstrated by the similar increment of HR in both protocols. Nevertheless, the higher work evidenced in ergometric test, may suggest that 20mMST underestimates the VO2 value for each level of effort.
Validating The Adidas miCoach For Estimating Pace, Distance, And Energy Expenditure During Outdoor Over-ground Exercise

Justin P. Porta, Angelica N. Lehker, Derek J. Acosta, Sean T. Miller, Joe Tomaka, George A. King. The University of Texas at El Paso, El Paso, TX.

No relationships reported

The Adidas miCoach was developed as a personal training system to estimate pace, distance and energy expenditure (EE) but has yet to be validated.

PURPOSE: To validate the Adidas miCoach for estimating pace (min/km), distance (km) and EE (kcal/min) during outdoor over-ground walking and running for two different sensor configurations.

METHODS: Six male and 8 female moderately endurance trained participants (mean ± SD age: 28.2 ± 8.5 y; height: 167.4 ± 7.8 cm; mass: 60.9 ± 11.1 kg; VO2max: 54.4 ± 5.5 mL/kg/min) completed this validation study. The protocol consisted of walking at 53.6, 80.4, and 107.2 m/min and running at 134.0, 160.8, 187.6, and 214.0 m/min on an outdoor track while wearing a portable metabolic measurement unit (Cosmed K4b²). A miCoach sensor was attached to the right shoelaces (Laces) and a second miCoach sensor was inserted in the right insole of the shoe (Midsole). Estimated pace, distance and EE were compared to values determined by criterion methods (Actual). Data were analyzed using a repeated-measure ANOVA (pace, distance) or ANCOVA (EE) to evaluate significant differences.

RESULTS: A significant main effect (P < 0.05) was observed for speed indicating an increase in measured values at each subsequent speed for pace, distance, and EE. For pace at all speeds, the laces and midsole miCoach estimated pace were significantly different from each other (P < 0.01), and from actual pace (P < 0.02). For distance, the laces and midsole miCoach estimates were similar for all speeds; however, significant differences were observed for the midsole at 53.6 m/min (P = 0.003) and for both laces and midsole at 80.4 and 107.2 m/min (P ≤ 0.05) compared to actual distance. For walking speeds, miCoach estimated EE was significantly different between laces and midsole (P ≤ 0.04), and compared to actual EE (P ≤ 0.001); however, midsole at 160.8 m/min (P = 0.035) and both laces and midsole at 187.6 and 214.4 m/min (P < 0.01) were significantly different from actual EE.

CONCLUSION: These data indicate that the Adidas miCoach is accurate for estimating distance. However, it lacks the ability to accurately estimate pace and EE across a range of walking and running speeds. Additionally, it appears that the laces configuration produced more accurate estimates than the midsole.

Partially supported by UTEP CHS graduate enhancement funds.

Validating The Nike+ Sport Kit For Estimating Pace, Distance, And Energy Expenditure During Treadmill Exercise

Derek J. Acosta, Sean T. Miller, Justin P. Porta, Angelica N. Lehker, Joseph W. Tomaka, Rebecca J. Reed-Jones, George A. King. The University of Texas, El Paso, TX.

No relationships reported

The Nike+ Wireless Sport Kit was developed to allow athletes of all skill levels to observe their pace, distance, and energy expenditure during walking or running.

PURPOSE: To validate the accuracy of the Nike+ Wireless Sport Kit to estimate pace (min/km), distance (km), and energy expenditure (EE) (kcal/min) during treadmill walking and running, and for two different sensor configurations.

METHODS: Nine male and 9 female moderately endurance trained volunteers (mean ± SD age: 28.83 ± 1.90 y; height: 168.72 ± 1.86 cm; body mass: 62.19 ± 2.58 kg; VO2max: 54.36 ± 1.15 mL/kg/min) completed a) a maximal oxygen consumption test and b) the Nike+ validation protocol comprised of level treadmill walking at 53.6, 80.4, and 107.2 m/min, and level treadmill running at 134.0, 160.8, 187.6, and 214.0 m/min. A Nike+ unit was attached to the left shoelaces and a second unit was placed within the left midsole of a compatible shoe. Nike+ estimated pace, distance, and EE were compared to actual values determined by criterion methods. Data were analyzed by conducting two repeated-measures ANOVAs, and one repeated-measures ANCOVA.

RESULTS: Each subsequent treadmill speed elicited a significant increase in pace (P < 0.037), distance (P < 0.001), and EE (P < 0.020). The Nike+ significantly overestimated pace (P ≤ 0.034) and distance (P ≤ 0.005) at walking speeds (53.6 and 80.4 m/min) by 23% and 9%, respectively; and significantly underestimated pace (P ≤ 0.034) and distance (P ≤ 0.005) at higher running speeds (160.8, 187.6, and 214.0 m/min) by 6% (pace only - laces), 10% and 15%, respectively. Compared to the criterion indirect calorimetry, the Nike+ significantly underestimated EE (P ≤ 0.022) by 24%, 10%, and 12% for 107.2, 187.6 and 214.0 m/min, respectively. There appears to be no marked difference between the laces and midsole sensor configurations for pace, distance, or EE.

CONCLUSION: Compared to actual, estimates of EE were most accurate; speculating that the device’s prediction equation is more suited for estimating EE. The sensor configuration affixed to the laces is a viable alternative to that of purchasing a Nike+ compatible shoe.

Partially supported by UTEP CHS graduate enhancement funds.

Validating The Adidas miCoach For Estimating Pace, Distance, And Energy Expenditure During Outdoor Over-ground Exercise

Sean T. Miller, Derek Acosta, Angelica Lehker, Justin Porta, George King. University of Texas at El Paso, El Paso, TX.

No relationships reported

The use of accelerometry based physical activity monitors among recreational athletes to meet or exceed recommended physical activity guidelines has grown in popularity. In the interest of capitalizing on this demand, Adidas developed the miCoach Pacer System which allows the user to observe pace, distance, and energy expenditure during walking or running.

PURPOSE: To validate the accuracy of the Adidas miCoach activity monitor in estimating energy expenditure (EE) (kcal/min), pace (min/km), and distance (km) during treadmill walking and running, and for two different sensor configurations.

METHODS: Nine male and 9 female moderately endurance trained volunteers (mean ± SD age: 28.83 ± 1.90 y; height: 168.72 ± 1.86 cm; body mass: 62.19 ± 2.58 kg; VO2max: 54.36 ± 1.15 mL/kg/min) completed a maximal oxygen consumption test, and the miCoach validation protocol comprised of level treadmill walking at 53.6, 80.4, and 107.2 m/min, and level treadmill running at 134.0, 160.8, 187.6, and 214.0 m/min. A miCoach unit was attached to the right shoelaces (Laces) and a second unit was placed within the right midsole of a modified shoe (Midsole). MiCoach estimated pace, distance, and EE were compared to actual values determined by criterion methods (Actual). Data were analyzed using a repeated-measures ANCOVA (EE), or a repeated-measures ANOVA (pace, distance).

RESULTS: There was a significant increase in EE (P ≤ 0.003), pace (P ≤ 0.001), and distance (P < 0.001) with each subsequent treadmill speed. The Adidas miCoach significantly overestimated actual EE for the midsole at 53.6 m/min (P = 0.045), and for both laces and midsole at 80.4 and 107.2 m/min (P ≤ 0.036). No significant differences were observed for laces or midsole EE compared to actual EE at any running speeds. Further, no significant differences were observed for estimated pace or distance of laces or midsole compared to actual values.

CONCLUSION: The Adidas miCoach device appears to accurately estimate pace and distance across a range of treadmill walking and running speeds and accurately estimate EE during treadmill running. Additionally, these results suggest that either laces or midsole sensor configuration provides similar values. Partial support for this study was provided by UTEP CHS Graduate Enhancement Funds.
The Nike+ Wireless Sport Kit was designed to estimate pace, distance, and energy expenditure (EE) during walking and running.

**PURPOSE:** To validate the Nike+ Wireless Sport Kit for estimating pace (min/km), distance (km), and EE (kcal/min) during walking and running on an outdoor track and to compare the accuracy of the Nike+ laces sensor to the midsole sensor configuration.

**METHODS:** The Nike+ was assessed for 6 male and 9 female moderately endurance trained participants (mean ± SD age: 28.07 ± 8.22 y; height: 167.13 ± 7.62 cm; mass: 60.46 ± 10.86 kg; VO2max: 54.25 ± 5.36 mL/kg/min) during walking at 53.6, 80.4, and 107.2 m/min and running at 134.0, 160.8, 187.6, and 214.0 m/min on an outdoor track. The Nike+ validation protocol involved wearing a portable metabolic measurement unit (Cosmed K4b2), one Nike+ sensor attached to the left shoes (Laces), and a second Nike+ sensor inserted in the left insole of a compatible shoe (Midsole). Pace, distance, and EE values estimated from the laces and midsole were compared to criterion measures (Actual). A repeated-measures ANOVA (pace, distance) or ANCOVA (EE) was used to evaluate data for statistical significance.

**RESULTS:** Each subsequent speed elicited a significant increase in pace (P < 0.005), distance (P < 0.005), and EE (P < 0.17). However, compared to actual pace, both laces and midsole values were significantly different at 53.6, 80.4, 134.0 and 214.0 m/min (P < 0.03), and midsole at 160.8 m/min (P < 0.001). For distance, both laces and midsole values were significantly different at 53.6, 80.4, 134.0 and 160.8 m/min (P < 0.03) and laces at 214.0 m/min (P = 0.002). Significant differences were observed between estimated and actual EE for laces at 53.6 m/min (P = 0.043), and for both laces and midsole at 80.4, 134.5, 160.8, and 187.6 m/min (P < 0.05).

**CONCLUSIONS:** The Nike+ accurately distinguishes various intensities of walking and running on an outdoor track. Despite small but significant differences compared to actual values, these data indicate that the Nike+ provides similar estimates when mounted on the shoelaces as when inserted in a compatible shoe.

Partially supported by UTEP CHS graduate enhancement funds.
METHODS: Twenty-one female division I college athletes (10 basketball and 11 volleyball) performed hand-eye reaction time tests of peripheral vision (PV), peripheral vision with number recall (PVNR), and visual-reaction (VR) on the Dynavision D2 (Dynavision, Ontario Canada). The PV and PVNR tests measured accuracy (hits) in reacting to light stimuli for one minute duration. The VR measured time in reacting to 5 separate visual stimuli with the dominant and non-dominant hands. Each volunteer completed four trials of each test. Differences between subsequent trials were analyzed with one-way repeated measures ANOVA.

RESULTS: Significant improvements in PV were seen between T1 (69.3 ± 7.8 hits) and T2 (77.3 ± 12.5 hits). No other significant differences were noted between testing sessions. Similarly, significant improvements were noted in PVNR between T1 (55.5 ± 11.1 hits) and T2 (65.6 ± 10.9 hits), but no additional improvements (p > 0.05) were seen in subsequent testing sessions. No significant differences between trials were observed for VR in visual reaction time in dominant (0.40 ± 0.07 s) or non-dominant hands (0.41 ± 0.10 s), or in motor reaction time in dominant (0.37 ± 0.14 s) or non-dominant hands (0.38 ± 0.13 s). CONCLUSIONS: Results indicate that competitive athletes should perform two trials to achieve baseline performance measures in PV or PVNR. In addition, both visual and motor reaction time does appear to be consistent with each testing trial, suggesting that there is a limited learning effect in VR observed during consecutive testing trials when assessing competitive athletes.
measures MANOVA indicated no significant differences among trials for SSS scores (BL: 3.89±1.24; EX: 4.15±1.14; WB: 3.40±1.47; FB: 4.10±1.28), bedtime sleepiness (BL: 4.09±1.41; EX: 4.13±1.55; WB: 4.50±1.77; FB: 4.38±1.19), and the patterns of daytime sleepiness on the following day (BL: 2.81±0.58; EX: 2.84±1.32; WB: 2.75±1.04; FB: 2.72±0.89) (p>0.05).

CONCLUSIONS: These observations indicate no benefits of pre-bedtime endogenous (moderate intensity exercise) and exogenous (whole body and foot baths) body warming interventions on subjective sleep quality and bedtime/daytime sleepiness in postmenopausal women suffering from insomnia.

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**2097**  
**Board #143**  
**May 31**  
**9:00 AM - 10:30 AM**  
**Level Evaluation Of Physical Activity After Six Months Of Monitoring In Sedentary Individuals Through Emails**  
Carolina Vicaria Rodrigues D'Aure1, Carla Giuliano de Sá Pinto1, Marcio Maue2, Felipe Gambetta Carmona1, Alyton Figueira Júnior2, José Antônio Maluf de Carvalho1,3  
1Hospital Israelita Albert Einstein, São Paulo, Brazil. 2Universidade São Judas Tadeu, São Paulo, Brazil.  

(No relationships reported)

Physical activity is an important intervention to the prevention, and treatment of cardiovascular diseases, hypertension, diabetes mellitus, stroke, some kinds of cancers, osteoporosis, depression and imbalance in the lipid profile. Counseling for physical activity has been poorly applied for the needs of individuals who should be encouraged to develop healthier lifestyles.

**PURPOSE:** To investigate the effect of counseling, for 6 months, through emails, on the level of physical activity in sedentary adults.

**METHODS:** The study sample consisted of 104 adults of both sexes who completed the program for Continuing Health Revision at the Center for Preventive Medicine of the Albert Einstein Hospital. To participate in this study, the clients should be defined as sedentary, considering the physical activity level (IPAQ), signing the informed consent and having participated in the monitoring program and answered the three IPAQs applied: on the day of RCS, after 3 months and 6 months follow-up. The monitoring was done by physical education teachers through periodic e-mails, sent at weeks 1, 2, 3, 4, 6, 8, 10, 12, 16, 20 and 24. Statistical analysis was performed, using the Statistical Package for Social Sciences (SPSS) v.15.0.

**RESULTS:** After 3 months of follow-up, 29.8% of this sample, began to be lazy and at the end of 6 months follow-up, 67.3% became active and 9.6% became very active (p<0.0001). After 6 months, compared with the initial physical activity level, there was a considerable increase in the number of active individuals, reaching the necessary recommendations to achieve a healthier lifestyle.

**CONCLUSIONS:** The counseling and monitoring conducted through periodic and individualized e-mails, proved to be very motivating and effective for sedentary individuals, which contribute to a change in their lifestyles, making them more active for the encouragement of regular physical activity practice.

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**2098**  
**Board #144**  
**May 31**  
**9:00 AM - 10:30 AM**  
**Comparison Of Awareness Of ACSM Physical Activity Recommendations Between College Students And Other Population**  
Luis Leite1, Dulce Leal Esteves2, Paulo Gonçalves Pinheiro1, Sergio Vieira1, Kelly O’Hara2, Rui Brás3, 1Beira Interior University & CIDESD, Covilha, Portugal. 2Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal.  

(No relationships reported)

Many health behaviors are established during late adolescence and early adulthood, when many attend college, so the decline in physical activity (PA) during college is a disturbing trend. Increasing efforts to promote college students PA have been made, but is not clear if college students have a better knowledge on adequate PA characteristics for health improvement than other populations.

**PURPOSE:** This study aims to examine the extent to which knowledge of the ACSM PA recommendations has diffused through college students and compare with recommendations knowledge of the rest of population.

**METHODS:** The study included a randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 y; and 200 undergraduate college students (31.0% M; 69.0% F) age 20.4±3.3. The awareness of ACSM PA Recommendations was assessed as indicated by Bennett et al., 2009.

**RESULTS:** There is not widespread knowledge of the ACSM PA recommendations neither for college students (only 28.5% know the recommendations) nor for the rest of population (26.3%). No statistic differences were found (p<0.05) between these two groups.

**CONCLUSIONS:** Despite efforts to widespread knowledge on ACSM recommendations on college students, their knowledge is similar to the rest of population. This finding should highlight the limited ability to enhance knowledge from existing campaigns designed to college students and the need for more effective strategies to widespread accurate information both for college students and for the rest of population.


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**2099**  
**Board #145**  
**May 31**  
**9:00 AM - 10:30 AM**  
**Awareness Of ACSM Physical Activity Recommendations For Health Promotion: Assessing BMI And METS Differences**  
Sergio Vieira1, Paulo Gonçalves Pinheiro1, Rui Brás1, Kelly O’Hara2, Ricardo Gouveia Rodrigues2, Dulce Leal Esteves1, 1Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal. 2Beira Interior University & CIDESD, Covilha, Portugal.  

(No relationships reported)

Regular moderate physical activity (PA) has an important influence on health and well-being, but is not clear if adult population knows the adequate PA characteristics for health improvement.

**PURPOSE:** This study aims to examine whether knowledge of the American College of Sports Medicine (ACSM) physical activity recommendations varies with BMI and METS.

**METHODS:** The study included a randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 years. The awareness of ACSM PA Recommendations for Health Promotion was assessed as indicated by Bennett et al., 2009. METS were estimated using IPAQ, validated to Portugal.

**RESULTS:** PA evaluation revealed 40.6% of low; 9.2% moderate and 50.2% high PA level. BMI (Kg/m2) assessment found 2.48% underweight (BMI<18.5); 51.59% normal (18.5≤BMI<24.99); 36.95% overweight (25.0≤BMI<29.99) and 8.98% obese (BMI≥30). Less than a third of respondents (26.3%) were accurately knowledgeable of the ACSM PA recommendations. Recommendations knowledge increases with PA level (22.1%, 25.6% and 30.0% for low, average and high PA level, respectively) and with BMI (14.3%, 23.3%, 39.1% and 35.5% for underweight, normal, overweight and obese, respectively).

**CONCLUSIONS:** For almost three quarters of interviewed population there is not widespread knowledge of ACSM PA recommendations. Knowledge augments with PA level, what is an unexpected finding, and also with BMI: obese have a better knowledge of ACSM PA recommendations than underweight and normal weight. This unexpected result may be related with people with higher BMI could be alerted to the need of physical exercise to lose weight, so, their knowledge on exercise recommendations is better.


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**2100**  
**Board #146**  
**May 31**  
**9:00 AM - 10:30 AM**  
**Longitudinal Non-exercise Models For Estimating Cardiorespiratory Fitness Of Men And Women**  
Andrew S. Jackson, FACSM1, Xueimi Su2, Daniel P. O’Connor3, Duck-chul Lee4, Enrique G. Artero5, Timothy S. Church, FACSM6, Steven N. Blair, FACSM7  
1University of Houston, Onalaska, TX. 2University of South Carolina, Columbia, SC. 3University of Houston, Houston, TX. 4Pennington Biomedical Research Center, Baton Rouge, LA.  

(No relationships reported)

Low cardiorespiratory fitness (CRF) is associated with high risk of chronic diseases and mortality. CRF measured with a maximal or sub-maximal exercise test has limited application in clinical and public health settings due to time constraints and the need for specialized test equipment and trained administrators. Published cross-sectional, non-exercise (Non-Ex) models show that CRF can be estimated with reasonable accuracy, but cannot be generalized to changes in CRF associated with aging.
PURPOSE: To develop longitudinal Non-Ex models for men and women that accurately estimate CRF and changes in CRF associated with aging.

METHODS: The sample included 1,325 women (age range 20-78 y) and 10,040 men (age range 20-86 y) who completed from 2 to 21 maximum treadmill exercise tests from 1977 to 2005. The number of observations was: women, 3,816; and men, 38,716. The dependent variable was CRF measured with a maximal Balke treadmill test. The independent variables were age, body composition (body mass index and waist circumference), self-report physical activity (SR-PA), smoking behavior and resting heart rate. Linear mixed levels regression (LML) modeled the data and the standard error of estimate defined model accuracy.

RESULTS: the LML analyses found that all variables were independently related with CRF (p<0.001) and were used to construct the longitudinal models. The longitudinal model error estimates (95% CI) were: women, 1.51 MTEs (1.45, 1.58); and men, 1.66 MTEs (1.63, 1.68). These error estimates are congruent with published cross-sectional error estimates.

CONCLUSIONS: The longitudinal models provide accurate Non-Ex equations for estimating CRF with data routinely collected in public health settings. These results can be generalized to assessing changes in CRF associated with aging.

Supported by National Institutes of Health grants AG06945, HL62508, and R21DK088195; and an unrestricted research grant from the Coca Cola Company.
Mobility disability is prevalent in obese older populations, yet little is known about the effect of obesity and weight loss on mobility in younger populations.

**PURPOSE:** To determine the effect of a clinical weight loss program conducted by an integrated multidisciplinary team including physicians, registered dieticians, and clinical exercise physiologists on selected anthropometrics and mobility in obese patients.

**METHODS:** Program evaluation of patients (n=66); 46.6±8.3 y; 114kg + 22; BMI= 41.3 kg/m², enrolled in a 12 week weight loss program. Integrated team visits included medical, nutrition and physical activity assessments; weekly follow-ups included weight loss behavior education, lifestyle strategies, tracking and guidance. Physical activity visits included functional field assessments, pre-exercise screening, medical and current activity status. Patients received a pedometer with step tracking instructions and a First Step to Active Health® kit. An individualized home/gym exercise program based on ACSM guidelines was designed and progressed over time. Dieticians reviewed patient’s food and step log/activity records. Physicians reviewed patient’s health status, with intervention as needed.

**RESULTS:** The following table summarizes results.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Baseline</th>
<th>12 week</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>114±21.8</td>
<td>107±18**</td>
<td>-6</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>41.3±18.2</td>
<td>38.9±16**</td>
<td>-2.8</td>
</tr>
<tr>
<td>Percent body fat (%)</td>
<td>43.8±7.1</td>
<td>41.9±5.8**</td>
<td>-3.3</td>
</tr>
<tr>
<td>Muscle mass (kg)</td>
<td>58.8±5.1</td>
<td>57.8±5.6**</td>
<td>-1.62</td>
</tr>
<tr>
<td>Walking: Pedometer steps</td>
<td>5,000±1574</td>
<td>8,040±733**</td>
<td>+67.6</td>
</tr>
<tr>
<td>Strength/lower: Sit to stands</td>
<td>11.6±4.9</td>
<td>14.7±5.8**</td>
<td>+26.7</td>
</tr>
<tr>
<td>Strength/upper: Arm curls</td>
<td>17.3±4.6</td>
<td>20.4±8.2**</td>
<td>+17.9</td>
</tr>
<tr>
<td>Balance (seconds)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left leg</td>
<td>26.4±9.3</td>
<td></td>
<td>+5.3</td>
</tr>
<tr>
<td>Right leg</td>
<td>24.1±8.3</td>
<td></td>
<td>+10.7</td>
</tr>
<tr>
<td>Flexibility: Back Scratch (inches)</td>
<td>7.0±5.1</td>
<td></td>
<td>+2.8</td>
</tr>
<tr>
<td>Right arm</td>
<td>8.6±5.4</td>
<td></td>
<td>+2.3</td>
</tr>
<tr>
<td>Left arm</td>
<td>8.6±5.4</td>
<td></td>
<td>+2.3</td>
</tr>
</tbody>
</table>

* p<.05. ** p<.0001

Measures revealed significant improvements in all areas except balance of the left leg. Baseline scores were below older adult (60-94 y) normative mobility scores and by 12 weeks, our patients exceeded all older adult normative scores except for flexibility.

**CONCLUSIONS:** This multidisciplinary team weight management program is an approach that can help young obese patients lose weight and improve mobility.
CONCLUSIONS: The used LSMP was effective in upper body postural alignment by reducing abdominal fat and strengthening the knee (extensors). Supported by CNPq and FUNDAP.

2107  Board #153  May 31  9:00 AM - 10:30 AM  
Relationship between Body Mass Index and Percent Body Fat: Preliminary Results from the Energy Balance Study.  
Vivek K. Prasad, Gregory A. Hand, FACSM, E Patrick Crowley, Kelly Kavanaugh, Jason R. Jaggers, Robin P. Shook, Steven N. Blair, FACSM. University of South Carolina, Columbia, SC.  
(No relationships reported)  

PURPOSE: The CDC has stated that “BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems.” However, previous work has shown that BMI is not a reliable indicator in special populations including children, elderly, and some minorities. The purpose of this study was to examine in a healthy group of men and women the relationship between BMI and the body fat “cut points” for overweight and obesity.  

METHODS: A group of healthy women and men were assessed for BMI and body fat percent (BF). BMI was calculated as weight in kg/height in meters2. BF percentage was calculated as the percentage of total weight identified as fat tissue by dual x-ray absorptiometry (DXA). Descriptive statistics were calculated and a Pearson correlation was determined for BMI and BF percent by gender. BMI overweight and obese cut points were 25.0 to 29.9 and 30.0 and above, respectively. Obesity cut points for BF percent were 25 and 32 percent for men and women, respectively.  

RESULTS: The population consisted of 55 healthy adults (22 men and 33 women; aged 21 to 35 years). Body weight ranged from 53.7 to 110.8 kgs (men: 83.66±14.55 kgs; women: 72.53±13.29 kgs) with a BMI range of 19.3 to 35.0 for men (26.7±4.14) and a range for women of 19.8 to 35.1 (26.5±4.46). BF percent for men ranged from 7.83 to 39.54 (35.6±3.67) and for women ranged from 16.39 to 50.54 (35.6±3.67). Pearson correlations were 0.816 (p<0.0001) and 0.793 (p<0.0001) for men and women, respectively. Of the 6 men in the BMI overweight range of 25 to 29.9, all were in the obese BF range of over 25%. Eleven women were in the BMI overweight range of 25 to 29.9, and 9 of those were in the obese range of over 32% BF.  

CONCLUSIONS: These results indicate that the majority of men and women (100% and 82%, respectively) who were categorized as overweight by BMI cut points were in the obese BF range. The findings suggest that the correlation between BMI and percent BF is high, but nearly all individuals classified as overweight by BMI were obese by percent BF standards. The range of BF percent is significantly higher than would be expected by BMI classification of the individuals. In this population, BMI does not accurately categorize individuals as overweight or obese. Supported by the Coca Cola Corporation and the NINR/NIH.

2108  Board #154  May 31  9:00 AM - 10:30 AM  
Effect Of Overestimated Resting Metabolic Rate (rmr): Preliminary Results From The Energy Balance Study  
Gregory A. Hand, FACSM, John C. Sieverdes, Kelly Kavanaugh, Madison DeMello, E. Patrick Crowley, Vivek K. Prasad, Jason R. Jaggers, Robin P. Shook, Steven N. Blair, FACSM. University of South Carolina, Columbia, SC.  
(No relationships reported)  

PURPOSE: Body weight control requires a balance of energy intake and energy expenditure (EE) that is regulated by physiological, behavioral, environmental, and genetic components. The largest portion of EE is resting metabolic rate (RMR). RMR has been defined as 1 MET and an oxygen consumption of 3.5 ml/kg/min. As energy requirements for activity are calculated as multiples of METs, an overestimation of RMR will result in greater error in estimating EE as intensity or duration increases. The purpose of this study was to determine the RMR of a group of healthy adults, and calculate the effect of overestimating EE.  

METHODS: RMR was measured in 55 healthy adults. Participants arrived fasted for at least 12 hrs. and having refrained from alcohol or exercise for at least 24 hrs. Participants rested in a supine position under a ventilated hood for 15 minutes, followed by a 30 minute RMR gas collection period in which inflow and outflow of oxygen and carbon dioxide was measured. Height and weight were measured and BMI calculated as body weight (kgs)/height (meters)2. Descriptive statistics were calculated and a Pearson Correlation of BMI to RMR was determined.  

RESULTS: The population consisted of 22 men and 33 women (aged 21 to 35 years). Body weight ranged from 53.7 to 110.8 kgs (men: 83.66±14.55 kgs; women: 72.53±13.29 kgs) with a BMI range of 19.3 to 35.4 (men: 26.7±4.14; women: 26.5±4.46). The RMR ranged from 0.15 to 0.32 L/min (men: 0.25±0.037; women: 0.21±0.03) resulting in a RMR per body weight range of 2.25 to 3.58 ml/kg/min (men: 2.99±0.33; women: 2.89±0.36). The Pearson Correlation analysis of BMI to RMR for men was -0.443 (p=0.039) and for women was -0.71 (p<0.001).  

CONCLUSIONS: These results indicate that the inverse relationship between BMI and RMR is stronger in women than men. Further, both genders showed a significantly lower RMR than the standard estimate of 3.5 ml/kg/min. The findings suggest that using the standard RMR estimate would have overestimated EE of 1 MET by approximately 0.55 ml/kg/min. This error would overestimate resting energy consumption for this population by approximately 2.5 L oxygen/hr, or by 2134 kcals per week. This error would dramatically increase as MET minutes of activity, calculated as multiples of RMR, were added to the total EE. Supported by the Coca Cola Corporation and NINR/NIH.

2109  Board #155  May 31  9:00 AM - 10:30 AM  
Exercise is Medicine with Altitude  
Rachel Cline, Rebekah Lauersdorf, Jeff Bakke, Tim Behrens, FACSM. University of Colorado Colorado Springs, Colorado Springs, CO.  
(No relationships reported)  

The Exercise is Medicine on Campus campaign was adapted for the University of Colorado Colorado Springs (UCCS) and was titled Exercise is Medicine with Altitude (EIMA).  

PURPOSE: To increase physical activity and its health benefits at UCCS through the implementation of EIMA.  

METHODS: Students were recruited to participate in this descriptive study through flyers posted around campus, the student health center (SHC), the student recreation center (SRC), and social networking. The planning phase began in Fall 2010 and included recruiting departments and developing implementation strategies. The campaign and data collection began February 1, 2011, consisting of a physical activity screening and referral process, health education flyers posted around campus, an EIMA team for a campus 5K, health and fitness assessments at the campus health fair, and a campus mascot with his own Facebook page. The Physical Activity Vital Signs (PAVS) tool was used to screen for physical activity at the SHC. If the PAVS score resulted in a physical activity level below federal recommendations, a referral was made to the SRC for a free gym orientation, fitness assessment, and semester group fitness pass. To determine the effectiveness of the screening and referral process, PAVS scores and referral coupons were collected. The following ratios were calculated: patients screened/total number of SHC patients, patients referred/patients screened, and referrals used/reerrals given. The number of Facebook friends and 5K EIMA team members were also collected.  

RESULTS: 7.4% of SHC patients were screened, 81.4% of patients screened were referred to the SRC, and 8.6% of referrals made were used at the SRC. The campaign’s mascot obtained 30 Facebook friends and the 5K team had 14 members.  

CONCLUSIONS: This pilot study proved effective in collaborating with departments and gaining interest through the Facebook page and mascot. Although the campaign only reached a small portion of students, it still increased physical activity and increased awareness of physical activity benefits. The results from the screening and referral process highlighted the importance of communication between researchers and departments. Future efforts should aim for greater participation and more consistent implementation to help the campaign reach its full potential.

2110  Board #156  May 31  9:00 AM - 10:30 AM  
Venice Maps-s ( Measuring Activity Patterns Study - In Students)  
Robert V. Muscel2, Peter H. Brubaker, FACSM1, Makoto Ayabe2, Hiroshi Tanaka2. 1Wake Forest University, Winston-Salem, NC. 2Fukuoka University, Fukuoka, Japan.  
(No relationships reported)  

PURPOSE: Most Americans do not accumulate the amount of physical activity (>300 kcal/day) associated with a reduced risk of cardiovascular disease (CVD). The lower prevalence of CVD observed in the Mediterranean Region is generally attributed to a healthier diet, but the contribution of increased PA cannot be discounted. This study examined the effects of the built environment of Venice, Italy (a city with minimal automotive transportation) on PA levels in college students.  

METHODS: This study compared the physical activity levels of 18 American students from Wake Forest University (WFU) before (AS@WFU) and during the semester they spent abroad in Venice, Italy (AS@VEN). A matched group of 12 Italian university students (IS@VEN) were recruited for comparison. Participants were instructed to wear a LifeSaver (Kenz) accelerometer.
continuously for ten days. Daily physical activity energy expenditure (PAEE) and minutes of light (LPA), moderate (MPA), and vigorous (VPA) PA were determined for each group. T-tests, with a p<0.05 level of significance, were used to compare PA levels between groups.

RESULTS: Although not significantly different, daily PAEE levels were higher in AS@VEN (423.2 ± 187.4 kcal) and IS@VEN (408.8 ± 113.8 kcal) than AS@WFU (329.3 ± 217.2 kcal). Furthermore, daily minutes of LPA (72.5 ± 27.6 min, 66.5 ± 21.5 min, 36.9 ± 10.8, respectively) and MPA (57.3 ± 25.8 min, 58.3 ± 23.6 min, 34.0 ± 14.0, respectively) were significantly higher in AS@VEN and IS@VEN vs. AS@WFU. There were no significant differences between AS@VEN and IS@VEN for LPA, MPA or VPA. In contrast, minutes of VPA were significantly higher in AS@WFU than AS@VEN or IS@VEN (17.8 ± 26.1, 7.3 ± 12.5, 3.9 ± 3.8, respectively).

CONCLUSIONS: American students, while in Venice, achieved a PAEE level of >300 kcal/day by adopting a similar pattern of PA, with greater reliance on LPA and MPA and less on VPA, as their Italian counterparts. In contrast, American students (at WFU) relied more on vigorous (i.e. structured bouts of exercise) than lifestyle PA and expended ~100 fewer kcals/day than VEN. These findings suggest that lifestyle PA (i.e. LPA and MPA) can produce a PAEE level that may contribute to the reduced prevalence of CVD observed in the Mediterranean region.

**CONCLUSIONS:**

**METHODS:**

173 men from 40-49 year (44.0±3.5yr) without cardiovascular disease, diabetes and other diseases. They answered their PA by IPAQ. To test their BP, HR, PWV, TC, TG, HDL-c, LDL-c, myocandien enzymes, ICRP, OP of EEG and LF/HF of heart rate variability in the quiet and fasting state before the GXT at the same day. The GXT was performed on a cycle ergometer of Custo-med with incremental work loads starting with 25 w and adding 25 w at 2 min intervals until the subject reached the heart rate maximum or abnormal change in ST. The performance of GXT, ECG and VO2 were recorded. To analyze the relationships between indicators of ECG and other indicators by multiple regression analysis; To build the regression equations by stepwise regression. The significance was p<0.05. The highly significance was p<0.01.

RESULTS: 28 men had abnormal change in ST, 145 men had normal change in ST during GXT. For the normal men, LDH1, LDH1/LDH, OP of EEG and PA in the quiet and fasting state had closed relationships to change in ST of ECG, p<0.05. The prediction equation for the men of normal change in ST was Y = 0.022 ± 0.001X1-0.147X2 + 0.34X3 + 5.31 ± 6.0X4. Y was the change of ST, X1 was LDH1, X2 was LDH1/LDH, X3 was OP, X4 was PA. R = 0.496, R2 = 0.246. The forecast range of ST was -0.07 ± 0.08mm. The correlation between the real values and the predictive value was 0.471 (p<0.000).

For the abnormal men, HDL-c, OP of EEG and DBP in the quiet and fasting state had closed relationships to change in ST of ECG, p<0.05. The prediction equation for the men of abnormal change in ST was Y = 0.440 ± 0.04X1 + 0.042X2 ± 0.002X3. Y was the change of ST, X1 was DBP, X2 was HDL-c, X3 was OP, R = 0.733, R2 = 0.538. The forecast range of ST was -0.24 ± 0.1 mm. The real values and the predictive value was 0.643 (p<0.045). We used the equation to predict the men of normal change of ST. The forecast range of ST was -0.1 ± 0.14 mv.

CONCLUSIONS: The values of the real, LDH1/LDH, OP of EEG, PA in the quiet and fasting state can be used to predict the normal change of ST in 40-49yr Chinese men in GXT; 2. The values of HDL-c, DBP and OP of EEG can be used to predict the abnormal change of ST in 40-49yr Chinese men in GXT.

**CONCLUSIONS:**

**METHODS:**

17 participants (age=52±13 yr; height=1.66±0.16 m; weight=85.0±20.2 kg; BMI=31.5±9.6 kg/m²; 88% male) completed two treadmill walking trials, during which steady-state VO2 was measured. They then completed two overground walking trials at least 4 min. The first trial was self-paced following instructions to “walk briskly”. The second trial was paced using a digital music track which was individually determined from the treadmill trials to be at a moderate cadence (~3MET). Data were analyzed using RM t-test, Cohen’s d, and Bland-Altman plot.

RESULTS: During the self-selected brisk walking trial (5.33±0.28 min), participants walked at a cadence of 113±13.3 steps/min (range = 88-139). Cadence during the music-paced walking trial (5.37±0.28 min) was significantly slower (104±1.32 steps/min; range = 80-122; p < .05, d = 0.69). This pattern occurred for all participants (range = 1 to 23 steps/min slower). From the Bland-Altman plots, 12 of 17 (71%) participants walked within 10 steps/min of the prescribed cadence. No participants walked slower than the prescribed cadence.

CONCLUSIONS: Non-traumatic lower limb amputees can walk faster during self-selected “brisk” walking than during music-paced moderate intensity walking. Additionally, they are able to match a prescribed cadence by following an auditory stimulus relatively well. The use of auditory stimuli is therefore an effective way to prompt walking at a health-enhancing pace in this population, and they appear to be quite capable of walking above moderate intensity.
Perceived Barriers To Physical Activity And Program Incentives In A University Wellness Program

Elizabeth G. Groendal1, Samantha J. Dunbert2, Jeremy L. Knous3, Joshua J. Ode4, 1Saginaw Valley State University, University Center, MI. 2Michigan State University, East Lansing, MI.  

(No relationships reported)

Exercise is Medicine on Campus (EIMC) is a national initiative aimed at improving physical activity (PA) and health on college campuses. One way to promote EIMC is through the development of a university employee wellness program, which can potentially lead to individual improvements in health and fitness. In order to enhance the effectiveness of a wellness program, both barriers to PA participation and appropriate program incentives for the participants should be evaluated.

PURPOSE: Therefore, the purpose was to evaluate fitness, perceived barriers to PA and appropriate program incentive levels among university employee wellness program participants.

METHODS: Participants included 150 employees enrolled in a wellness program. Fitness assessments included anthropometrics, body composition, flexibility, muscular endurance, muscular strength, and aerobic capacity. Survey evaluation included perceptions of PA barriers and program incentives. Perceived barriers to PA were assessed using a 5 point Likert scale and dichotomized for analysis. Program incentives were categorized as least, moderately, or most appealing. Descriptive data (means±SD) were reported for fitness data. Barrier and program incentive prevalence was reported. Chi-square and T-test were used to assess gender differences.

RESULTS: Mean (±SD) age was 44±4.12 years with 63% of participants being female. 55% of the participants were considered overweight or obese by BMI, with a statistical difference (p > 0.05) between males and females. Mean (±SD) estimated VO2max was 35±9 ml/kg/min, percent fat 25±8, curl-ups 26±13, push-ups 26±14, grip strength 77±28 kg, sit-and-reach 32±49 cm. Estimated VO2max and grip strength values were higher in males than females, while percent fat and sit-and-reach values were lower. Lack of time due to work (46%) and feeling tired (27%) were the most common barriers. The greatest perceived program incentive was cash (36%) while additional vacation time was the least (14%).

CONCLUSIONS: Participants in this wellness program have a high prevalence of overweight/obesity and low aerobic fitness highlighting the need for university wellness programs. In order to maximize the effectiveness of these programs, lack of time as a barrier to physical activity and cash incentives for participation should be considered.

Achieving Recommended Physical Activity Requirements For Enrolled Aged Children In New Jersey

M. Alyssa Mastrangelo, FACSM1, Patrick Lesniak2, Edward C. Chaloupka, FACSM3, Lisa Scheetz2, 1Richard Stockton College of New Jersey, Galloway, NJ. 2Rowan University, Glassboro, NJ. 3Cumberland Cape Atlantic YMCA, Vineland, NJ.  

(No relationships reported)

PURPOSE: Childhood obesity has become a national issue. Over the past three decades, obesity has dramatically increased. Childhood obesity has been linked to a decrease in physical activity (PA) among children. The purpose of this study was to increase vigorous to moderate physical activity (VMPA) into the school day in an attempt to meet the state mandated 150 minutes of required physical activity.

METHODS: Students in kindergarten and 1st grade participated in the program. They were surveyed on the amount of physical activity they participated in during five data collection weeks: baseline, first, second, third and fourth quarter. Following the baseline data collection week, the students began an eight month physical activity program. The program, structured recess was utilized for the structured recess. The program 30 min/day provided 150 min/wk of VMPA.

RESULTS: A total of 909 students participated in the eight month program. At baseline, 890 students participated and achieved 49.98 min of PA. At the first quarter data collection week, 887 students participated for a mean of 203.62 min of PA per student. During the second quarter data collection week, 882 students participated for a mean of 211.06 min of PA per student. In the third quarter, 884 students participated for a mean 229.44 min of PA per student. The fourth quarter had 880 students participating for a mean of 240.28 min of PA per student. There was an increase in PA from baseline to the end of the fourth quarter of 79.58%.

CONCLUSIONS: Infusing structured PA into the school day ensured that the students received more than the 150 min state requirement for PA. The students also demonstrated a progressive increase in the amount of PA they were performing outside of the school day during the eight month program.

Relationships Among Participation In A Worksite Wellness Program, Leisure-time Physical Activity, And Aerobic Capacity

Samantha J. Dunbert1, Jeremy L. Knous2, Jordan J. Schluff1, James M. Pivarnik, FACSM2, 1Saginaw Valley State University, Saginaw, MI. 2Michigan State University, East Lansing, MI.  

(No relationships reported)

Studies have found worksite wellness programs to improve biometrics and employee behaviors, however their effect on aerobic capacity (VO2max) and leisure-time physical activity (LTPA) levels is not well established.

PURPOSE: Our purposes were to 1) describe active University worksite wellness participants and 2) determine the relationships between time spent in a worksite wellness program, LTPA levels, and fitness.

METHODS: Participants included faculty/staff enrolled in a worksite wellness program ranging from 1 to 72 months (n=68). Each received a fitness assessment (anthropometry, body composition, aerobic capacity, muscular strength, muscular endurance, and flexibility). In addition, participants' self-reported LTPA was assessed via the Global Physical Activity Questionnaire (MET.min/wk). Descriptive statistics were calculated using means and standard deviations. The sample was split into three groups based on time spent in the program (1-20, 21-36, >36 months). Relationships between time spent in the wellness program and 1) LTPA levels and 2) fitness measures were assessed via a one-way ANOVA.

RESULTS: Mean (±SD) age was 43.6 ± 10.3 years and 66% of participants were female. Participants reported engaging in strength and flexibility training an average of 2.2 ± 1.9 and 2.2 ± 2.0 times per week, respectively. Mean (±SD) BMI was 25.9 ± 5.1 kg/m2, % fat was 28.9 ± 8.1, VO2max averaged 34.7 ± 8.2 ml/kg/min, and MET.min/wk was 2103 ± 1769. VO2max of participants enrolled for 21-36 months was significantly lower (30.8 ml/kg/min; p ≤ 0.05) than those enrolled for 1-20 months (36.0 ml/kg/min) and >36 months (36.9 ml/kg/min). No significant differences were found in BMI, %fat, muscular strength, muscular endurance, flexibility, or MET.min/wk.

CONCLUSIONS: Knowing health and fitness characteristics of active worksite wellness participants may help to create effective programming to improve participation and fitness measures. Our results suggest that length of time spent in a worksite wellness program is not related to LTPA levels, but may have a relationship with aerobic capacity. Longitudinal data collected at consistent time points might help explain the observed differences in aerobic capacity.
RESULTS: There were 101 CHC participants (50 female, 51 male, mean education 12.1± 2.5yr, mean age 53.9 ± 8.1yr) and 100 FC participants (50 female, 50 male, mean education 16.3± 2.6yr, mean age 55.5 ± 16.8yr). Multiple comparisons (means±SD) showed that FC female participants performed significantly better on each PF measure compared to female CHC: UBE (CHC=17.6±6.2, FC=20.1±5.6, p<0.001); LBE (CHC=9.4±4.3, FC=11.2±5.2, p<0.05); AE (CHC=40.9±17.7, FC=69.2 ± 95.6, p<0.001); LBE (CHC=11.6±4.5, FC=17.3±4.4, p<0.001); AE (CHC=48.7±19.1, FC=69.8±89.2, p<0.001); UBF (CHC=9.9±6.9, FC=2.8±5.6, p<0.001); and %BF (CHC=29.3±10.0, FC=24.0±8.0, p=0.05).

CONCLUSIONS: FC adults were more physically fit than CHC adults. Results support the need for access to fitness centers and professionals in disadvantaged populations in order to more completely address health disparities.

2118 Board #164 May 31 9:00 AM - 10:30 AM Engaging and Enabling Rural Communities in Chronic Disease Prevention: The HealthSteps Program Lyndsay Foisey1, Sheila Cook1, Brittany Inzandi2, Melanie Stuckey2, Robert Petrella, FACSM2, 1Lawson Health Research Institute, London, ON, Canada. 2The University of Waterloo, Waterloo, ON, Canada. The University of Western Ontario, London, ON, Canada. (No relationships reported)

Heart disease and type II diabetes are on the rise, and more than half of Canadian adults are classified as overweight or obese. Rural communities have a higher prevalence of heart disease and diabetes while they face additional barriers to performing regular exercise compared to their urban counterparts. Our previous research has demonstrated that tailored exercise prescription in the family health team setting is feasible and effective, as at-risk patients improved cardiovascular fitness, reduced waist circumference, normalized blood pressure and increased energy expenditure.

PURPOSE: To implement a post-research study program to engage and enable rural communities in sustainable lifestyle change for individuals at-risk of developing type II diabetes.

METHODS: The HealthSteps program is the knowledge translation phase following a 12-month randomized controlled trial to determine the efficacy of a prescriptive exercise intervention in patients with cardiovascular risk factors of type II diabetes (ARTEMIS). The HealthSteps program consists of group lifestyle prescription sessions led by healthcare professionals in the family health team (FHT) setting. Program components include a comprehensive, community-sensitive program of training and support for healthy lifestyle change delivered by the family health team.

RESULTS: Conceptualization and then construction of the program was informed by knowledge brokering stakeholders and users in focus group sessions. The HealthSteps pilot program was launched in September 2011 in a rural Southwestern Ontario FHT comprised of 8 physicians and 10 healthcare professionals serving a population of 59,325. Analysis revealed that participants found the program suitable to their needs to continue a healthy lifestyle and 100% would continue the program and recommend it to others. In addition, participants noted that the support of a health team was essential to their continuing motivation for a healthy lifestyle.

CONCLUSIONS: The HealthSteps program is the knowledge to action outcome of an evidence-based research program that has demonstrated feasibility and utility in the FHT setting. Next steps will include implementation in a range of rural and urban community family health teams to demonstrate generalizability and fidelity of the program.

2119 Board #165 May 31 9:00 AM - 10:30 AM Atherosclerotic Cardiovascular Risk and Aerobic Fitness in Paralympic Athletes with Locomotor Impairments Marco Bernardi1, Paolo Emilio Adams1, Silvia Carucci2, Emanuele Guerra1, Antonio Spataro2, Carlo Tranquilli3, Alessandro Biffi4, Antonio Pelliccia1. 1School of Specialization in Sports Medicine, Sapienza University of Rome; 2Italian Paralympic Committee, Rome, Italy. 3School of Specialization in Sports Medicine, Sapienza University of Rome, Rome, Italy. 4Institute of Sports Medicine and Science of the Italian Olympic Committee, Rome, Italy. (No relationships reported)

Atherosclerotic cardiovascular disease (ACVD) represents a leading cause of morbidity and mortality in locomotor impaired (LI) individuals. A sedentary habit has been established as main risk factor (RF) in this population.

PURPOSE: We evaluated the hypotheses that (1) in LI athletes (LIA) aerobic fitness (oxygen uptake peak - VO2peak) was inversely related to ACVD RF and (2) the prevalence for each RF was higher in LIA with spinal cord injury (SCI) than in LIA with other locomotor impairments.

METHODS: A total of 70 male LIA, who competed in the last two summer and winter Paralympic Games (36 with SCI, 18 lower limb amputees, 3 with cerebral palsy, 5 with poliomyelitis and 8 with other locomotor disorders) were screened through anthropometric and blood pressure (BP) measurements, laboratory blood tests and graded maximal arm cranking exercise tests, to estimate both an ACVD RF score and VO2peak. The ACVD risk score was assessed summing 1 point for each of the following RF, potentially modifiable by fitness and evaluated in accordance with the ACSM recommendations: obesity, hypertension, dyslipidemia, impaired fasting glucose and subtracting 1 point when serum HDL cholesterol was higher than 60 mg·dl-1.

RESULTS: Prevalence of hypertension, obesity, total cholesterol, LDL cholesterol, HDL cholesterol and impaired fasting glucose were equal to 13.9% and 17.6%, 13.9% and 5.9%, 47.2% and 32.3%, 30.6% and 23.5%, respectively in LIA with SCI and LIA with other impairments. Based on the number of ACVD RF, 4 groups were formed: group 1 (RF=0, N=26), group 2 (RF=1, N=25), group 3 (RF=2, N=9), group 4 (RF=3, N=10). VO2peak values were equal to 36±8 ml·kg-1·min-1, 32±8 ml·kg-1·min-1, 27±5.5 ml·kg-1·min-1, 18±4.3 ml·kg-1·min-1 in group 1, group 2, group 3 and group 4, respectively.

CONCLUSIONS: ACVD risk was higher in LIA with SCI than in other LIA. VO2peak is inversely associated with ACDFR. High aerobic fitness, which has been demonstrated correlated with energy expenditure of some continuous and intermittent sports, provides a protective effect on the ACVD risk. Funding from Italian Paralympic Committee and Sapienza, University of Rome.

2120 Board #166 May 31 9:00 AM - 10:30 AM Objectively Measured Physical Activity And Health-related Quality Of Life: The Hong Kong Family Project Paul H. Lee1, Hairong Nan1, Brandford H. Y. Chun1, Ian McDowell2, Gabriel M. Leung1, Tai Hing Lam1. 1University of Hong Kong, Hong Kong, Hong Kong. 2University of Ottawa, Ottawa, ON, Canada. (No relationships reported)

The association between physical activity (PA) and health-related quality of life / well-being has been well established. However, most previous studies used self-reported questionnaire data with uncertain validity. Accelerometers offer an objective measurement of motion, and are becoming popular in PA monitoring, but the relationship between accelerometer-measured PA and health-related quality of life is unclear.

PURPOSE: To examine the relationship between PA, measured objectively both by time spent and by number of steps, and health-related quality of life, measured by the physical component subscale (PCS) and mental component subscale (MCS) of the Medical Outcome Study Short Form - 12 (SF-12) in Hong Kong.

METHODS: In the Hong Kong Jockey Club FAMILY Project Cohort Study household survey, 2,138 adults (aged 44.5 ±SD 17.6 years, 46.3% male) wore an ActiGraph accelerometer for four days and completed the SF-12 at baseline (March - October 2009). In the follow-up surveys, the SF-12 questionnaire was repeated 3, 9 and 15 months later.

RESULTS: The follow-up rates were 64% at 3 months, 75% at 9 months, and 68% at 15 months. Of all the participants, 40.9% had at least 150 minutes of moderate-to-vigorous physical activity (MVPA) in the four-day observation period, and 48.9% accumulated ≥3,000 steps per day. Adjusting for age, sex, income, education, marital status, smoking and drinking habits, multilevel regression for repeated measure showed that participants who had at least 150 minutes of MVPA per week over the 4-day had a higher PCS (difference = 0.71, Cohen’s d effect size = 0.10, p < 0.05) than those who did not, but there was no difference in MCS (p > 0.05). Participants who walked at least 8,000 steps per day had a higher PCS (difference = 0.80, Cohen’s d effect size = 0.12, p < 0.01) than those did not, but there was no difference in MCS (p > 0.05).

CONCLUSIONS: Both MVPA and number of steps were associated with physical ability but not with mental aspects of health-related quality of life. Supported by the Hong Kong Jockey Club Charities Trust.
Colorectal cancer is the third most commonly diagnosed cancer in the United States and also in Korea. Although the effects of physical activity on prevention and prognosis of colorectal cancer have been reported previously, the amount of physical activity participation and barrier factors affecting physical activity in colorectal cancer patients, have not been fully elucidated.

**PURPOSE:** This study was to examine the level of physical activity participation, barrier factors affecting physical activity participating and attitude toward exercise in colorectal cancer patients in Korea.

**METHODS:** A total of 431 patients (male:271, female:160, aged:59.69 ±10.86), diagnosed with colorectal cancer, were recruited for this study. Data collection is accomplished through a structured interview.

**RESULTS:** The level of physical activity participation increased significantly after patients were diagnosed with colorectal cancer. The subjects showed higher level of physical activity participation of cancer treatment compared to the level of physical activity participation during cancer treatment (p<0.05). 68.8% of patients believed that the exercise is beneficial for the prevention of cancer recurrence and 66.5% of patients were willing to participate in some kind of physical activity programs. However, only 34.9% of patients participated in more than 18 MET-hours per week of physical activity, which is known to have beneficial effects in the prevention of colorectal cancer recurrence. The major barriers in participating in physical activity experienced by colorectal cancer patients were fatigue, lack of fitness and not feeling well.

**CONCLUSIONS:** Interestingly, the colorectal cancer patients participate more physical activity after the cancer diagnosis with expectation that the exercise is helpful for them. Although most of colon cancer patients had an positive attitude toward physical activity and exercise, only one third of them participated in enough physical activity known to prevent cancer recurrence. Therefore, a strategy to increase the physical activity for colorectal cancer patients is required.

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**Board #168** May 31 9:00 AM - 10:30 AM

**Free Choice Access to Wellness Education and Services Positively Impact Employee Wellness**


(G.A. Sforzo: Contracted Research - Including Principle Investigator; Plus One Health Management.)

The effects of wellness and exercise programming are usually studied in subjects agreeing to a minimal level of participation. This research removes a normal degree of free choice from these studies. In the present study we recruited subjects to partake in wellness programming but did not dictate a minimum level of involvement but instead simply made healthful services available to them. The most prominent services provided were wellness education and healthy cafeteria meals. The obligated participants had to complete all outcome measures.

**PURPOSE:** Examine effects of voluntary participation in employer-sponsored, multi-point wellness education programming on employee wellness.

**METHODS:** A randomized and controlled design was used to organize 96 participants into three groups: education-access; access-only; and control. Those receiving education were offered health promoting: email messages three times weekly; lectures once per week; and web portal entry. Those receiving access were offered use of a corporate fitness facility and discounted healthy cafeteria meals. Outcome measures included biometrics, fitness, psychological, and health knowledge variables and were made at start and end of a 12-week intervention period.

**RESULTS:** Education-access improved wellness knowledge (pre: +50; 14 post: +59; 14; p<.05) which led to improvements in life satisfaction (r = .27; p < .05), employee morale (r = .29; p < .05), energy (r = .25; p < .05), and nearly in stress level (r = .24; p < .06). Those who received facility access without educational programming did not reap health benefits. Employees voluntarily used the fitness facility and healthy meal cards only 1.3 and 1.5 times/week, respectively.

**CONCLUSIONS:** Participants made limited and likely inadequate use of wellness opportunities when given access but free choice. As a result, physical health benefits (e.g., fitness parameters, blood pressure) were not seen. It is evident that motivation to participate, and determining obstacles that limit participation, is of great concern for employee wellness programs. However, wellness education, delivered in a multi-point fashion was effective and resulted in psychosocial health benefits in just 12 weeks.

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**Board #169** May 31 9:00 AM - 10:30 AM

**Reaching Targeted Participants In An Urban Ciclovia: The Case Of Sunday Streets San Francisco**

Susan G. Zieff, Mi-Sook Kim, San Francisco State University, San Francisco, CA. (Sponsor: Marialice Kern, FACSM)

(No relationships reported)

Community-based events that use public spaces such as city streets for physical recreation have the potential to influence population-wide health behavior. The rotating routes used for an urban, monthly “street opening” event, Sunday Streets SF (SS), purposely include neighborhoods that lack recreational resources.

**PURPOSE:** Previous studies showed that convenient access to physical activity (PA) influences participation of residents living on or near SS routes. The purpose of this study first examined the extent to which SS attracts participants who reside in neighborhoods that are underserved for PA resources but are outside of route boundaries. Second, the study explored these participants’ experiences while at SS.

**METHODS:** A total of 626 participants (mean age: 39.51 years, SD=10.8) from three SS events were recruited to complete a 24-item survey in 2010. The participants reported demographic information, their residential zipcodes, reasons to attend and return to the event, and their experience while attending SS. Using residential zipcodes of participants, the target group for the present study was selected from a list of zipcodes identifying neighborhoods lacking recreational facilities using a park assessment report, city government website zipcode data, and a city Planning Department map.

**RESULTS:** A total of 17.3% of participants were classified as the targeted group (n=108). The participants traveled an average of 7.3 miles (SD=5.9 miles) to attend SS and 67% reported attending multiple SS events. Biking (20.4%) and walking (19.4%) were the most commonly reported activities and participants indicated an average of 57 minutes engaged in PA of their total average time of 168 minutes at the event. The most important reasons to attend and return were for the safe environment and the opportunity for outdoor PA. Printed advertisements (billboards and buses) (22.2%) and word of mouth (22.2 %) were the most common ways that participants learned of the event.

**CONCLUSIONS:** Public streets offer a unique and effective strategy for increasing PA among underserved populations. This study suggests that community events successfully attract a substantial group of participants from distant neighborhoods with low-access to recreational opportunities thereby reducing the need for separate events in each location.

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**Board #170** May 31 9:00 AM - 10:30 AM

**Exercise Is Medicine On Campus: Participation Rates In A University Employee Wellness Program**

Jeremy L. Knous, Joshua Odc. Saginaw Valley State University, Saginaw, MI.

(No relationships reported)

Exercise is Medicine on Campus (EIMC) is a national initiative aimed at improving physical activity (PA) and health on college campuses. One way to promote EIMC is through the development of a university employee wellness program, which can potentially lead to individual improvements in health and fitness. Employee wellness programs may offer a variety of structured opportunities for participants to improve health. In order to maximize participation it is important to evaluate participation within all components of the wellness program.

**PURPOSE:** Therefore, the purpose of this study was to assess participation rates of university employees in each component of a university worksite wellness program. Participation was tracked for the following components of the wellness program: 1) logging of exercise, 2) strength training, 3) annual physical exams, 4) lunch and learns, and 5) fitness testing. Maximal monthly participation and mean yearly participation rates, along with percentage of each as a function of active program participants and total eligible participants, are reported for the various components of the wellness program.
CONCLUSIONS: Over a three year period, participation in the university wellness program has slowly increased from 40% to 49% of the eligible participants. The average number of participants using the exercise log to record physical activity has increased from 43% of active and 18% of eligible participants in year 1 to 54% and 22% in year 3, respectively. Participation in lunch and learns has remained steady over the 3 year period at 18% of active and 7% of eligible employees. Only 9% of the active participants participated in fitness testing this past year.

CONCLUSIONS: While university wellness program participation has increased over the past 3 years, less than half of the eligible participants are taking advantage of the opportunity. Of the various components offered through the program, tracking of exercise using the exercise log is the most often utilized (54%) by active participants. These finding highlight a need for greater EIMC promotion and increased employee participation in an already established university wellness program.
The prevalence of Diabetes Mellitus (DM) in African-Americans (AA) is higher than Caucasians. The Lifestyle Intervention for Veterans (LIVe) Program was developed to provide intensive diabetes management through lifestyle interventions as an adjunct to traditional medication therapy.

**PURPOSE:** To assess metabolic and cardiovascular changes following a 12-week supervised exercise and dietary intervention in AA diabetic veterans.

**METHODS:** Individuals from our Primary Care and Diabetes clinics were referred to the program. Baseline exercise capacity was assessed by a peak exercise test. Blood chemistries, blood pressure and exercise parameters were recorded at baseline and after 12 weeks of individualized dietary counseling provided by a registered dietitian and a supervised cardiovascular and resistance exercise training. Exercise intensity was maintained at 50% to 80% of heart rate reserve. In addition to the supervised, participants were instructed to supplement their exercise by daily brisk walks aiming to accumulate at least 150 minutes of exercise per week.

**RESULTS:** The average weekly time spent in supervised exercise sessions was 72 minutes. There were significant improvements noted in exercise capacity (8.5±1.8 to 10.1±2.1 METs), body weight, and waist circumference, cardiovascular and metabolic parameters (Table).

**CONCLUSIONS:** Supervised exercise program and dietary interventions were effective in improving cardiovascular and metabolic parameters in AA with Type 2 DM.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>BASELINE</th>
<th>POST-EXERCISE</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt (lbs)</td>
<td>230±64</td>
<td>224±39</td>
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</tr>
<tr>
<td>Waist (inches)</td>
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<td>44.2±5</td>
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<tr>
<td>Rest SBP (mm Hg)</td>
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<td>120±14</td>
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<tr>
<td>Rest DBP (mm Hg)</td>
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<td>68±8</td>
<td>0.08</td>
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<tr>
<td>HR @ 3 min (bpm)</td>
<td>107±13</td>
<td>104±14</td>
<td>0.02</td>
</tr>
<tr>
<td>SBP @ 3 min (mm Hg)</td>
<td>158±20</td>
<td>147±20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DBP @ 3 min (mm Hg)</td>
<td>94±17</td>
<td>93±10</td>
<td>0.02</td>
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<tr>
<td>Peak HR (bpm)</td>
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<td>Peak SBP (mm Hg)</td>
<td>187±25</td>
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</tr>
<tr>
<td>Peak DBP (mm Hg)</td>
<td>84±14</td>
<td>77±11</td>
<td>0.003</td>
</tr>
</tbody>
</table>

When studying the associations between physical (in)activity and health outcomes we are faced with two specific issues: genetic selection may explain some of the associations in observational follow-up studies, and RCTs that investigate the effects of exercise on health outcomes are usually of a too short duration to document the long-term effects on health.

**PURPOSE:** To tackle these limitations, we have investigated 7 monozygotic (MZ) and 9 dinyzotic (DZ) twin pairs (50.74 yrs), discordant for leisure-time physical activity habits during their adult life, to document the specific effects of long-term physical activity on fitness and obesity status while controlling for genes and childhood family environment.

**METHODS:** Twin pairs were comprehensively identified from the Finnish Twin Cohort. Discordance was initially defined in 1975 and the same co-twin remained more active during the 32-year long follow-up. Symptom-limited maximal clinical exercise test with cycle ergometer was performed for the assessment of cardiorespiratory fitness. Maximal isometric left knee extensor force was measured using an adjustable dynamometer chair. Body composition was measured using bioimpedance technique (InBody 720) after a 10-h fast. T1-weighted midthigh intramuscular fat area was measured using MRI axial scans acquired from the abdomen and mid thigh with 1.5T GE-Signa Exite HD CVI.

**RESULTS:** Estimated peak oxygen uptake was 6.1 ml/kg/min lower (p<0.001) in inactive compared to the active co-twins, the difference being 4.8 ml/kg/min between inactive and active MZ co-twins. Compared to their inactive co-twins, maximal knee extension force was 20% higher among the active twins (p=0.006) and 26% higher among the active MZ twins. The fat percent was lower among all active (21.5 vs 27.0 kg/m², p=0.004) and active MZ twins (22.9 vs 27.9 kg/m², p=0.10). The area of visceral fat at the level of L4-L5+5cm was 1.5 times greater among the inactive twins (p=0.01) and 1.3 times greater among the inactive MZ twins (p=0.18). Midthigh intramuscular fat area was 1.5 times greater among the inactive twins (p=0.002), being also 1.5 times greater among the inactive MZ twins (p=0.028). The prevalence of Diabetes Mellitus (DM) in African-Americans (AA) is higher than Caucasians. The Lifestyle Intervention for Veterans (LIVe) Program was developed to provide intensive diabetes management through lifestyle interventions as an adjunct to traditional medication therapy.

**PURPOSE:** To assess metabolic and cardiovascular changes following a 12-week supervised exercise and dietary intervention in AA diabetic veterans.

**METHODS:** Individuals from our Primary Care and Diabetes clinics were referred to the program. Baseline exercise capacity was assessed by a peak exercise test. Blood chemistries, blood pressure and exercise parameters were recorded at baseline and after 12 weeks of individualized dietary counseling provided by a registered dietitian and a supervised cardiovascular and resistance exercise training. Exercise intensity was maintained at 50% to 80% of heart rate reserve. In addition to the supervised, participants were instructed to supplement their exercise by daily brisk walks aiming to accumulate at least 150 minutes of exercise per week.

**RESULTS:** The average weekly time spent in supervised exercise sessions was 72 minutes. There were significant improvements noted in exercise capacity (8.5±1.8 to 10.1±2.1 METs), body weight, and waist circumference, cardiovascular and metabolic parameters (Table).

**CONCLUSIONS:** Supervised exercise program and dietary interventions were effective in improving cardiovascular and metabolic parameters in AA with Type 2 DM.
cumulative dose needed to meet ACSM vigorous activity guidelines (i.e., 75 min/wk, ≥60%HR, HRPA = 675) was associated with a 1.3% decrease in percent body fat, a 4.0 b.min-1 decrease in resting HR, and a 2 cm decrease in waist and hip circumferences independent of age, gender and race.

CONCLUSIONS: Cumulative aerobic exercise dose is associated with improved physiological outcomes including measures of body composition, resting HR, and estimated fitness.

2131 Board #177 May 31 9:00 AM - 10:30 AM
Aerobic Exercise Training Improves Heart Rate Recovery Activity In Sedentary African Americans With Abnormal Diastolic Function
Jan Kretzschmar1, Deborah Crabble1, Deborah Fearinheller2, Kathleen Sturgeon1, Keith Diaz1, Sheara Williamson1, Praveen Veerabhadrap1, Chenyi Ling1, Amanda Polet1, Kassandra McGloin1, Olivia Menardy1, Michael Brown, FACSM1, 1Temple University, Philadelphia, PA. 2University of California Los Angeles, Los Angeles, CA.

Purposes: African Americans are at risk population for diastolic heart failure (DHF). Increased Sympathetic Nervous System Activity (SNSs) is strongly associated with DHF. Abnormal diastolic function (ADF) is a precursor to DHF and manifests itself early in the disease process without any other apparent signs or symptoms. Like DHF, ADF is often accompanied by increased SNSs. Heart Rate Recovery (HRR) obtained from a graded exercise test is thought to be an indicator of SNSs. Aerobic exercise training has been shown to decrease SNSs and improve HRR; therefore, presenting a potential tool for early intervention for people with ADF. Thus, the purpose of this preliminary study was to investigate the effects of aerobic exercise training on HRR in African Americans with abnormal diastolic function.

Methods: AA subjects (n=9) ages 45-62, who were sedentary, non-diabetic, non-smoking, and had abnormal diastolic function, but were free of cardiovascular disease, underwent 6 months of aerobic exercise training (3days/week, 65% of VO2max, 40 minutes/day). E’ was measured by Doppler ultrasound during an echocardiographic stress test, and abnormal diastolic function was defined as having an E’ value less than 10 cm/sec. HRR (maximum heart rate obtained during the test minus 4 min heart rate of passive recovery) determined from a sub-maximal graded exercise test was used as a surrogate measure for SNS activity.

Results: HRR significantly (p<0.001) improved (60.22±3.58 bpm vs. 70.22±2.55 bpm) with 6 months of aerobic exercise training. However, aerobic fitness measured via VO2max did not (p=0.176) change (28.07±2.76 m/kg/min vs. 30.57±2.94 m/kg/min).

Conclusions: Although no improvements in aerobic fitness were observed, likely due to the small sample size, a significant improvement in HRR was seen, which might indicate an improvement in SNSs. Therefore, among individuals at risk for the development of DHF, aerobic training may be a useful tool at altering one associated abnormality associated with its progression, increased SNS activity.

2132 Board #178 May 31 9:00 AM - 10:30 AM
Aerobic Gait Training in Older Adults With Mild Cognitive Impairment and Hypertension: Preliminary Results.
Noah Kobliinsky1, Joseph DeCari1, Manuel Montero-Odasso2, Robert Petrella, FACSM1, 1University of Western Ontario, London, ON, Canada. 2Lawson Health Research Institute, London, ON, Canada. 3Parkwood Hospital, London, ON, Canada.

Purposes: To determine the effect of aerobic exercise combined with step length feedback on blood pressure (BP), executive function (EF), and gait in hypertensive older adults with signs of mild cognitive impairment (MCI) and hypertension.

Methods: Eleven community dwelling older adults (72.5±6.3 years) with hypertension and objective signs of MCI completed 12 weeks of an aerobic gait-training intervention. The participants exercised at a moderate to vigorous intensity for 30 minutes, 3 times a week on a treadmill that provided real time visual feedback about their step length. BP was measured over 24 hours by ambulatory monitoring and EF was measured using the Trail Making Test (TMT) and the Digit Symbol Substitution Test (DSST). An electronic walkway measured gait under single and dual task conditions. Paired t-tests were used to detect changes between baseline and 12 weeks.

Results: Baseline 24-hour mean systolic and diastolic BP was 125.7±12.31 and 74.27±8.63 mmHg respectively. Mean baseline TMTa time was 39.57±18.92 seconds and mean DSST score was 52.91±11.20 items. Baseline single and dual task (naming animals) step length was 65.04±8.21 cm, and 61.30±11.32 cm respectively, while baseline single and dual task (serial 7’s) gait velocity averaged 121.22±17.25 cm and 85.05±34.98 cm respectively. Following the intervention, 24-hour mean systolic and diastolic BP decreased by [mean difference (95%CI)] 1.09 (1.95; -4.13) mmHg (p=0.443) and 2.18 (-0.43; -3.93) mmHg (p=0.019). Mean TMTa scores improved by 4.55 (1.04; 8.06) seconds (p=0.016) while improvements in DSST scores were not significant (p=0.120). Dual task step length increased by 3.74 (1.47; 6.01) cm (p=0.004) and dual task velocity increased by 9.85 (0.12; 19.59) cm/s (p=0.048).

Conclusions: Our 12-week aerobic gait training intervention was feasible in our sample and the significant improvements observed warrant a larger trial to evaluate the impact of this intervention in at risk older adults. Supported by the St. Joseph’s healthcare foundation

2133 Board #179 May 31 9:00 AM - 10:30 AM
The POTS Registry: Treatment of Patients with the Postural Orthostatic Tachycardia Syndrome with Exercise Training
Tiffany B. Bivens1, M. Melyn Galbreath2, Dianne Hendrickson1, Cheryl Livingston1, Qi Fu3, Benjamin D. Levine, FACSM2, 1Institute for Exercise and Environmental Medicine, Dallas, TX. 2University of Texas Southwestern Medical Center, Dallas, TX.

The Postural Orthostatic Tachycardia Syndrome (POTS) is characterized by chronic orthostatic intolerance resulting in upright tachycardia (≥120 bpm or >30 bpm over supine heart rate) (HR) at 10-min standing, with lightheadedness, fatigue, and reduced quality of life. Our prior research has shown that “cardiovascular deconditioning” (i.e., cardiac atrophy and hypovolemia) is a significant underlying mechanism, and that an “optimized” 3 month exercise training program improved or even cured POTS (53% “cure” rate, i.e. they no longer meet heart rate criteria) as well as improved patient quality of life.

Purposes: To determine the effectiveness of this program in the community setting in POTS patients.

Methods: We established a World-wide POTS registry and enrolled 111 patients from five countries [12 M, 99 F, 26 ± 11 (mean ± SD) years old]. Before and after use of the program, a 10-min stand test was performed to obtain heart rate (HR) and blood pressure (BP), and patient quality of life was assessed using the Short-Form 36 Health Survey. The program begins with semi-recumbent exercise and progresses to upright modes while encouraging adherence in the face of likely increased fatigue in the first 4-6 weeks. Weight training focused on leg and core muscles. In addition, water and salt intake were increased.

Results: Forty patients completed the program to date. Fourteen patients dropped out (12.6% drop out rate). Thirty-six are still pending due to lack of follow up data, and twenty-one are still training. The HR response to 10-min standing was significantly reduced after training (AIR 40.9 ± 14.8 bpm pre vs. 21 ± 9.3 post, p<0.001). Mean BP was not different before and after training (Supine: 85.8 ± 9.3 mm Hg pre vs. 85.1 ± 16.3 post; at 10-min standing: 84.3 ± 8.8 vs. 89.1 ± 12.2, p=0.129 for interaction). Patients’ physical (27.3 ± 7.3 pre vs. 35.2 ± 6.5 post, p<0.001), mental (42.5 ± 9.6 vs. 46.5 ± 6.4, p=0.026), and social function (36.6 ± 5.9 vs. 44.7 ± 6.5, p<0.001) scores were significantly improved. Twenty-five out of forty patients were “cured” (63% “cure” rate).

Conclusions: These results suggest this unique training program is effective in the community setting, and thus, can be used as a non-drug treatment for POTS patients. However, it remains to be determined if maintaining exercise is an effective life-long treatment strategy.
2134  Board #180  May 31  9:00 AM - 10:30 AM

Hemodynamic, Cardiorespiratory, And Perceived Exertion Responses To Low-impact Exercise In Coronary Patients
Rogier L. Sacks, Barry Franklin, FACSM, Adam deJong, FACSM, Jenna Brinks, Brad Gila, Kirk Hendrickson, Lindsey Krajewski, Amy Fowler, Lisa Schomak, Judy Boura. William Beaumont Hospital, Royal Oak, MI. (No relationships reported)

PURPOSE: Exercise cardiac programs use varied forms of exercise equipment. For patients with orthopedic limitations, low or non-impact equipment, including the elliptical trainer (ET), is commonly recommended to minimize musculoskeletal discomfort. We compared hemodynamic cardiorespiratory and perceived exertion (RPE) responses to the ET and the Cybex Arc Trainer (AT) in clinically stable patients with coronary disease.

METHODS: Ten low risk cardiac men (mean ± SD age = 58 ± 11 years) satisfying inclusion criteria (functional capacity ≥ 7 metabolic equivalents [METs]) without evidence of impaired left ventricular function, signs/symptoms of myocardial ischemia or significant dysrhythmias) were monitored for heart rate (HR), blood pressure (BP), and oxygen consumption (VO2) responses at rest and during submaximal exercise bouts on the AT and traditional ET using legs-only at 50 and 70% heart rate reserve (HRR). Data were obtained for each piece of equipment on 2 non-consecutive days at the same time of day. Metabolic data were directly obtained using breath-by-breath measurements of VO2, adjusted for body weight (kg). RPE was assessed using the category Borg Scale (6-20), as was pain/discomfort using the 0-4 Scale.

RESULTS: Mean ± SD aerobic requirements at 50% HRR on the AT and ET were 17.8 ± 4.8 and 18.5 ± 5.1 ml/kg/min (NSD), respectively. Exercise BP responses at 50% HRR during AT and ET were 21.8 ± 6.5 and 21.8 ± 6.9 ml/kg/min (NSD), respectively. Exercise BP responses at 70% HRR on AT and ET were 178 ±22 and 173 ± 26 mmHg (NSD), respectively. RPE responses at 70% HRR on the AT and ET were 11 ± 1 and 12 ± 2 (NSD), respectively. At 50% HRR subjects reported no pain/discomfort on either device. Aerobic requirements at 70% HRR using the AT and ET were 21.8 ± 6.5 and 21.8 ± 6.9 ml/kg/min (NSD), respectively. Exercise BP responses at 70% HRR on AT and ET were 178 ±22 and 173 ± 26 mmHg (NSD), respectively. RPE responses at 70% HRR on the AT and ET were 13 ± 1 and 13 ± 1 (NSD), respectively. At 70% HRR, 3 subjects reported 1/4 (mild) leg pain on the AT whereas 2 subjects reported comparable discomfort on the ET.

CONCLUSIONS: Our findings suggest the AT is a viable alternative to the ET, with comparable hemodynamic, cardiorespiratory and perceived exertion responses at either 50 or 70% HRR.

2135  Board #181  May 31  9:00 AM - 10:30 AM

Exercise Training Increased SOD Activity in Liver of NASH Rats
Shen Ken Hung1, Chan Che-Chang3, Wei-Chih Huang1, Shioow-Chwen Tsai1, 2Taipei Physical Education College, Taipei, Taiwan. 2National Yang-Ming University, Taipei, Taiwan. (Sponsor: Chia-hua Kuo, FACSM) (No relationships reported)

PURPOSE: To investigate the interaction of exercise training and MCD diet on steatosis and oxidative stress in liver.

METHODS: In this study, 8-week-old male Sprague Dawley rats were randomly divided into 5 groups: control (fed normal diet, W0), MCD diet fed for 9 weeks or 14 weeks without (W9, W14) or with exercise training (W9+Ex, W14+Ex). The exercise training was treated for 4 weeks on a motorized treadmill before sacrifice. The blood were collected and analyzed for AST. The liver tissues were collected, extracted and assayed for the production of glutathione (GSH) and lipid peroxidation and the activities of superoxide dismutase (SOD), catalase, glutathione peroxidase (GPO), and glutathione reductase (GR) by using commercial kits. The hematoxylin-eosin staining was used to determine the degree of lobular inflammation and fibrosis in liver. The degree of fibromatosis and inflammation were evaluated by METAVIR score. The statistical analysis was done using the one-way ANOVA for independent samples, with significance level of 5%.

RESULTS: Rat fed with the MCD diet showed a rapid induction of AST and hepatic steatosis, loss of body weight and liver weight, but increased the ratio of liver to body weight. Compared with W14, the W14+Ex significantly decreased steatosis (p≤0.05) and fibrosis (p≤0.05). The production of lipid peroxidation in liver increased significantly in W14 (24.0±6.9 vs 0.40±0.05 nmol/mg/g protein, p≤0.05) but not in W14+Ex compared with W0 group. The activity of SOD in W14 and W14 +Ex were increased compared with W0. Feeding with MCD diet for 14 weeks significantly decreased the activities of catalase (p≤0.01), GPO (p≤0.05), and GR (p≤0.05). Exercise training did not alter MCD diet abolished activities of antioxidant enzymes.

CONCLUSIONS: Exercise training improves NAFLD through increased activity of SOD in liver.

2136  Board #182  May 31  9:00 AM - 10:30 AM

Lead, Exercise Training and Herbal Supplementation: Concomitant Neuroprotective Effects of Endurance Exercise Training and Curcumin
Valiollah Dabidi Roshan1, Mahdi Hossein Zadeh2, Somayeh Hosseinizadeh3, Jonathan Myers, FACSM. 1University of Mazandaran, Babolsar, Iran, Islamic Republic of. 2Center for Sensory-Motor Interaction (SMI), Aalborg University, Denmark, Aalborg, Denmark. 3University of Mazandaran, Babol, Iran, Islamic Republic of. (No relationships reported)

PURPOSE: To investigate neuroprotective effects of treadmill running (TR) and/or Curcuma Longa (CCML) on lead-induced neurotoxicity in the hippocampus and cortex of rats.

METHODS: 40 male rats were randomly divided into 5 groups: (1) lead acetate. (2) CCML. (3) TR. (4) TR+CCML. and (5) a sham-treated group. The rats in groups 1 to 4 received lead acetate (20 mg/kg). In addition, groups 3 and 4 underwent TR, 15 to 22 min for 25 to 64 minutes, 5 times a week for 8 weeks, while groups 2 and 4 received CCML (30 mg/kg) intraperitoneally. Rats in group 5 received CCML solution (ethyl oleate), only.

RESULTS: Chronic administration of lead increased lipid peroxidation as measured by malondialdehyde (MDA) in the plasma (72%), hippocampus (59%), and cortex (96%) in comparison to the sham group. In addition, lead decreased brain-derived neurotrophic factor (BDNF) in the hippocampus and cortex (17% and 10% respectively), nerve growth factor (NGF) levels in the cortex (39%), and total antioxidant capacity (TAC) levels in the hippocampus (27%), and the cortex (38%), as compared to the sham-treated group (P ≤ 0.05). Both training and supplementation treatment alone ameliorated the adverse effects of lead, however, the combination of them was more effective. Treadmill+CCML treatment resulted in a significant decrease in MDA levels in plasma and hippocampus (60 % and 22%, respectively). However, it increased BDNF in the plasma, hippocampus, and cortex (45%, 76% and 113%, respectively), NGF in the cortex (14%), and TAC levels in plasma (62%) in comparison to the lead only group.

CONCLUSIONS: These results provide a rationale for an inhibitory role of CCML and regular exercise in the attenuation of lead-induced neurotoxicity.

2137  Board #183  May 31  9:00 AM - 10:30 AM

Estimating Fitness Improvements After Phase II Cardiac Rehabilitation: Comparison of Three Methodologies
Susan S. Haapaniemi, Lindsey Krajewski, Amy L. Fowler, Barry A. Franklin, FACSM, Judith Boura, Brenda White. Beaumont Hospital, Royal Oak, MI. (No relationships reported)

A recent review of modulators of coronary patient outcomes suggests that each 1-metabolic equivalent (MET) increase in functional capacity (FC) appears to confer an 8% to 35% reduction in mortality. The Duke Activity Status Index (DASI) is a self-administered questionnaire that has been shown to accurately estimate FC, expressed as METs. Other widely used methods for estimating fitness improvements in phase II cardiac rehabilitation (PII CR) include the increase in training workload (Train WL) and the decrease in heart rate (HR) at a fixed workload, where a 10 bpm decrease ~1 MET.

PURPOSE: The present study compared the change (∆) in METs following PII CR using the DASI questionnaire with the ∆ in METs via the Train WL and HR at a fixed WL.

METHODS: Patients (157 men, 41 women) who completed ≥18 PII CR sessions were evaluated. A comparison of the improvement in METs (∆ METs) according to the 3 methodologies is shown in the table, with specific reference to gender and to patients on versus off beta-blocker (BB) therapy.
RESULTS: Meta-analyses may provide insights into the BP response to exercise but to date none have achieved contemporary quality standards. Our results offer some guidance as to whether new meta-analyses are needed to address particular problems and help readers of these meta-analyses to realize what constitutes a high-quality review.

CONCLUSIONS: Meta-analyses may provide insights into the BP response to exercise but to date none have achieved contemporary quality standards. Our results offer some guidance as to whether new meta-analyses are needed to address particular problems and help readers of these meta-analyses to realize what constitutes a high-quality review.

2138  Board #184  May 31  9:00 AM - 10:30 AM  Quality Coding Of Meta-analyses Of The Blood Pressure Response To Exercise: A Systematic Review
Blair T. Johnson1, Hayley V. MacDonald2, Michael L. Bruneau, Jr.3, TaShaua U. Goldsby2, Justin C. Brown3, Tania B. Huedo-Medina1, Linda S. Pescatello, FACSM4. 1University of Connecticut, Storrs, CT. 2University of Pennsylvania, Philadelphia, PA.  (No relationships reported)

PURPOSE: Many meta-analyses have been conducted to summarize the growing numbers of controlled trials addressing the blood pressure (BP) response to exercise. The methods involved in meta-analysis have improved across science, but it is not known to what extent meta-analyses on exercise and BP exhibit high quality among all of the steps required in conducting meta-analyses. This study addressed this gap.

METHODS: Meta-analyses were retrieved from electronic databases (PubMed, Biosis, Scopus, and Web of Science) with pre-established inclusion criteria: 1) applied meta-analytic procedures; 2) to controlled exercise trials; and 3) that had systolic BP (SBP) or diastolic (DBP) as endpoints. The AMSTAR questionnaire (Shea et al., 2007) and several customized items quantified the quality of the procedures in the meta-analyses. Across the 17 dimensions, two trained coders exhibited high reliability (mean agreement=87%; mean kappa=0.80).

RESULTS: The 22 meta-analyses that qualified for this review were published between 1993 and 2011 and reviewed widely varying exercise modalities and populations. Total methodological quality ranged from 13.33% to 76.47% of the total points possible (Mean 46.72±20.22%), with more recent meta-analyses scoring significantly higher, r(21)=0.59, p<.01, and with higher quality meta-analyses being more cited per year in the Web of Knowledge, in a non-significant trend, r(21)=0.30, p=.17. Nearly all meta-analyses (95%) satisfactorily followed a priori design, but they tended not to satisfy quality criteria related to literature search and duplicate effort (46%); coding of studies (44%); analysis and interpretation (56%); and 5) reporting potential conflicts of interest (41%). Criteria that were the least likely to be met satisfactorily were with regard to documenting the quality of studies included in the meta-analytic sample (8%) and interpretation of results relative to the quality of studies (5%).

CONCLUSIONS: Meta-analyses may provide insights into the BP response to exercise but to date none have achieved contemporary quality standards. Our results offer some guidance as to whether new meta-analyses are needed to address particular problems and help readers of these meta-analyses to realize what constitutes a high-quality review.

2139  Board #185  May 31  9:00 AM - 10:30 AM  Single Session of Exercise Ameliorates Differences in Insulin Resistance Between Active and Inactive Overweight Adults
Rachael K. Nelson, Jeffrey F. Horowitz, FACSM. University of Michigan, Ann Arbor, MI.  (No relationships reported)

Regular physical activity (PA) is an essential component of lifestyle programs targeting the prevention and/or treatment of obesity-related metabolic complications, such as insulin resistance. However, the contribution of habitually active lifestyle compared with the effects of the most recent session of exercise on improvements in insulin resistance remains unclear.

PURPOSE: To determine the influence of habitual PA level and a single session of exercise on insulin resistance in overweight-to-mildly obese adults.

METHODS: A total of 22 overweight-to-mildly obese men and women BMI: 27.34 kg/m2) were divided into 2 cohorts based on their self-reported PA. Five men and 7 women were classified as ACTIVE (>2.5h moderate-to-vigorous PA/week), while 5 men and 5 women were INACTIVE (<30m in PA/week). Participants reported to the laboratory the next morning for a second OGTT. After completing the OGTT, participants performed a single session of exercise for 1h at an intensity of ~70% of their age-predicted HRmax, and they returned to the laboratory the next morning for a second OGTT.

RESULTS: Despite similar body weight (89±3 vs. 91±3 kg) and %body fat (34±2 vs. 36±2%) in ACTIVE vs. INACTIVE, ISI tended to be greater in ACTIVE (measured 3 days after their last exercise session) compared with INACTIVE (4.0±0.6 vs. 2.5±0.3), but this difference did not reach statistical significance (P=0.09). A single session of exercise increased ISI the next morning in INACTIVE (P=0.03), but interestingly the exercise session did not increase ISI the next day in our ACTIVE participants (P=0.89). As a result, ISI was similar between ACTIVE and INACTIVE subjects in the morning after a single session of exercise (3.9±0.7 vs. 3.2±0.4; P=0.49).

CONCLUSIONS: A single session of moderate exercise was sufficient to increase ISI the next day in our INACTIVE participants, which ameliorated the difference in insulin resistance between habitually active and habitually inactive overweight adults.

2140  Board #186  May 31  9:00 AM - 10:30 AM  Effects of Accumulated Short and Very Short Bouts of Exercise on Cardiovascular Fitness: A Meta-Analysis
Joel D. Reece, Youngdeok Kim, Minsoo Kang, FACSM. Middle Tennessee State University, Murfreesboro, TN.  (No relationships reported)

The American College of Sports Medicine recommends 30 minutes of moderate exercise most days of the week, which can be accumulated in short bouts of as little as 10 minutes. A number of studies have also examined the effect of very short bouts of exercise (< 10 minutes), yet this effect is uncertain.

PURPOSE: To determine the effect of accumulated short and very short bouts of exercise on cardiovascular fitness and to examine the difference in effect size (ES) between accumulated short (10-15 minutes) and very short bouts (<10 minutes).

METHODS: Multiple online databases (i.e. Medline, Web of Science, EBSCO Host, Science Direct, Pubmed, Google Scholar, and Oregon PDF in Health and Performance) were used to identify applicable articles. Search terms included the following words: accumulate, exercise, physical activity, short bouts, intermittent, and health benefits. In addition, extensive cross-referencing from review and original articles were conducted. Only articles that were randomized, trained for at least 4 weeks (not sport specific), measured cardiovascular fitness, and included an experimental group with well-defined or well-estimated accumulated short or very short bouts of exercise (2-15 minutes) were included. Comprehensive Meta-Analysis software was used for the analysis.

RESULTS: A total of 51 articles were collected in the initial searches. After further review, 14 ES values from 12 articles and 5 ES values from 5 articles were calculated using a random effect model for accumulated short and very short bouts. Overall, accumulated bouts of exercise yielded a moderate ES of 0.43 (95% CI = 0.30, 0.57). No significant difference
was identified between accumulating short and very short bouts of exercise (Q = 0.41, df = 1, p = 0.52). Accumulating short (10-15 minutes) and very short bouts (<10 minutes) of exercise yielded moderate effects of 0.41 (0.25, 0.56) and 0.51 (0.24, 0.78), respectively.

CONCLUSIONS: The accumulation of short and very short bouts of moderate-to-vigorous exercise has a moderate and positive effect on cardiorespiratory fitness. In addition, evidence from this study suggests the effects of exercise accumulated in as short as 2-minute bouts are homogeneous to those accumulated in 10- to 15-minute bouts of exercise.
RESULTS:

Equipped thermometers were ingested to monitor core temperature and a dose of deuterium was administered to determine hydration kinetics via stable isotope dilution established. Public health guidelines generally advocate a relatively high-volume of moderate-intensity exercise, but a growing body of evidence suggests that low-volume, high-intensity training may be a time-efficient means to achieve health benefits. In the present study, we measured changes in health status markers after 10 wk of training using an established, efficacious high-intensity interval training protocol [4 x 4 min at 90% of maximal heart rate (HRmax) interspersed with 3 min active recovery at 70% HRmax; 4-BOUT], or a novel single bout protocol that requires a markedly lower time commitment (1 x 4 min at 90% HRmax; 1-BOUT)

METHODS: Twenty-six healthy, sedentary overweight men (BMI: 25-30; age: 35-45 y) were randomized to either 1-BOUT (n=13) or 4-BOUT (n=13).

RESULTS: After 10 wk of training, VO2max increased by 10% (~5.0 mL.kg-1.min-1) and 13% (~6.5 mL.kg-1.min-1) in 1-BOUT and 4-BOUT, respectively, with no group difference (P=0.22). Work economy also improved in both groups after training, as evidenced by lower oxygen cost during running at a sub-maximal work load (14% and 13%, respectively, in 1-BOUT and 4-BOUT, respectively, no group difference P=0.40). Systolic blood pressure decreased 7.7 and 6.1 mmHg in 1-BOUT and 4-BOUT respectively (no group difference P=0.74). Both groups had a decrease in fasting glucose (-6% and -5% in 1 and 4-BOUT respectively, no group difference P=0.30). 4-BOUT improved blood-profile to a larger extent than 1-BOUT, although without any group difference.

CONCLUSIONS: These preliminary data suggest that training using a relatively brief, single bout of vigorous exercise three times per week may be a time-efficient strategy to improve health in previously sedentary but otherwise healthy middle-aged individuals. Such brief bouts of exercise could be translated into public health policies and programs.

C-32 Free Communication/Poster - High Altitude/Hypoxia I

MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2144 Board #190 May 31 9:00 AM - 10:30 AM
Training using Single Versus Multiple Intermittent Bouts Of High-intensity Exercise Training Are Equally Effective For Increasing Maximal Oxygen Uptake


(Purpose not reported)

PURPOSE: Regular exercise training improves maximal aerobic capacity (VO2max) and reduces all-cause mortality risk, but the influence of intensity and volume remains to be clearly established. Public health guidelines generally advocate a relatively high-volume of moderate-intensity exercise, but a growing body of evidence suggests that low-volume, high-intensity training may be a time-efficient means to achieve health benefits. In the present study, we measured changes in health status markers after 10 wk of training using an established, efficacious high-intensity interval training protocol [4 x 4 min at 90% of maximal heart rate (HRmax) interspersed with 3 min active recovery at 70% HRmax; 4-BOUT], or a novel single bout protocol that requires a markedly lower time commitment (1 x 4 min at 90% HRmax; 1-BOUT)

METHODS: Twenty-six healthy, sedentary overweight men (BMI: 25-30; age: 35-45 y) were randomized to either 1-BOUT (n=13) or 4-BOUT (n=13).

RESULTS: After 10 wk of training, VO2max increased by 10% (~5.0 mL.kg-1.min-1) and 13% (~6.5 mL.kg-1.min-1) in 1-BOUT and 4-BOUT, respectively, with no group difference (P=0.22). Work economy also improved in both groups after training, as evidenced by lower oxygen cost during running at a sub-maximal work load (14% and 13%, respectively, in 1-BOUT and 4-BOUT, respectively, no group difference P=0.40). Systolic blood pressure decreased 7.7 and 6.1 mmHg in 1-BOUT and 4-BOUT respectively (no group difference P=0.74). Both groups had a decrease in fasting glucose (-6% and -5% in 1 and 4-BOUT respectively, no group difference P=0.30). 4-BOUT improved blood-profile to a larger extent than 1-BOUT, although without any group difference.

CONCLUSIONS: These preliminary data suggest that training using a relatively brief, single bout of vigorous exercise three times per week may be a time-efficient strategy to improve health in previously sedentary but otherwise healthy middle-aged individuals. Such brief bouts of exercise could be translated into public health policies and programs.

2145 Board #191 May 31 8:00 AM - 9:30 AM
Climbing Mount Rainier: Water Turnover and Core Temperature

Walter Hailes, John S. Cuddy, Dustin S. Slivka, Brent R. Ruby, FACSM. University of Montana, Missoula, MT. University of Nebraska at Omaha, Omaha, NE.

(No relationships reported)

PURPOSE: Hydration is an important logistical consideration for individuals performing in austere environments because water demands must be balanced with the burden of carrying the water. Therefore investigation into the water turnover of individuals climbing Mount Rainier can provide insight into the hydration demands of high altitude activity in cool to cold environments.

METHODS: Seven novice climbers participated in a study to determine the hydration kinetics and core temperatures associated with a successful summit of Mt Rainier. Ingestible, radio equipped thermometers were ingested to monitor core temperature and a dose of deuterium was administered to determine hydration kinetics via stable isotope dilution.

RESULTS: Mean core temperature was 37.6 ± 0.3°C, water turnover was 95.0 ± 17.5 mL*kg-1*h-1 and body mass was not different from pre (75.9 ± 13.0 kg) to post (74.8 ± 12.5 kg) climb (p=0.06), but urine specific gravity increased from pre (1.013 ± 0.002) to post (1.022 ± 0.006) climb (p=0.004).

CONCLUSIONS: Hydration demands of climbing Mt Rainier are highly elevated despite modest fluctuations in core temperature. Participants were able to maintain sufficient hydration with limited access to water over the course of the approximately 30 hour climb.

2146 Board #192 May 31 8:00 AM - 9:30 AM
OUES And VE/VCO2 Slope, At Sea Level And 3600 Meters, In Professional Soccer Player


(No relationships reported)

PURPOSE: In previous works [1, 2], we analyzed VE/VCO2 Slope and Oxygen Uptake Efficiency Slope OUES, during a soccer-specific test. In this paper we are comparing VE/VCO2 Slope and OUES, not native high; 43 at sea level in Guayaquil (GYE) and 10 from La Paz Bolivia (LPB) at 3600 m. All underwent maximum treadmill ramp (MXRT). Expired gas samples were taken with an automatic analyzer K4b2. All variables are representative of the total test time.

RESULTS: Mean core temperature was 37.6 ± 0.3°C, water turnover was 95.0 ± 17.5 mL*kg-1*h-1, body mass was not different from pre (75.9 ± 13.0 kg) to post (74.8 ± 12.5 kg) climb (p=0.06), but urine specific gravity increased from pre (1.013 ± 0.002) to post (1.022 ± 0.006) climb (p=0.004).

CONCLUSIONS: These preliminary data suggest that training using a relatively brief, single bout of vigorous exercise three times per week may be a time-efficient strategy to improve health in previously sedentary but otherwise healthy middle-aged individuals. Such brief bouts of exercise could be translated into public health policies and programs.

2147 Board #193 May 31 8:00 AM - 9:30 AM
Effects of Garlic Consumption on Exercise in Hypoxia

David Morris, Reid Beloni, Hannah Wheeler, Collier Scott. Appalachian State University, Boone, NC.

(No relationships reported)

Effects of Garlic Consumption on Exercise in Hypoxia

David M. Morris, Reid K. Beloni, Hannah Wheeler, & Scott R. Collier, FACSM

Appalachian State University, Boone, NC 28608

Hypoxia can induce pulmonary vasoconstriction (HPV) and ventilatory shunt. The reduced interface between alveoli and vasculature contributes to reductions in blood oxygenation and aerobic...
exercise performance. Reduction in HPV via pharmacological vasodilators reduces pulmonary hypertension and improves blood oxygenation and exercise performance. Garlic administration to rats has also been shown to reduce HPV.

PURPOSE: To investigate the effects of garlic supplementation on blood oxygen saturation and aerobic exercise performance during exercise in acute hypoxia.

METHODS: Ten male subjects (21 ± 3 yr, 70.7 ± 5.0 kg) completed an initial graded exercise test to exhaustion (GXE) on an electronically braked cycle ergometer under normoxic conditions (P₂O₂ ≥ 90 Torr) and acclimation to garlic (G) for 1 wk. After acclimation, subjects underwent three treatments using repeated measures ANOVA and Bonferroni post-hoc analyses.

RESULTS: For VO₂max, heart rate (HR), %BF, and VO₂ during exercise, garlic supplementation resulted in lower values than placebo (P < 0.05). Total oxygen consumption (VO₂total) and HR during recovery were also significantly lower in garlic compared to placebo (P < 0.05). In terms of cognitive function, there was a significant main effect of time (P < 0.01) and time by trial interaction (P > 0.05) for TMTA. For TMTB, there was a significant main effect of time (P < 0.01), but no time by trial interaction emerged (P > 0.05).

CONCLUSION: Garlic supplementation improved blood oxygen saturation, VO₂, %BF, and HR during exercise in acute hypoxia.

Supported by a Grant from the Gatorade Sport Science Institute.
360. Marie R. Grunbeck, Beth A. Beildeaman, Stephen R. Muza, FACSM, Sean P. Androw, Janet E. Staab, Charles S. Fulco. U. S. Army Research Institute of Environmental Medicine, Natick, MA. (No relationships reported)

Altitude exposure increases the concentration of reactive oxygen species (ROS) in the brain, which may impair cerebral vascular auto-regulation and result in reduced cerebral oxygenation. Whether minimizing ROS accumulation would benefit vascular function to improve oxygenation has not been determined.

HYPOTHESIS: N-acetyl-cysteine (NAC), a product that minimizes ROS accumulation, will increase cerebral blood flow (CBF) and cerebral oxygenation during exposure to 3500 m.

METHODS: Seventeen unacclimatized men and two women (mean ± SD; 22 ± 3 yr; 77 ± 12 kg; 176 ± 9 cm) were divided into two groups who were treated t.i.d. with either 800 mg of NAC (n=10, FDA-approved oral suspension) in 240 ml of diet soda or placebo (PLA, n=9, 240 ml of diet soda only) for 2 days prior to and during a 24 hr exposure to 3500 m. Near infrared spectroscopy estimated cerebral oxygenation and CBF via relative concentration changes in oxy-Hb ([OxyHb]) and total ([HbT]) hemoglobin, respectively, in the mornings at sea level (SL) and following 2 hr (ALT2) and 24 hr (ALT24) of altitude exposure. Delta values were calculated as the difference between breathing 100% O2 and 20.9% O2 (room air).

RESULTS: For both groups at ALT compared to SL, [OxyHb] was higher (P<0.05), indicating decreased cerebral oxygenation at ALT2 and ALT24 while [HbT] did not change at ALT2 but was lower (P<0.05) at ALT24, indicating an increase in cerebral blood flow. There were no differences (P>0.05) between PLA and NAC groups at ALT for either [OxyHb] at ALT2 (2.96 ± 0.6 vs 3.64 ± 0.5) and ALT24 (2.71 ± 0.4 vs 2.04 ± 0.4) or for [HbT] at ALT2 (-0.64 ± 0.4 vs 0.02 ± 0.4) and ALT24 (-0.84 ± 0.5 vs -1.46 ± 0.5).

CONCLUSION: Results suggest that administering NAC to reduce ROS accumulation does not alter CBF and cerebral oxygenation at 3500 m.

This does not reflect the views of the U.S. Army. Funding provided by the Defense Medical Research and Development Program (D10_1_AR_J5_419).

2152

Board #199 MAY 31 8:00 AM - 9:30 AM

Prediction of Susceptibility to Acute Mountain Sickness by Baseline Physiological Measurements Obtained at Sea Level

Justin P. Waxman, Erin N. Harper, Rose M. Ward, Mark S. Walsh, Miami University, Oxford, OH. (Sponsor: Helaine Alessio, FACSM) (No relationships reported)

High altitude illness describes several syndromes, ranging from mild to life threatening, which can occur in unacclimatized individuals shortly after ascending to altitudes of greater than 2500 meters. Acute Mountain Sickness (AMS) includes a constellation of symptoms and is the most common (and most mild) altitude related illness, affecting approximately 40-50% of individuals ascending from sea level to high altitude each year. While the cause of AMS is well established, just what causes some people to suffer from AMS but not others is still undefined. The only treatment for individuals suffering with symptoms of AMS is to let the individual spend more time acclimatizing or descend to lower elevation, however sometimes these options are not feasible. If susceptible individuals could be identified prior to ascending to high altitude, precautionary measures could be taken to reduce or eliminate the risk of developing AMS.

PURPOSE: The purpose of this study was to determine if one or more physiological variables measured at sea level could predict the occurrence of AMS at high altitude (5140 m).

METHODS: Twenty college students participating in a study abroad trip to the Himalayas volunteered for this study. Before leaving for Nepal, 15 sea level measurements were obtained for each participant (e.g., blood parameters, body composition, VO2max). On the trek, evaluation of AMS symptoms was obtained through the administration of the Lake Louise Questionnaire. Multiple regression analysis was used to determine whether any of the baseline values obtained predicted AMS.

RESULTS: A series of multiple linear regression analyses evaluated how well baseline physiological measurements predicted AMS scores at the highest elevation of the trek. Of the 15 physiological measurements, only Red Blood Cell (RBC; coefficient of .47) was significantly related to the AMS score in the sample was accounted for by RBC. The multiple correlation coefficient of .47, indicated approximately 17% of the variance of the AMS score in the sample was accounted for by RBC.

CONCLUSIONS: Results of this study suggest that a pre-trek evaluation of RBC count can help to identify a subpopulation at risk of developing AMS at high altitude. This laboratory measurement may prove to be a useful screening tool for a trek leader when creating a high-altitude protocol.

2153

Board #199 MAY 31 8:00 AM - 9:30 AM

Male Gendered and Lower Arterial Oxygen Saturation are Associated with Acute Mountain Sickness

Janet E. Staab1, Beth A. Beildeaman1, Charles S. Fulco1, Allen Cyerman1, Paul B. Rock2, Stephen R. Muza, FACSM1, 4U.S. Army Research Institute of Environmental Medicine, Natick, MA. 4University of Colorado, Colorado Springs, Colorado. 2Ohio State University, Tulsa, OK. (Sponsor: Helaine Alessio, FACSM) (No relationships reported)

Although the ultimate cause of acute mountain sickness (AMS) is thought to be hypoxia, arterial oxygen saturation (SaO2) has not been consistently related to AMS. The lack of a clear association may be due to measurements having been made under diverse altitudes, time points and experimental conditions (i.e., field environment with no control for hydration, medication usage, or acclimatization status).

PURPOSE: Assess the relationship of AMS to SaO2 and demographic data in a large sample collected under well-controlled experimental conditions at 4300 m.

METHODS: Seven prior USARIEM studies on the summit of Pikes Peak, CO (4300 m, P<0.05). Seven prior USARIEM studies on the summit of Pikes Peak, CO (4300 m, P<0.05).

RESULTS: For both groups at ALT compared to SL, [OxyHb] was higher (P<0.05), indicating decreased cerebral oxygenation at ALT2 and ALT24 while [HbT] did not change at ALT2 but was lower (P<0.05) at ALT24, indicating an increase in cerebral blood flow. There were no differences (P>0.05) between PLA and NAC groups at ALT for either [OxyHb] at ALT2 (2.96 ± 0.6 vs 3.64 ± 0.5) and ALT24 (2.71 ± 0.4 vs 2.04 ± 0.4) or for [HbT] at ALT2 (-0.64 ± 0.4 vs 0.02 ± 0.4) and ALT24 (-0.84 ± 0.5 vs -1.46 ± 0.5).

CONCLUSION: Results suggest that administering NAC to reduce ROS accumulation does not alter CBF and cerebral oxygenation at 3500 m.

This does not reflect the views of the U.S. Army. Funding provided by the Defense Medical Research and Development Program (D10_1_AR_J5_419).

2154

Board #200 MAY 31 8:00 AM - 9:30 AM

Acid-base Balance During Moderate Altitude Exposure Under Acid Or Alkaline Forming Nutrition

Petra Platen, FACSM, Mirjam Limmer, Bau-High Altitude Laboratory, Bochum, Bochum, Germany. (Sponsor: Helaine Alessio, FACSM) (No relationships reported)

PURPOSE: The present pilot study was conducted to examine the effects of moderate altitude exposure in combination with acid or alkaline forming nutrition on blood and urinary acid-base parameters.

METHODS: 12 healthy physical education students (n=10 males; n=2 females) were randomized into 2 groups according to the acid/alkaline load of their nutrition: the alkaline forming (ALK; n=6) and acid forming (ACID; n=6) group. 7 days of moderate hypobaric altitude exposure were obtained in the European Alps while living and hiking at an altitude level of 2434 m to 3772 m. During altitude exposure, ALK mainly consisted of naturally alkaline forming nutrients while ACID mainly consisted of naturally acid forming nutrients. Blood acid-base parameters (pH, oxygen saturation, bicarbonate, oxygen and carbon dioxide partial pressure, active/standard base excess and standard bicarbonate) were determined in capillary blood samples taken daily or every other day from the earlobe in the morning prior to breakfast. Furthermore, urinary pH values were determined daily in spontaneous early morning urine samples. All parameters were analyzed directly after sampling (blood acid-base-status: Radiometer system, urinary pH-values: pH-paper-sticks). Data were analyzed with repeated measures ANOVA.
RESULTS: We could not find any significant differences of the blood parameters in ALK and ACID. Urinary pH values, however, significantly declined over time in ACID (from 6.18 to 5.57) while it remained nearly constant in ALK (from 6.18 to 6.08).

CONCLUSIONS: The results indicate that nutritional acid/alkaline load influenced urinary acid excretion during moderate altitude exposure, while blood acid-base-balance remained more stable under these conditions. Further studies with longer or higher altitude exposure are needed to demonstrate chronic effects of nutritional manipulation on acid-base balance.

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2155  Board #201  MAY 31  8:00 AM - 9:30 AM  

Time-trial Performance Is Impaired To A Greater Degree In Hypobaric Versus Normobaric Hypoxia At The Same Ambient PO2

Beth A. Beidleman, Janet E. Staab, Charles S. Fulco, Allen Cymerman, Stephen R. Muza, FACSM. USAIRIEM, Natick, MA.  

(No relationships reported)  

Previous research has suggested differences in pulmonary ventilation, arterial oxygen saturation (SaO2) and heart rate (HR) in hypobaric hypoxia (HH) versus normobaric hypoxia (NH) at the same ambient PO2.

PURPOSE: To determine whether time-trial (TT) performance also differs between HH and NH at the same ambient PO2 (92 mmHg, 4300 m equivalent).

METHODS: Seventeen volunteers (21±3 yr, 79±11 kg, 48.7±4.2 ml/kg/min) were randomized to HH (P=0.05) compared to NH (99±5 kg, 51±8.5 ml/kg/min) at 4300 m. All subjects performed 20-km TT on a cycle ergometer both at sea level (SL) and following 1-h of exposure to the same ambient PO2 (92 mmHg, 4300 m equivalent) in either HH or NH. Volunteers were free to manually increase or decrease the work rate on the cycle ergometer by 5 watt increments. Heart rate, SaO2 and rating of perceived exertion (RPE) were collected every 5 min during the TT and mean values were calculated.

RESULTS: Five volunteers (29%) were unable to complete the 720-kJ TT in HH so only the remaining 12 volunteers were utilized for data analysis. Both groups exhibited nearly identical TT performance (min; SL (73.5±12.2 vs. 73.2±8.3) and NH TT performance was longer (p=0.05) in HH (120±20.6) compared to NH (99±18.1). Similarly, the % decrement in TT performance from SL to HH was greater (p=0.01) than the % decrement from SL to NH (35.5±13.7, HH). In HH, the HR (bpm) and SaO2 (%) (148±7; 74±4) tended (p=0.09) to be lower than in NH (157±13; 77±3). There were no differences in RPE during the TT in HH or NH.

CONCLUSION: Time-trial performance is impaired to a greater degree in hypobaric compared to normobaric hypoxia at the same ambient PO2 equivalent to 4300 m despite similar cardiovascular responses. Funding provided by US Army MRMC ATO. Authors' views not official US Army or DoD policy.

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2156  Board #202  MAY 31  8:00 AM - 9:30 AM  

The Ergogenic Effect Of Oxygenation At Exhaustion In Severe Acute Hypoxia: A Placebo Effect?

José Losa-Reyna, Jesús Gustavo Gustavo Ponce-González, Rafael S. de Torres-Peralta, Ismael Pérez-Suárez, David Feijóo, Pedro J. Martínez-Muñoz, Lorena Rodríguez-García, Jaime Calle-Herrero, José A. L Calbet. Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain.  

(No relationships reported)  

At exhaustion in hypoxia (FI02=0.115) administration of an O2-enriched gas mixture relieves fatigue swiftly. It is unknown what minimal level of oxygenation improvement is required for this ergogenic effect. This question requires an experimental design ruling out a potential placebo effect due to avoid lack of concealment and deception.

PURPOSE: To determine what is the minimal level of oxygenation required to swiftly relieve fatigue in hypoxic exercised humans.

METHODS: Ten men (21±7±2 years; V̇O2 max 53±4±4 ml·kg⁻¹·min⁻¹, mean±SD) performed five randomized incremental exercise tests (cycle ergometer, 80 rpm) to exhaustion on different days. One test was carried out in normoxia (LA0=20 ml/min). The other four tests started in severe hypoxia (P=0.047 mmHg; LA0=220mmHg (HYP1)). At exhaustion (inability to maintain a pedaling rate above 50 rpm despite strong verbal encouragement for 5 seconds) the breathing gas mixture was swiftly changed and subjects requested to try overcome fatigue. After two minutes the intensity was increased (LA0=220mmHg) until exhaustion (HYP2). Four different gas mixtures were randomly administered in HYP2 (P=0.047 (placebo), 83, 91, 99 mmHg). At exhaustion, subjects were again requested to overcome fatigue when swiftly switched to breathe normoxia (NX3, P=143 mmHg) and after 2 min the exercise intensity was increased (LA0=220mmHg) until termination.

RESULTS: Similar V̇O2max were achieved in NX3 and in the control incremental test in a 5 s. (3.5±0.17, 3.6±0.17, 3.6±0.16, 3.6±0.13, and 3.6±0.12). The transition to HYP2 resulted in significantly increased work (p<0.05) only for the 99 mmHg PAO2. A placebo effect accounted for 25% of the extra work performed with oxygenation in HYP2. The transition to NX3 allowed continuing the incremental exercise in all conditions. The work performed in NX3 was significantly lower when the preceding PAO2 was 99 mmHg compared to the other conditions.

CONCLUSION: Fatigue during incremental exercise to exhaustion in severe acute hypoxia is swiftly relieved by even small increases in oxygenation. The latter combined with the existence of a placebo effect is compatible with central fatigue as the main mechanism causing exhaustion during exercise in either moderate or severe acute hypoxia. Supported by MEC. Spain (DEP2009-11638).

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2157  Board #203  MAY 31  8:00 AM - 9:30 AM  

Ischemic Preconditioning Does Not Improve Cycling Capacity At Sea Level Or During Acute Normobaric Hypoxia


(No relationships reported)  

Ischemic preconditioning (IPC), a technique involving brief episodes of occlusion-derived ischemia followed by reperfusion, has been shown to improve outcomes from surgical procedures that necessitate prolonged ischemia. IPC may also benefit exercise performance that is limited by arterial hypoxemia, but little is known of this effect to-date.

PURPOSE: To examine the effect of IPC of the arm on pulmonary function and peak cycling capacity at sea level (SL) and acute normobaric hypoxia (NH).

METHODS: Nine highly trained cyclists and triathletes (32.1 ± 5.8 yr, 56.1 ± 7.0 ml/kg/min V̇O2max, mean ± SD) performed four experimental exercise trials at least 48 h apart at SL and NH (12.8% ḞO2 = 3900 m) with or without IPC before exercise in randomized and counterbalanced fashion. Each trial consisted of pulmonary function measurements at rest, IPC or no IPC, and a continuous progressive cycling capacity test. Pulmonary function (FVC, FEV1, FEV1/FVC, FEF25-75%, PEF) was measured using an open-circuit metabolic cart. The IPC protocol was 4 cycles of 5 min of occlusion of one arm to 200-220 mm Hg followed by 5 min of reperfusion. The cycling capacity test started 10-15 minutes after the end of the IPC cycles and consisted of 2 min of 50 W and increases in workload by 50 W every 2 min until 150 W, and then by 20 W every 2 minutes until volitional exhaustion on an electromagnetically braked cycle ergometer. Heart rate measured by telemetry and RPE were assessed at the end of every stage and arterial oxygen saturation was measured continuously by pulse oximetry.

RESULTS: IPC of one arm did not significantly change peak cycling capacity at either SL (316 ± 20 vs. 323 ± 43 W, control vs. IPC) or NH (253 ± 24 vs. 251 ± 21 W). IPC also did not significantly change arterial oxygen saturation at either SL (91 ± 4 vs. 90 ± 5%, control vs. IPC) or NH (70 ± 5 vs. 68 ± 5%) or any other variable measured.

CONCLUSION: IPC of the arm does not positively affect pulmonary function or peak cycling capacity at SL or NH, but these results may be limited by the small amount of musculature made ischemic by the IPC procedure.

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2158  Board #204  MAY 31  8:00 AM - 9:30 AM  

Time-course Of Changes In Cardiorespiratory Measures Post-altitude Training: Implications For Competitive Endurance Performance

Abigail S. Laymon, Daniel P. Wilhite, Joseph W. Duke, Jonathon L. Stickford, Joel M. Stager, Timothy D. Mickleborough, FACSM, Robert F. Chapman, FACSM. Indiana University, Bloomington, IN.  

(No relationships reported)  

Coaches have anecdotally noted that best performances following altitude training occur either: a) very early after return from an altitude training camp, or b) after a period of 10-25 days of post-altitude sea level training. However, there is little scientific evidence to support these “ideal” times for post-altitude competition.

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PURPOSE: To describe serial changes in cardiorespiratory measures related to performance in elite distance runners over three weeks at sea-level (SL), immediately following return from a “live high - train low” (LHTL) altitude camp.

METHODS: Six elite male distance runners completed a 28-day altitude training intervention at 2150m, following a LHTL training model. Isocapnic hypoxic ventilatory response (HVR), submaximal and maximal exercise ventilation (VE), oxygen uptake (VO2), heart rate (HR), and respiratory muscle VO2 (VO2RM) were measured in the one week prior to and within 24h upon return (D1) from altitude. Additional SL measures of HVR and submaximal VE, VO2, HR, and VO2RM were taken on days 3-6 (D5), 12-13 (D12), and 20-21 (D20) post-alt.

RESULTS: HVR was significantly elevated above pre-alt levels on D1 post-alt and declined back to pre-alt levels over the ensuing three weeks. There were no significant differences between any cardiorespiratory measures during maximal exercise pre- to D1 post-alt. During submaximal exercise, VO2 tended to be lower at all speeds and all days post-alt as compared to pre-alt. HR was significantly lower D1, D5, and D20 at all speeds compared to pre-alt, but not at D12. Following a similar pattern, the VO2RM was less than pre-alt measures at D1 post-alt and rose to a peak at D12 before declining again at D20. Average race time in competition on days 9-10 post-alt was 0.4% slower than the athlete’s pre-alt personal best; results from competition on day 26 showed an average time of 0.6% faster than pre-best.

CONCLUSION: The time course of changes in cardiorespiratory measures post-altitude training appears to follow a pattern that matches the anecdotally noted timing of best competitive performances. Whether post-altitude variations in competitive performance are explained by physiological de-acclimatization effects or post-altitude training effects has yet to be determined.
respectively and in the 332 female subjects were 26.5 (25.6, 27.4), 24.9 (24.0, 25.7), 24.5 (23.6, 25.4), and 24.0 (22.4, 25.7), respectively.(P for trend 0.03 and 0.01). In the 825 males subjects for leg extension power measurement (age 45.0 ± 11.0) were 18.7 (18.1, 19.4), 18.2 (17.6, 18.8), 17.9 (17.3, 18.5), and 17.4 (16.7, 18.2), respectively, and in the 332 female subjects for grip strength measurement (age 42.9 ± 10.7) were 26.5 (25.6, 27.4), 24.9 (24.0, 25.7), 24.5 (23.6, 25.4), and 24.0 (22.4, 25.7), respectively (p for trend ≤0.01 and 0.04).

CONCLUSION: A lower serum CRP concentration is found to be favorably related to muscle strength, even within a very low range (<1.0mg/l). The findings suggest that maintaining CRP levels as low as possible may potentially maintain a better muscle strength.

2162 Board #208 MAY 31 9:00 AM - 10:30 AM
Clinically Significant Side-to-Side Lower Extremity Strength Asymmetries in US Army 101st Airborne Soldiers
Nicholas C. Clark1, Karen A. Keenan1, John P. Abt2, Timothy C. Setl2, Takashi Nagai1, Jennifer B. Deluzio1, Mita T. Lovalekar1, Larry J. McCord2, Michael D. Wirt2, Scott M. LePehrt3. 1University of Pittsburgh, Pittsburgh, PA. 2101st Airborne Division (Air Assault), Fort Campbell, KY.

NO relationships reported

Side-to-side (S-S) symmetry of lower extremity (LE) muscle strength is important for preventing between-limb compensations that overload one side and increase injury risk. As such, S-S comparisons in LE strength are frequently made in injury prevention and rehabilitation contexts. Past work consistently shows S-S LE strength differences <10% are normal in athletes. However, S-S LE strength differences in large military samples have not been previously reported. Considering the healthcare burden of unintentional musculoskeletal injuries, characterizing the S-S LE strength differences in Soldiers will give data of the frequency of potentially dangerous S-S muscle imbalance. This data can then be used to screen for future risk of new LE injury or re-injury.

PURPOSE: To describe the prevalence of clinically significant S-S asymmetry (S-S difference ≥10%) in LE strength of Soldiers,

METHODS: Fully operational male US Army 101st Airborne Soldiers (n=402; age 28.1 ± 6.6yr; height 177.7 ± 7.1cm; mass 84.1 ± 12.5kg) were tested. An isotonic dynamometer measured concentric quadriceps (QUAD) and hamstring (HAM) mean peak torque (Nm/kg, 5 reciprocal repetitions, 60°/sec), and isometric hip abductor (ABD) mean peak force (N/kg, 3 reciprocal repetitions, 5 sec/effort). A handheld dynamometer measured isometric ankle eversion (EV) and inversion (INV) mean peak force (kg, 3 repetitions, 5 sec/effort). Counts were made of Soldiers with S-S differences ≥10% (designated ‘suprathreshold’ (ST)) and proportions calculated.

RESULTS: For QUAD and HAM strength, 41% had S-S differences ≥10% (ST range=11-50%). For ABD strength, 38% had S-S differences ≥10% (ST range=11-53%). For EV strength, 34% had S-S differences ≥10% (ST range=11-49%). For INV strength, 40% had S-S differences ≥10% (ST range=11-46%).

CONCLUSION: A large proportion of Soldiers (≥33%) had S-S leg strength differences ≥10% (maximum S-S difference=53%). Consideration should be given to correction of S-S imbalances via targeted training programs. Such intervention may contribute to reducing the risk of sustaining new unintentional LE injury or re-injury, and enhance Soldiers’ ability to safely and effectively execute mission essential tasks.

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2163 Board #209 MAY 31 9:00 AM - 10:30 AM
Concurrent Inspiratory-Expiratory And Aerobic Training Effects On Respiratory Muscle Strength In Asthmatics
Brandon S. Shaw1, Ina Shaw2, Gregory A. Brown, FACSM1. 1Pittsbugh University, Pittsburgh, PA. 2Eshwane University of Technology, Johannesburg, South Africa.

NO relationships reported

The evaluation of respiratory muscle strength can prove useful to determine the severity and progress of asthma and is an appropriate indicator of an increased use of health care resources and survival in hospitalized patients with respiratory disease.

PURPOSE: The purpose was to evaluate and compare the effects of eight weeks of aerobic, inspiratory-expiratory training and concurrent inspiratory-expiratory and aerobic training on respiratory muscle strength.

METHODS: Previously sedentary, moderate-persistent asthmatics (n = 88) were divided into a non-exercising control (NOEX), aerobic trained (AERT), inspiratory-expiratory trained (IET) or endurance trained (CONC) group. AERT, IET and CONC subjects exercised three times weekly over eight weeks with the AERT program (n = 22) consisting of walking/jogging at 60% of individual age-predicted maximum heart rate, the IET program (n = 22) of inspiratory and expiratory training in a semi-recumbent position at varying inspiration, expiration ratios while the CONC program (n = 22) utilized a combination of the AERT and IET programs. NOEX subjects (n = 22) were instructed to continue their usual activities and received no prescribed exercise.

RESULTS: While there were no significant changes in any of the measured variables in the NOEX group, AERT, IET and CONC resulted in significant (p ≤ 0.05) strength improvements in eleven of the thirteen measured inspiratory muscles. AERT and CONC resulted in significant strength improvements in all seven of the measured expiratory muscles, while IET improved the strength of five of the seven measured expiratory muscles, excluding left lattissimus dorsi and left quadratus lumborum.

CONCLUSIONS: Programs utilizing aerobic and inspiratory-expiratory training can improve respiratory muscle strength in moderate-persistent asthmatics and are essential to the asthmatic to ensure ventilation by adapting to the increasing workloads of the disease.

2164 Board #210 MAY 31 9:00 AM - 10:30 AM
Effects Of Muscle Strengthening Activities And Protein Intake On Fat-free Mass Percentage In Us Adults
Jonathan Kurka1, Kelly Launor2, Robert Cullen2, Dale Brown, FACSM2, Julie Schumacher1. 1Arizona State University, Phoenix, AZ. 2Illinois State University, Normal, IL.

NO relationships reported

PURPOSE: The study examined the independent and dependent effects of grams of protein intake per kilogram body weight per day (PI) and frequency of participation in muscle strengthening activities per week (MSF) on fat-free mass percentage (FFM%) estimated by bioelectrical impedance analysis.

METHODS: The sample consisted of males (n=499) and females (n=2,373) aged 20-49 years from the National Health and Nutrition Examination Survey (NHANES, 2001-2004). PI and MSF were divided into three groups based on American College of Sports Medicine (ACSM) guidelines and prior research. Multiple regression was used to determine the association between varying levels of PI, MSF and FFM%, while stratifying by sex and controlling for age, race, socio-economic status, standing height, and total caloric intake.

RESULTS: There was a significant association between FFM% and MSF in males (0.66±0.1% per unit MSF) and females (0.4±0.1 FFM% per unit MSF). The same was true for the association between FFM% and PI in males (3.5±0.4% per unit PI) and females (5.9±0.4% per unit PI). Using MSF=0 and PI 1-4 categories respectively, compared to referent groups. It was significantly observed that the MSF=0 and PI1-4 group interaction.

CONCLUSIONS: Results of the study showed that MSF and PI significantly predict FFM% increases in males and females, even when controlling for covariates. From a nationally representative sample, results indicated that higher PI was a stronger predictor of FFM% in females, while MSF was more predictive in males. Meeting ACSM guidelines of ≥2 MSF per week and the PI recommended dietary allowance (RDA) of ≥0.8 showed significant increases in FFM% in males and females.
C-34  Free Communication/Poster - Neuro-Motor Control

MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2165  Board #211  MAY 31  8:00 AM - 9:30 AM
Asymmetry In Parkinson’s Disease Is Reflected In The Timed Up And Go Test

Kyle M. Rose, Arend W. A. Van Gemmeren, Jan M. Hondzinski, Li Li, FACSMD, Louisiana State University, Baton Rouge, LA.

The cardinal symptoms of Parkinson’s disease (PD) are movement related. The severity and effects of the disease, along with the effectiveness of rehabilitation within this population, can be measured using the Timed Up and Go (TUG). Since PD manifests itself typically with asymmetrical symptoms, we reasoned that asymmetry might influence performance of the TUG test in this population. We investigated whether TUG scores were influenced by turning direction congruent with the most affected side of PD patients.

PURPOSE: To determine if asymmetry observed in PD influences TUG scores when turning toward or away from the most affected side.

METHODS: Performance of the TUG test by people with PD was measured electronically in three segments: approaching the turn (approach), turning (turn), and returning back to the chair (return). Each patient completed the course a total of six times, turning different directions three times each. The segments collected in each trial were analyzed separate to the total time in seconds. Mean and standard deviations of the relative approach, turn, and return segments, in addition to total time for the most vs. least affected sides were analyzed using one-tailed, paired T-Tests. The most affected side was determined by leg rigidity on the United Parkinson’s Disease Rating Scale (UPDRS).

RESULTS: The relative approach, turn, and return percentages and the total mean times (seconds) and standard deviations on turns toward the most affected side were 2.26%±0.52 (P<.05), 2.17%±0.61 (P.05), and 5.35%±1.98 (P<.05), respectively. P-values less than .05 indicated that approach and turn segments as well as total times differed between most and least affected sides.

CONCLUSIONS: Our results indicate directional turning to the most affected side vs. the least affected side can produce different TUG scores in PD patients. This difference can be primarily attributed to the relative timing of the turn segment. This outcome offers greater insight into asymmetrical movement patterns for people with PD that should be considered when designing training interventions for this population.

2166  Board #212  MAY 31  8:00 AM - 9:30 AM
Emergency Brake Response Time after Stroke

Hui Yu Shih1, Chih Chung Wang2, Jing Min Liang1, Wei Tso Hung1, Ying Yi Chen1, Jia Hroung Wu1, Wen Lan Wu1,2 Kaohsiang Medical University, kaohsiung, Taiwan.1Kaohsiung Medical University Hospital, kaohsiung, Taiwan. 2Taipei Institute of Technology, Taichung, Taiwan.

INTRODUCTION: Previous research has shown that most of stroke patients didn’t obtain enough information about resuming driving during their hospital stay and nearly half of them would like to have driving training to help them drive safely.

PURPOSE: For assessing the driving capabilities, 3 stroke patients (mean age=48.3±4.04) with right hemiplegia and 10 healthy controls (mean age=22.80±2.39) were included in this study to investigate whether their ability was sufficient for the emergency braking function.

METHODS: The driving simulator was used in this study. This simulator consisting of actual brake and accelerator pedal assemblies attached to an automobile steering column was constructed. A 17-in color monitor that displayed a driving simulation was placed in front of the steering wheel. The monitor was positioned at the subject’s eye level, and the steering wheel was placed at a height to represent his or her normal driving position. An automobile seat is adjustable for the patient’s height. Subjects were instructed to drive in the city condition, the average speeds ranged from 45 to 55 km/hr. The machine recorded the time taken from the appearance of the walker to brake until the moment the patient began to lift the foot from the accelerator pedal; this was recorded as the reaction time. The machine also calculated the time taken from the moment the patient began to release the accelerator pedal to the moment the patient depressed the brake pedal; this was recorded as the brake time.

RESULTS: Improvement in both scores. (mean age=48.3±4.04) with right hemiplegia and 10 healthy controls (mean age=22.80±2.39) were included in this study to investigate whether their ability was sufficient for the emergency braking function. This was determined by leg rigidity on the United Parkinson’s Disease Rating Scale (UPDRS). A four week interval active-assisted cycling intervention leads to improvements in some measures of balance in individuals with PD. Performance of the TUG test by people with PD was measured electronically in three segments: approaching the turn (approach), turning (turn), and returning back to the chair (return). Each patient completed the course a total of six times, turning different directions three times each. The segments collected in each trial were analyzed separate to the total time in seconds. Mean and standard deviations of the relative approach, turn, and return segments, in addition to total time for the most vs. least affected sides were analyzed using one-tailed, paired T-Tests. The most affected side was determined by leg rigidity on the United Parkinson’s Disease Rating Scale (UPDRS).

RESULTS: The relative approach, turn, and return percentages and the total mean times (seconds) and standard deviations on turns toward the most affected side were 2.26%±0.52 (P<.05), 2.17%±0.61 (P.05), and 5.35%±1.98 (P<.05), respectively. P-values less than .05 indicated that approach and turn segments as well as total times differed between most and least affected sides.

CONCLUSIONS: Our results indicate directional turning to the most affected side vs. the least affected side can produce different TUG scores in PD patients. This difference can be primarily attributed to the relative timing of the turn segment. This outcome offers greater insight into asymmetrical movement patterns for people with PD that should be considered when designing training interventions for this population.

2167  Board #213  MAY 31  8:00 AM - 9:30 AM
Interval Active Assisted Cycling Improves Balance in Individuals with Parkinson’s disease

Angela L. Ridget, Emily J. Fickes, Corey A. Peacock, Kayla A. Wilson, Megan L. Williamson. Kent State University, Kent, OH. (Sponsor: Ellen L. Glickman, FACSMD)

PURPOSE: To determine the effects of a four week interval active-assisted cycling program on balance in individuals with Parkinson’s disease.

METHODS: Individuals were counterbalanced into two groups: a non-exercise control group and an exercise group. Participants in the exercise group completed 30 minutes of interval active-assisted high-rate cycling with 5 minutes of warm-up and cool-down, three times a week for four weeks. Balance was assessed by testing postural stability, Clinical Test of Sensory Integration of BalanceClinical Test of Sensory Integration of Balance test risk and sensory integration of balance (m-CTSIB) using the Biodex Balance System SD. The Biodex Balance System measures the ability to maintain postural stability on an unstable surface and the ability to move the centre of mass within the limits of stability utilizing a circular platform that moves in the anterior-posterior and medial-lateral axes. Balance was also assessed using the Berg balance scale. All participants (exercise and control groups) were tested at baseline, 2 weeks and 4 weeks.

RESULTS: Repeated-measures ANOVA analysis demonstrated a significant (p = 0.025) improvement in postural stability in the exercise group (1.66 ± 1.73 pre, 0.8 ± 1.0 post). Although there was no significant change in fall risk (p = 0.371; 2.0 ± 1.1 pre, 1.74 ± 0.76 post) and m-CTSIB (p ≤ 0.088; 1.11 ± 0.51 pre, 0.86 ± 0.41 post), there was improvement in both scores. Furthermore, slight, but non-significant, improvements were also present in the Berg balance scale scores after 4 weeks (p = 0.239; 38.8 ± 11.1 pre, 42.6 ± 13.9 post). However, this slight difference moves this group from the medium fall risk to the low fall risk category.

CONCLUSION: A four week interval active-assisted cycling intervention leads to improvements in some measures of balance in individuals with PD.
Electromyographic Responses Across Repeated Maximal Isometric And Concentric Muscle Actions
Clayton L. Cani1, Marcia L. Taddy1, Jorge M. Zuniga1, Terry J. Hough, FACSM1, Daniel A. Taylor2, Haley C. Bergstrom3, Richard I. Schmidt4, Glen O. Johnson1.
1University of Wisconsin-Platteville, Platteville, WI. 2 Western New Mexico University, Silver City, NM. 3University of Nebraska-Lincoln, Lincoln, NE.

PurPOSE: To examine the pattern of electromyographic (EMG) responses associated with fatigue across repeated maximal isometric (ISO) and concentric (CON) muscle actions.

METHODS: Twelve female subjects (mean age ± SD = 21.1 ± 1.4 yrs; BW = 63.3 ± 7.4 kg) volunteered to perform ISO and CON muscle actions of the leg extensors on a Cybex 6000 isokinetic dynamometer on three separate days. The first visit was structured as an orientation session to familiarize the subjects with the testing protocols. During the second and third visits, the subjects performed randomly ordered ISO and CON fatigue protocols separated by 72 hours. The intermittent ISO fatigue protocol involved 30 maximal ISO muscle actions that were sustained for 3 seconds followed by 3 seconds of rest. The CON fatigue protocol involved 30 consecutive maximal CON muscle actions at 30°·s⁻¹. In addition, EMG signals were recorded from the vastus lateralis during the ISO and CON fatigue protocols. The relationships for torque, EMG amplitude, and EMG mean power frequency (MPF) versus repetition number were examined using polynomial regression analysis.

RESULTS: There were significant (p < 0.05) decreases across the 30 repeated maximal ISO muscle actions for torque (linear, r² = 0.95), EMG amplitude (quadratic, R² = 0.44), and EMG MPF (linear, r² = 0.62). In addition, there were significant decreases across the 30 repeated maximal CON muscle actions for torque (quadratic, R² = 0.97), EMG amplitude (quadratic, R² = 0.46), and EMG MPF (quadratic, R² = 0.86).

CONCLUSIONS: The pattern of responses for EMG amplitude indicated that both the ISO (quadratic, R² = 0.44) and CON (quadratic, R² = 0.46) muscle actions led to a fatigue-induced decrease in the recruitment of activated motor units and/or a reduction in the global firing rate that occurred after 10-15 maximal repetitions. These findings also suggested that complete muscle activation during the maximal ISO and CON muscle actions required multiple repetitions. Furthermore, the decreases in EMG MPF during both the ISO (linear, r² = 0.62) and CON (quadratic, R² = 0.86) muscle actions were parallel to the linear (r² = 0.95) and quadratic (R² = 0.97) decreases in torque, respectively. Thus, the present findings suggested that the mechanisms of fatigue responsible for decreases in torque were consistent between the ISO and CON muscle actions.

Continuous loading of the low back tissues results in modified neuromuscular output to external perturbations, and influences temporal and spatial movement variables. It is believed that these movement outcomes provide evidence to support hypotheses related to movement disorders.

To observe trunk kinematics parameters after introduction of an acute load before and after passive cyclic trunk flexion-extension exercise.

METHODS: Fifteen healthy volunteers (7 males, 8 females; 21.3 ± 2.1 yrs, 1.74 ± 0.08 m, 70.8 ± 11.8 kg) participated. Reflective markers were adhered to the skin over boney landmarks at C7, L1, L3, and S1 for kinematics analysis. An isokinetic dynamometer was used in performing two, five min sets of cyclic trunk flexion-extension conditions at a preset velocity of 10°/s through the subjects’ range of trunk motion from seated upright posture at α: 1) passive and 2) active. Blocks of three trials were performed before and after (3 blocks, B) each trunk cyclic loading period as subjects stood on a platform while holding a crate affixed to a pulley system with a 9 kg mass attached. A traxial accelerometer affixed to the crate was used to determine the onset time of trunk perturbation. Kinematics dependent variables included trunk displacement (Dis_T), peak trunk velocity (PV_T), rate of trunk displacement (SLOPE), and SLOPE to PV_T ratio (VR). A 2 x 3 x 2 (condition x block x gender) repeated measures ANOVA was performed on the kinematics data. Alpha was set at 0.05.

RESULTS: A significant difference for Dis_T between blocks was present (B1: 10.13 ± 5.0°, B2: 8.24 ± 4.8°, B3: 8.11 ± 5.0°, p < 0.01). Gender difference were present for PV_T (males: 49.47 ± 22.0°·s⁻¹ vs. females: 60.85 ± 38.1°·s⁻¹, p < 0.01) and SLOPE (males: 26.4 ± 13.1°·s⁻¹ vs. females: 30.1 ± 16.7°·s⁻¹, p < 0.032). A non-significant trend (p = 0.0518) was present for VR between B (B1: 0.501 ± 0.16, B2: 0.539 ± 0.13, B3: 0.539 ± 0.10). All other variables were not significantly different.

CONCLUSIONS: Kinematic differences were noted across conditions, which may or may not agree with neuromuscular response of the system to these protocols. However, there is evidence present to indicate a time-dependent modified kinematics response to these protocols.

Effect Of Coffee On Dual-task Performance
Mojdeh Baniasadi, Nassim Nadj, Jeremy A. Patterson, FACSM, Douglas F. Parham. Wichita State University, Wichita, KS.

PurPOSE: To assess the effects of coffee on dual-task performance (DTP).

METHODS: 23 college-aged individuals (15/8 m/f; 25±3.4 yrs) participated in this study. Each participant attended 3 sessions (Familiarization, Baseline, and Experimental). Before each session, participants were asked to abstain from consuming caffeinated beverages the night before testing. The DTP assessment was completed during all three visits, this consisted of testing cognition (Stroop color-word test / N-back test) while measuring balance (modifiedCTSBI) to the same test. The modifiedCTSBI test consist of four, 30-second tests; Condition 1: eyes open on a firm surface, Condition 2; eyes closed on a firm surface, Condition 3; eyes open on a foam surface, Condition 4; eyes closed on a foam surface reporting the Stability Index as the average position of the participant’s body from center. In Conditions 1 and 3, subjects were asked to stand on the balance machine with eyes open and respond to the Stroop color-word test by naming the color of a word that appears on the screen in front of them in a color different from its name. In Conditions 2 and 4 of balance test, the N-back test was completed with eyes closed and participants responded by saying ‘yes’ when a word had already been read aloud two words previously. Additionally, on the Experimental visit participants were asked to consume one cup of brewed coffee (12 oz) that contain 240 mg caffeine, and after 30 minutes the DTP assessment was repeated. Statistical analysis was performed using paired sample t-test, with significance set at p < 0.05.

RESULTS: Outcomes suggest that the DTP assessment showed significant differences between Condition 1 (p = 0.018) and Condition 3 (p = 0.013) at Baseline compared to Familiarization. Moreover, after consuming coffee the results of all DTP assessments indicated no significant differences between Baseline and Experimental (p = 0.063; p = 0.390; p = 0.992; p = 0.204).

CONCLUSION: The data of this study suggests that the DTP assessment requires a Familiarization visit. In addition, significant improvement appears on DTP in Condition 1 and 3, but it does not report any significant effect on DTP after consuming coffee.
time. Repeated measures ANOVA was conducted on the fixation data with obstacle height and time delay as independent factors.

RESULTS: A significant interaction between obstacle height and POI was found (p = 0.024). Participants directed gaze to the obstacle itself when the obstacle moved from a low position to a high position. In contrast, gaze was directed to the post foot position when the obstacle moved from a high position to a low position. Overall, young adults directed their gaze to either the obstacle or the post foot position on all trials with little fixation spent pre obstacle. No significant effect of time delay was found for gaze behavior.

CONCLUSION: The results indicate that obstacle height rather than time-delays change where young adults direct their gaze. Future research will examine the gaze behavior of older adults to assess whether there are differences in gaze behavior and whether this contributes fall risk.

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**2172** Board #218  MAY 31  8:00 AM - 9:30 AM
Assessment Of Oculomotor Control And Balance In Concussed And Non-concussed Individuals
Nicholas Murray, Pradeep V.N Ambati, Fabrizio Saucedo, Monica Contreras, Anthony Salvatore, Rebecca Reed-Jones. The Univ. Of Texas at El Paso, El Paso, TX. (No relationships reported)

Damage sustained from a concussion can result in lingering balance disturbances and vertigo. Rehabilitation focused on the vestibular system has shown to improve balance performance post concussion. However the role of the vestibular system in oculomotor control (stabilization and tracking) has been generally overlooked. Investigating oculomotor control post concussion could provide valuable scientific information regarding vestibular function post concussion.

PURPOSE: The purpose of this research is to study oculomotor function during concussion recovery. The goal is to provide evidence for the use of oculomotor assessment in addition to balance assessment post concussion.

METHODS: Nine post concussion athletes and nine non-concussed athletes performed 3 balance trials while wearing a head mounted eye tracking system (Applied Science Laboratories, MA, USA). Balance performance was measured using the Nintendo WiiFit® soccer heading game. This test assesses combined oculomotor control and balance as it incorporates directing center of pressure in response to visual stimuli. Gaze stabilization was used as the measure of oculomotor control and coded as the percent of time fixed on the center of the game screen. Between subjects ANOVA and Pearson Product correlations were performed for gaze time on center and soccer game score.

RESULTS: A significant correlation between gaze time on center and soccer game score was found, however; these were different between the concussed and non-concussed groups. Non-concussed individuals had a positive correlation (r = .792, p = .011) between gaze and soccer variables. In contrast, concussion subjects showed a significant negative correlation (r = -.846, p = .004). No significant between group differences in Wui score or time on center were found. However, group differences were lower in the concussed (94.90 ± 21.80) versus non-concussed group (132.2 ± 25.57), while time on center was similar between the groups (63.5% non-concussed versus 64.2% concussed).

CONCLUSION: Results indicate deficits in visually driven balance responses in concussed athletes. Concussed athletes directed gaze to the center however balance responses were reduced. Further research will examine the association of these measures with the vestibular system.

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**2173** Board #219  MAY 31  8:00 AM - 9:30 AM
Changes in Kinematic Sequence with Fatigue: A Comparison of Female Dancers and Female Athletes
Karl F. Onishiño1, Ian J. Kremenic2, Evangelos Pappas2, Marshall Hagins2, Marijanne Liederbach1. 1Lenox Hill Hospital, New York, NY. 2Long Island University, Brooklyn, NY. (No relationships reported)

The propulsive phase of a stretch-shortening cycle movement is characterized by a proximal to distal transfer of joint velocities, with peak hip velocity preceding peak knee velocity, which in turn precedes peak ankle velocity. Due to their extensive training in jumping activities, dancers are considered experts in these tasks. While fatigue affects jump biomechanics, it is not known how it alters the kinematic sequence or if fatigue-induced changes are different between dancers and athletes.

PURPOSE: To compare the effects of fatigue on kinematic sequence of female dancers and female athletes during the propulsive phase of a single-leg countermovement jump.

METHODS: Twenty female dancers and twenty female athletes performed single-leg countermovement jumps to 50% of their maximum jump height before and after a lower extremity fatigue protocol. Joint kinematics were measured with eight infrared cameras and 22 markers. For each subject, the velocity profile of each joint was normalized to the maximum velocity achieved by that joint. Repeated-measures ANOVA (Group x Joint x Fatigue) were used to compare the timing of peak joint velocities as well as the percentage of peak velocity of each joint when the other two were maximal.

RESULTS: As documented elsewhere, dancers achieved peak joint velocities later in the propulsive phase compared to the athletes (Group: P = 0.044). With fatigue, peak hip and knee velocities were delayed while ankle timing was unchanged.

CONCLUSIONS: Fatigue affected the kinematic sequence in both groups similarly by shifting the timing of peak hip and knee velocities closer to that of peak ankle velocity. This could be compensated for the changes in muscle mechanics following fatigue in order to maintain jump height.

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**2174** Board #220  MAY 31  8:00 AM - 9:30 AM
Assessment Of Prediction And Learning Effect On Dynamic Postural Stability In Single Leg Landing Task
Issei Ogasawara1, Yoshih Koyanagi2, Ken Nakata1, 1Mukoogawa Women's University, Nishinomiya, Japan. 2Osaka University, Suita, Japan. (No relationships reported)

PURPOSE: The purpose of this study is to investigate the prediction of posture demands after single legged landing and to elucidate whether human can learn how to stabilize their posture even in the unpredictable condition.

METHODS: 12 subjects with no histories of lower limb surgery or neurological disorder participated in this study. The subjects were asked to land on the target with their dominant leg from the 30 cm high box. The length of the center of pressure (CoP) trajectory from 0 to 100 ms after foot impact was compared between following two conditions. In the normal condition (NC), the target was displayed before the trial to allow the subjects to predict the postural demands after the foot impact. In perturbation condition (PC), the target was displayed beforehand, however, when the subject started their landing, it was moved to another position (10 cm apart from the initial position) in order to interfere with the subjects' prediction for postural adjustment.

RESULTS: Figure compares the trial-by-trial change for the CoP trajectory length between NC and PC from a representative subject. The white circle denotes NC and the gray dose PC. In NC, the length gradually decreased as the subject adopted to stabilize the post landing posture, however, in PC, the length was entirely longer than that of NC (NC 0.25 ± 0.69 cm vs PC 0.32 ± 0.56 cm, p<0.05) and the obvious adaptation was not observed. Similar results were also obtained in CoP velocity.

CONCLUSIONS: Our findings suggest that it is difficult to learn the postural stabilization skill in unpredictable condition. Difficulty in predictive postural adjustment may contribute to develop the sports injury, such as knee ligament injury, which occurs in unpredictable situation.
**2175 Board #221 MAY 31 8:00 AM - 9:30 AM**

Assessment Of Muscle Use With Surface Electromyography And Positron Emission Tomography

Jens Bojesen-Moller1, Thomas Losnegard2, Jostein Hallén3, Per Aagaard1, Inge-Lis Kanstrup1, Kari Kalliokoski5, Peter Magnusson1. 1Norwegian School of Sport Sciences, Oslo, Norway. 2University of Southern Denmark, Odense, Denmark. 3Herlev Hospital, University of Copenhagen, Copenhagen, Denmark. 4University of Turku, Turku, Finland. 5Bispebjerg Hospital, University of Copenhagen, Copenhagen, Denmark.

Surface EMG (SEMG) has certain inherent limitations when applied during dynamic human movements. By quantifying exercise induced glucose uptake, positron emission tomography (PET) presents an alternative method to acquire detailed 3D information about muscle use during complex human movement. PET and SEMG have not previously been combined.

**PURPOSE:** To compare PET and SEMG obtained during different contractile tasks.

**METHODS:** In total 12 subjects participated: 6 subjects performed concentric vs. eccentric plantarflexor (PFLX) contractions on separate days with similar load (%MVC) and duration (6 contractions/min for 3 min). 6 other subjects performed aerobic whole body exercise in a skiing ergometer (20 min bouts, intensity: 55-75% of VO2max). Prior to exercise, a tracer ([18F]FDG) was injected, during exercise EMG was sampled, and after exercise the subjects underwent a PET scanning. An MRI scan was performed for anatomical reference. Muscle activation/use during exercise was quantified by 1) peakEMG (%MVC) and 2) by a glucose uptake index (GUI) for each muscle based on PET scans. To determine associations between the two methods, linear regression analyses was performed, and Pearson product-moment correlations were computed.

**RESULTS:** Two PFLX muscles were examined in eccentric/concentric conditions and 10 muscles for the aerobic exercise trial. For the PFLX exercise average GUI of all muscles (related to passive muscle) was 32±18% MVC. A positive, weak but significant (r=0.45, P<0.05) correlation was seen for this condition. For the aerobic exercise, average GUI of all muscles (related to passive muscle) was 17±21%, while EMG was 37±18% MVC with a positive moderate correlation (r=0.85, P<0.01).

**CONCLUSIONS:** The two methods are highly different with respect to time/spatial resolution, to actual measurement (electrical voltage vs. glucose uptake) and to normalization method (EMG is related to maximal contraction, PET is normalized to passive tissue uptake). Nonetheless, a reasonable relation exists between the outcomes suggesting certain compatibility. Depending on the research question, PET may be an alternative or supplementary method when high spatial resolution is required and further when muscles that can not be accessed by EMG (surface or indwelling) are examined.

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**2176 Board #222 MAY 31 8:00 AM - 9:30 AM**

Heterogenic Effect of Exercise Induced Quadriceps Muscle Damage on Ankle Kinematics and Step Cycle Timing During Slope Walking

Manning Sabatier1, Chris Black2, Megan Luallen1, Kourtney Aylor1, Samantha Drew1. 1Clayton State University, Morrow, GA. 2University of Mississippi, University, MS. (Sponsor: Melanie Poudievigne, FACSM)

Bilateral deficit (BD) is the reduction in the maximal voluntary force output from a synchronous bilateral contraction, when compared to the combined force outputs in biomechanically similar unilateral contractions (Bobbert et al., 2006). A number of theories for the occurrence of BD have been suggested; (1) an inhibition in neural drive or (2) differences in the mechanics between bilateral and unilateral jumping. If BD is principally a neural phenomenon, then a change in load should not affect the relative magnitude of BD observed. However, if there is a mechanical basis for BD then a difference will present in the observed BD between unloaded and loaded conditions.
**PURPOSE:** Examine the effects of an additional load of 10% body-weight (BW) on the occurrence of bilateral deficit.

**METHODS:** A group of 26 physically active students (22.3±4.2 yrs, 22 male, 4 female) performed a series of counter-movement jumps under both unloaded (BW) and loaded (BW+10%) conditions: 3 x unilateral left leg jumps (UL), 3 x unilateral right leg jumps (UR) and 3 x bilateral jumps (BL). A period of 30 s rest was taken between jumps, with 5 min between sets of jumps. Participants were randomly assigned to 1 of 2 groups. Group 1 performed unloaded followed by loaded condition. Group 2 performed loaded followed by unloaded condition. Vertical jump height was determined using a jump mat with the percentage difference (%diff) in jump height between the combined unilateral jumps (UL + UR) and BL for the unloaded and loaded conditions being analyzed.

**RESULTS:** No effect for jump order was observed (p > 0.05). A significant reduction in BL was observed in the jump heights recorded during the unloaded and loaded conditions (unloaded %diff: 81.1 ± 6.7%; loaded %diff: 82.8 ± 7.9%; p < 0.05)

**CONCLUSION:** A significant reduction in the difference between unilateral and bilateral vertical jumps resulting from the addition of extra load suggests that mechanical factors may predominate in BL, with the additional load causing a shift in the force-speed continuum of the active musculature.

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**PURPOSE:** To compare the magnitude and pattern of neural drive during explosive force production to neural drive at MVF.

**METHODS:** Following familiarisation, 27 healthy, untrained, young men performed two identical trials of isometric contractions of the knee extensors at a knee joint angle of 120°, 7 days apart, with data averaged across both trials. Force was measured by a strain gauge perpendicular to the tibia and double differential surface EMG recorded from two sites over each of the three superficial quadriceps muscles (RF, VM, VL). Participants performed: two series of four maximum voluntary contractions of 3-s duration in order to measure MVF and EMG amplitude (RMS of a 500-ms epoch around MVF, EMG<sub>MVF</sub>); and 10 explosive contractions of 1-s duration. For the explosive contractions, force was assessed for 200-ms after force onset, and EMG RMS amplitude measured in four successive 50-ms time periods after signal onset and the highest value from these time periods (EMG<sub>EXP-MAX</sub>).

**RESULTS:** Whole quadriceps EMG<sub>EXP-MAX</sub> exceeded EMG<sub>MVF</sub> (206±119 vs 181±84 µV; P=0.01), reaching 112±16 %EMG<sub>MVF</sub>, and this was also the case for all three individual muscles (All, P=0.02; VM 115, VL 112 and RF 113 %EMG<sub>MVF</sub>). Participants were divided into two groups according to relative explosive force after 100 ms (HIGH, 59±6 %MVF, n=14; LOW, 45±5 %MVF, n=13; P=0.02) with HIGH recording greater quadriceps EMG<sub>0-100</sub> %EMG<sub>MVF</sub>, P=0.01) and this elevated neural drive was followed by a decline in EMG that was not the case for LOW (-20±19 vs -3±20 %, P=0.03). Furthermore, for individuals with high quadriceps EMG<sub>0-100</sub> (>100%EMG@MVF, n=19) this value was correlated with the subsequent decline in neural drive (R=0.51; P=0.03).

**CONCLUSIONS:** In these untrained individuals neural drive during explosive force production was greater than at MVF, indicating that activation at MVF may be sub-maximal, and very high values of neural drive were associated with a subsequent decline indicating an inhibitory response.

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**PURPOSE:** To determine the effect of the continuous cycling training with foot ER on electromyographic activity of the vasti.

**METHODS:** Twenty-seven healthy young male (21±1 yrs) were randomly allocated into one of three groups, namely, neutral (N), ER 45°, and the control group (C). All subjects were trained 3 times per week for 8 weeks. Each session lasted 20 min on cycling. The foot position in the C was decided by themselves. The difference of electromyographic onset time and activities of the VMO and vastus lateralis (VL) were collected during step up (concentric contraction) and step down (eccentric contraction) that were performed before and after training. Statistical analysis using a 2-way ANOVA based on group and training was performed.

**RESULTS:** Between pre- and post-test, only subjects in the ER 45° group was significantly decreased in the difference of VMO-VL onset time (29±46 vs. -92±54 ms, p<0.05) during the descending step, and was significantly different compared to N and C (-92±54 vs. -8±38 vs. -7±32 ms, p<0.05) after training. No significant differences in the VMO/VL ratio were found.

**CONCLUSION:** The knee neuromuscular function during eccentric contraction might be enhanced after cycling training with foot ER in healthy young male. Supported by NSC100-2622-H-179-001-CC3, Taiwan, ROC.

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**Purpose:** Design a method assessing dual-task performance (DTP) using balance and cognition measures.

**METHODS:** 23 (15/8 m/f; 25±3.4 yrs) college-aged individuals participated in this study. Each participant attended two sessions which consisted of test cognition by combining the Stroop color-word and N-back test, while measuring balance at the same time. The balance test consisted of two 30-second tests. Test 1 was completed with eyes open on a firm surface and Test 2 with eyes closed on a firm surface, values were recorded as Stability Index. During Test 1, participants were asked to stand on the balance machine and respond to the Stroop color-word test by naming the color of a word that appears on the screen in front of them in a color different from its name. During Test 2, participants completed the N-back test with eyes closed by saying ‘yes’ when a word read aloud had already been read aloud two words previously. The scores of the cognitive tests were divided by the results of the Stability Index to create a single score (DTP Score = Cognition Score / Stability Index).

**RESULTS:** Study results suggest that individuals who achieved a higher DTP Score had a greater capacity to complete the dual-task assessment and likewise, a low DTP Score suggested a poor ability to perform dual-tasks.

**Table:**

<table>
<thead>
<tr>
<th>Mean of DTP Score Test 1 and 2</th>
<th>Cognitive</th>
<th>Stability Index</th>
<th>DTP Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1 Test 1</td>
<td>16.83± 2.83</td>
<td>2.7± 2.35</td>
<td>9.79± 5.76</td>
</tr>
<tr>
<td>Test 2</td>
<td>4.4± 0.88</td>
<td>3.7± 2.35</td>
<td>3.41± 3.74</td>
</tr>
<tr>
<td>Session 2 Test 1</td>
<td>6.25± 2.32</td>
<td>1.99± 1.95</td>
<td>3.13± 1.75</td>
</tr>
<tr>
<td>Test 2</td>
<td>4.83± 0.38</td>
<td>2.42± 2.29</td>
<td>3.86± 3.32</td>
</tr>
</tbody>
</table>
CONCLUSION: The DfP Score presented here, provides a single score assessment value to measuring two tests completed at the same time. Preliminary results suggest that the DfP Scoring has consistent reproducibility and represents a unique scoring scale for evaluating DfP. Further studies with larger sample sizes and including populations with balance and or cognitive deficits need to be completed to assess the effectiveness of the DfP Score.

2182 Board #228 MAY 31 8:00 AM - 9:30 AM
Fatigue-Induced Median Frequency Shifts in Healthy Aging and Parkinson’s Disease
Julia Falkenklou1, Amanda Morgan1, Nicholas J. Hanson2, Michael J. Ryan3, Paul D. Reneau1, Douglas W. Powell1. 1Fairmont State University, Fairmont, WV. 2The Ohio State University, Columbus, OH.

Parkinson’s disease (PD) is a neurodegenerative disease of the basal ganglia that is associated with the perception of fatigue. Muscular fatigue is associated with a reduction in the number, average size and firing rate of activated motor units resulting in a shift in median frequency (MdF).

PURPOSE: The nature of PD-related fatigue is not well understood; therefore, the purpose of this study was to compare changes in MdF in people with PD to healthy young (YA) and healthy old adults (OA). We hypothesized that people with PD would exhibit less muscular fatigue than YA and OA.

METHODS: 16 people participated in the current study (8PD, 5YA, 5OA). Surface EMG was recorded from the vastus lateralis. An isokinetic dynamometer (Biodex System 3) was used to record isometric knee extension torques (MVIC) at 60° of knee flexion before (pre-) and after (post-) an isokinetic fatiguing knee extension protocol. The fatiguing protocol consisted of repetitions of maximal knee extension contractions (MVC) at 60°/sec until peak torque was reduced by 50% for three consecutive contractions. After fatigue was reached, the MVIC was repeated (post-). Torque and surface EMG data were recorded using Datapac 2K2 software (1000 Hz, RunTech). EMG signals were smoothed using the root mean squared with a 20 ms window. Mean EMG data were calculated during a 200 ms window (100 ms pre- and post-) surrounding the peak knee extension torque. EMG amplitude was normalized to peak mean EMG of the MVIC contraction. EMG median frequency (MdF) from the pre- and post-fatigue MVICs was calculated using customized software (MatLab 2010a). A repeated measures analysis of variance was used to determine the effect of fatigue on MdF. Alpha level was set at p<0.05.

RESULTS: YA produced significantly less torque after the fatiguing protocol (Pre: 118.9±15.7; Post: 96.9±13.5; p=0.040) while reductions in torque were not significant in OA (Pre: 83.9±10.0; Post: 80.2±9.1; p=0.16) or PD (Pre: 69.2±14.9; Post: 70.5±17.6; p=0.726). YA had a significantly greater decrease in median frequency (39 Hz) than OA (25 Hz, p=0.027) or PD (26Hz, p=0.028) groups with fatigue.

CONCLUSIONS: These data suggest that PD and OA do not deplete the muscle substrate and experience greater levels of central fatigue, while younger adults experience peripheral muscular fatigue due to substrate depletion.

2183 Board #229 MAY 31 8:00 AM - 9:30 AM
Analysis Of EEG In Movement Sciences: An Example On Treadmill Walking

Recent advances in technology offer the possibility to record electroencephalograms (EEG) not only during rest, but also during exercise. The use of active EEG electrodes combined with new decomposition and source localization techniques should allow for the assessment of brain activity during complex movements and moderate exercise.

PURPOSE: This study will give an overview of 2 new analysis techniques for EEG data, i.e., independent component analysis (ICA) and standardized low resolution electromagnetic tomography (sLORETA), recorded during exercise, in this case treadmill walking.

METHODS: Ten volunteers (28.2 ± 4.1 years) participated in this study. Thirty-two channel EEG data were recorded with active electrodes during 20 minutes of treadmill walking. EEG data were segmented into epochs of 1 gait cycle based on heelstrike. ICA was used to unmix the EEG signal in its constituent components and remove artifacts. Next, data were averaged to 1 movement-related cortical potential (MRCP) for each subject. The component and channel cross spectra of the MRCPs were also calculated. The averaged MRCPs and cross spectra for each subject were imported into sLORETA software in order to compute intracerebral sources of activity.

RESULTS: Artifactual components due to movement can successfully be removed through ICA. It also reveals the different components that constitute the MRCP. When comparing with seated rest, sLORETA shows the visual, prefrontal and premotor cortex, the supplementary motor area, the cingulate cortex, the primary somatosensory, somatosensory association and primary motor cortex to be significant sources (p<0.05) that contribute to the MRCP. Gait ERSPs (event-related spectral perturbations) revealed significant modulations of spectral power in the alpha, beta and gamma frequency bands (p<0.05) which seem to correspond to the phases of a gait cycle.

CONCLUSION: Techniques such as ICA and sLORETA offer the opportunity to study brain activity during moderate exercise. In this study, these techniques revealed a specific pattern of brain activity inherent to treadmill walking (i.e., MRCP), the sources underlying this MRCP (through sLORETA), the different components (through ICA) and the corresponding perturbations in spectral power.

2184 Board #230 MAY 31 8:00 AM - 9:30 AM
Acute Muscle Damage Induced by Eccentric Contractions Increases Corticospinal Excitability
Takashi Endoh1, Tsuyoshi Nakajima2, Azusa Uematsu1, Tetsuya Ogawa1, Kimitaka Nakazawa1. 1Ikueoka Gakuen University, Chiba, Japan. 2Research institute, National Rehabilitation Center for Persons with Disabilities, Saitama, Japan. 3Osaka University of Health and Sport sciences, Osaka, Japan. 4University of Tokyo, Tokyo, Japan.

Acute muscle damage induced by intense eccentric exercise affects not only muscle structure but also the central nervous system. For example, electromyographic (EMG) activity and force fluctuation increase immediately after eccentric exercise. However, the mechanisms that underlie this increased EMG activity and force fluctuation after eccentric exercise are unclear.

PURPOSE: The purpose of this study was to clarify the effects of muscle damage induced by eccentric contractions on corticospinal tract excitability.

METHODS: Eight healthy male volunteers (age range, 21-33 yrs) performed submaximal voluntary pincer grip contractions (5, 10, and 20% of maximal voluntary contraction [MVC]) before and 3 hours after eccentric exercise (ECC). ECC was performed using hand grip and continued until MVC decreased to 50%. Force fluctuation and background EMG activities in the first dorsal interosseous muscle (FDI) were measured during these voluntary contractions. To obtain a recruitment curve for the motor evoked potentials (MEP) in the left FDI, transcranial magnetic stimulation at a wide range of intensities (0.8-2.0 x threshold) was applied to the contralateral motor cortex innervating the left FDI during 10% maximal EMG before and 3 hours after ECC. The maximum MEP value, slope, and calculated threshold were assessed using the Boltzmann sigmoid function. Indirect markers of muscle damage, such as MVC and pressure-pain threshold, were measured before and after ECC.

RESULTS: Following ECC, MVC decreased to 75% of the pre-exercise value without muscle soreness. During submaximal voluntary contractions, EMG activity and force fluctuation were significantly higher after ECC than before ECC (p < 0.05). Maximum MEP and slope values increased significantly after ECC compared with those before ECC (p < 0.05). The calculated MEP threshold did not change before or after ECC. Discussion: These results suggest that muscle damage induced by ECC increased corticospinal excitability, which was seen at high stimulator output levels. This could be attributed to increased EMG activities and force fluctuation during voluntary contractions of damaged muscle.
A Dynamic Systems Analysis of Phase Shift Identification in Long Jump Performance: A Longitudinal Study

David A. Kinnunen, Dawn K. Lewis. CSU Fresno, Fresno, CA. (Sponsor: Catherine G. R. Jackson, FACSM)

Dynamic systems theory predicts shifts in skill performance when one or more control parameters is altered. Kinnunen & Lewis (2006) identified structural-maturational variables (SM) that predict standing long jump (SLJ) performance in children age 7, at peak height velocity (PHV) (12.1 ± 1.4 m), and two years post PHV (14.1 ± 1.6 m). Shifts in SLJ performance have not yet been described along with associated rate attractors and limiters.

PURPOSE: To identify phase shifts in SLJ performance at age 7, age at peak height velocity and 2 years post PHV and to identify rate attractors and limiters associated with peaks and deep wells in performance.

METHODS: 2188 Twenty individuals with CAI (13F, 7M, 20.9±1.5 yrs, 171.0±11.23 cm, 67.9±11.6 kg) and 15 healthy individuals (11F, 4M, 21.4±2.6 yrs, 169.8±9.8 cm, 70.2±12.3 kg) participated. Q angle was measured in standing and supine during quadriceps relaxed and isometric quadriceps contraction (100% maximum effort) conditions. 2 QA x 2 BP RM ANOVA for each gender were used to test Q-angle (p<.05).

RESULTS: Q angle decreased when standing and during maximum effort QA. Posthoc analyses of the QA X BP interaction for Q-angle of both genders revealed that the greatest difference among mean Q angles (females and males, respectively: 7.62°, 4.79°) occurred between standing-relaxed (17.8 ± 3.5°, 11.38 ± 1.6°) and supine-maximum QA (10.2 ± 2.5°, 6.59 ± 0.9°).

CONCLUSION: Regardless of gender, Q angle is affected by an interactive effect of BP with QA. Females were comparatively more sensitive to the interaction than males. Therefore, it is recommended that a standardized protocol for measuring Q-angle should take into account the QA and BP. Separate Q-angle norms may be needed for standing and supine testing protocols.

Effect of Body Position and Isometric Quadriceps Activation on Q-Angle

Rumit S. Kakar1, Kathy J. Simpson1, Sumit Kalra2. 1University of Georgia, Athens, Athens, GA. 2Banarsidas Chandiwala Institute of Physiotherapy, GGSIPU, New Delhi, India.

An abnormal Q angle is associated with an increased risk for developing patellar problems, e.g., patellar subluxation and chondromalacia patella. Moreover, females involved in activities that create high quadriceps force are more prone to lateral patellar dislocation than their male counterparts. Therefore, using the most valid and standardized measurement protocol is crucial to clinicians. However, factors that influence Q-angle outcomes are not well understood, potentially affecting values among differing protocols used.

PURPOSE: To determine if isometric quadriceps activation (QA) and body position (BP) affect Q angle.

METHODS: 60 subjects (30 females, 30 males), 23 ± 3 yr participated. Q angle was measured in standing and supine during quadriceps relaxed and isometric quadriceps contraction (100% maximum effort) conditions. 2 QA x 2 BP RM ANOVA for each gender were used to test Q-angle (p<.05).

RESULTS: Q angle decreased when standing and during maximum effort QA. Posthoc analyses of the QA X BP interaction for Q-angle of both genders revealed that the greatest difference among mean Q angles (females and males, respectively: 7.62°, 4.79°) occurred between standing-relaxed (17.8 ± 3.5°, 11.38 ± 1.6°) and supine-maximum QA (10.2 ± 2.5°, 6.59 ± 0.9°).

CONCLUSION: Regardless of gender, Q angle is affected by an interactive effect of BP with QA. Females were comparatively more sensitive to the interaction than males. Therefore, it is recommended that a standardized protocol for measuring Q-angle should take into account the QA and BP. Separate Q-angle norms may be needed for standing and supine testing protocols.

The Effects of Visual-perception on Evasive Sidestepping: Implications for Anterior Cruciate Ligament Injury Prevention

Marcus Lee, Brendan Lay, David Lloyd, Paul Bourke, Jacqueline Alderson. The University of Western Australia, Perth, Australia. (Sponsor: Sports Medicine Australia, FACSM)

PURPOSE: Sidestepping (SS) to evade opponents in sports can result in non-contact anterior cruciate ligament (ACL) injuries. Although SS in response to different simple visual stimuli has been studied previously, it has never been investigated using “game-realistic” visual conditions. This study compared the biomechanics of high-level (HL) and low-level (LL) soccer players performing the SS tasks. Participants sidestepped in response to an arrow-planned condition (AP), arrow-unplanned condition (AUNP), one-defender scenario (1DS) and two-defender scenario (2DS). Temporal constraints imposed by the stimulus conditions increased in difficulty from the AP, 1DS, 2DS to the AUNP. A biomechanical model was used to investigate peak lateral trunk flexion and knee valgus loading during stance phase of the sidestep. Knee muscle activation measured during pre-contact and weight-acceptance phase was used to create flexor-extensor co-contracting ratios. Dependent variables were submitted to a 4 x 2 (stimulus x skill) mixed design ANOVA.

RESULTS: Stimuli significantly affected all measurements (p < 0.05). The trunk was most upright in the AP and approximately 4° more laterally flexed in the other conditions. Knee valgus moments were lowest in the AP, increased by 40% in the defender scenarios and 70% in the AUNP. In the 2DS, the shift from a flexor-dominant co-contraction strategy in pre-contact toward extensor dominance in weight-acceptance commenced earlier for the HL players compared with the LL players. HL players also exhibited lower knee valgus moments in the 2DS.

CONCLUSION: Compared with the arrow conditions, SS in response to the game-realistic defender scenarios resulted in different mechanics, which further differentiated between HL and LL players in the complex 2DS. These findings highlight the importance of stimuli realism and complexity, and the visual-perceptual contribution toward SS, which has implications for ACL injury prevention.

The Relationship Between Ankle Laxity and Tibialis Longus Spinal Reflex Excitability

Michelle M. McLeod, Brian G. Pietrosimone, Phillip A. Gribble. University of Toledo, Toledo, OH.

Ankle sprains are the most prevalent lower extremity injury in sport, and a risk factor for the development of chronic ankle instability (CAI). CAI is contributed to by mechanical and functional factors, such as ligamentous laxity, and neuromuscular alterations, respectively. While mechanical and functional factors individually contribute to CAI, the extent of their influence on each other is not well understood. The relationship between neuromuscular function and ankle laxity has not been determined in patients with CAI.

PURPOSE: To determine the relationship between mechanical and functional contributions to CAI measured through inversion-eversion (IE) laxity and spinal reflex excitability (SRE) of the tibialis longus (TL) muscle.

METHODS: Twenty individuals with CAI (13F, 7M, 20.9±1.5 yrs, 171.0±11.23 cm, 67.9±11.6 kg) and 15 healthy individuals (11F, 4M, 21.4±2.6 yrs, 169.8±9.8 cm, 70.2±12.3 kg) participated. IE laxity was quantified using an ankle arthrometer. SRE was assessed via the Hoffmann reflex (H-reflex). Maximum H-reflex was determined by peak-to-peak amplitude. The stimulus was increased until a maximal muscle response (M-wave) was elicited. H-reflexes were normalized to the M-wave (H/M ratio), which has been reported to denote SRE of the motor neuron pool, with larger values indicating greater excitability. A separate nonparametric Spearman rank order correlation was used to determine the relationship between laxity and excitability. Alpha level was set a-priori P ≤ 0.05.
RESULTS: The CAI group displayed a significant moderate correlation between laxity (44.24° ± 15.97°) and SRE (29.8 ± 19.3; p=0.043; P=0.040). No significant correlation was found in the healthy group (43.27° ± 20.17°, 26.1 ± 20.4; p=0.032; P=0.099).

CONCLUSION: The positive moderate correlation between laxity and SRE indicates that FL. SRE is increased in patients with greater IE laxity. It is possible that as IE laxity increases, reflexive excitability of the FL is up-regulated in an attempt to prevent an inversion injury. Continued research should examine if increased SRE may be part of a more sophisticated motor control strategy attempting to compensate for increased IE ankle laxity. ACKNOWLEDGEMENTS: The authors would like to acknowledge the University of Toledo Interdisciplinary Grant for funding this project.

2189 Board #235 MAY 31 8:00 AM - 9:30 AM
Within And Between Session Reliability Of The Maximal Voluntary Knee Extension Torque And Activation
Adnan C. Squires, Jihong Park, David H. Chinn, Dennis L. Eggett, J Ty Hopkins, FACSM. Brigham Young University, Provo, UT.
(No relationships reported)

PURPOSE: Calculation of central activation ratio (CAR) has been widely used to assess central activation failure. To date no data exist regarding the intersesession reliability of this measurement. To report within and between session reliability and the standard error of measurement (SEM) of quadriceps maximal voluntary knee extension torque and activation.

METHODS: Thirteen, neurologically sound volunteers (9 males and 4 females, age: 21.9±3.2 year, height: 1.73±0.1 m, mass: 76.6±10.1 kg) underwent three testing sessions with 48 hours between sessions. To obtain knee extension torque, subjects performed maximal voluntary isometric contraction (MVIC) of the quadriceps with the knee locked at 90° of flexion and the hip at 85°. Once the knee extension torque reached a plateau, an electrical stimulation (100 pulse/s, 600 µs pulse duration, 10 train in 100 ms duration, 125 V with peak output current 450 mA) was manually delivered and transmitted directly to the quadriceps via stimulating electrodes. This stimulation caused a transient increase of torque by recruiting any remaining muscle fibers or maximising the firing frequency of the quadriceps. CAR was calculated by dividing the MVIC by the sum of the torque generated by the MVIC and the superimposed burst (SIB) technique (CAR = MVIC / MVIC + SIB torque). Subjects performed three trials in each session. Means were calculated from three trials of each measurement. Intraclass correlation coefficient (ICC) within a session and between sessions were calculated using maximal MVIC torques and CAR values.

RESULTS: We found strong reliability in MVIC both within (ICC1,1 =0.96, ICC1,2 =0.97) and between session (ICC1,1 =0.91). CAR had moderate to weak reliability within a session(ICC1,1 =0.78, ICC1,2 =0.67) and weak in between session (ICC1,1 =0.63). SEM for MVIC and CAR within a session was 11.9 N·m and 0.03, respectively. SEM for MVIC and CAR between sessions was 17.7 N·m and 0.04, respectively.

CONCLUSIONS: Knee extension MVIC torque is very reliable both within and between measurement sessions. CAR had lower reliability within a session and between sessions compared with knee extension MVIC.

2190 Board #236 MAY 31 8:00 AM - 9:30 AM
Changes in Movement Patterns Following a Fatiguing Resistance Training Protocol
(No relationships reported)

PURPOSE: Resistance training has been found to have a multitude of benefits. However, when performed with short rest, resistance training can result in substantial fatigue, which may have a negative impact on exercise technique. The purpose of this study was to establish the effects that fatigue from resistance exercise has on joint biomechanics and therefore assess the potential consequences these changes might have.

METHODS: 14 men underwent a 3 dimensional analysis of 5 bodyweight squats using the flock of birds electromagnetic motion analysis system (Ascension technologies, Inc., Burlington, VT) before and after a highly fatiguing resistance training bout. The workout included barbell squat, barbell bench press and barbell deadlift performed at 75% 1RM with a descending pyramid of repetitions beginning at 10 and ending at 1 for all lifts. Peak angle, total angular displacement and displacement rate were assessed for knee flexion, trunk flexion, hip flexion, hip rotation and hip adduction.

RESULTS: Following a fatiguing resistance training workout, independent t-tests showed a significant decrease in peak angle for knee flexion (Pre: 120.28±11.93°, Post: 104.46±9.85°), hip flexion (Pre: -109.42±12.49°, Post: -95.8±12.30°) and hip adduction (Pre: -17.32±7.04°, Post: -10.44±6.7°). There was a significant reduction in angular displacement for knee flexion (Pre: 115.56±10.55°, Post: 103.35±10.49°), hip flexion (Pre: 97.94±10.69°, Post: 90.51±13.22°), hip adduction (Pre: 17.32±7.04°, Post: 11.89±4.34°) and hip rotation (Pre: 30.72±12.28, Post: 20.48±10.12). There was also a significant reduction in displacement rate for knee flexion (Pre: 2.20±0.20, Post: 1.98±0.20), hip flexion (Pre: 1.92±0.20, Post: 1.76±0.27), hip adduction (Pre: 0.44±0.17, Post: -0.31±0.17) and hip rotation (Pre: 0.59±0.23, Post: 0.38±0.21).

CONCLUSIONS: These findings indicate that resistance training combining high loads and short rest produce a substantial fatigue that results in significant changes in movement technique. Changes in movement technique have been associated with injury, therefore it is important for strength coaches to consider the effects that fatigue has on joint biomechanics to prevent possible injury.

2191 Board #237 MAY 31 8:00 AM - 9:30 AM
Effects Of Visual Biofeedback On Bilateral Force Symmetry In Sling Exercise Training
Yu-Lin You1, Shih-Ting Wang1, Chich-Haung Yang2, Lan-Yuen Guo1. 1Kaohsiung Medical University, Kaohsiung, Taiwan. 2Tzu-Chi University, Huilien, Taiwan.
(No relationships reported)

Deterioration of bilateral muscle activation symmetry may affect spinal stability, which has been associated with low back pain (LBP). Sling exercise training (SET) was often used to improve spinal stability; however the effect of visual biofeedback (VB) on bilateral force symmetry (BFS) still remained unknown.

PURPOSE: To confer the effects of the SET combined with VB on BFS between the LBP and control (CON) groups.

METHODS: 12 LBP (22.6±2.3 yrs) and 11 CON (22.6±2.1 yrs) subjects were recruited in this study. Two load cells were installed for quantifying the forces applied bilaterally accompanying with custom-designed VB software for BFS were added to the SET equipments. This study contained four movements (M1 to M4), and the test sequence of movements was randomized. M1 is downhill squat while kneeling on the bed with hands in the straps. M2 is lay supine with two legs in the straps and proceeded bridge exercise. M3 is lay prone with two legs in the straps and use the forearms to support the body. M4 is similar to M3, but it combined the knee flexion. 4 trails were collected in each movement, including two without visual biofeedback (NVB) and two with visual biofeedback (VB). Each movement was held for 15 seconds for each trial. The left-side applied force was divided by right-side to represent BFS, thus the ratio more close to 1 represent the better bilateral force symmetry.

RESULTS: In NVB condition, CON group (range from 1.10 to 1.20) had better BFS than LBP group (range from 1.12 to 1.27) for all 4 movements, but did not show the statistical difference. Comparing the difference in BFS between VB and NVB conditions, CON group exercise in M2 (1.10±0.03 vs. 1.06±0.02) and LBP group exercise in M1 (1.04±0.01 vs. 1.12±0.06), M2 (1.05±0.01 vs. 1.13±0.09) and M4 (1.10±0.08 vs. 1.19±0.11) showed significant improvement (P<0.05).

CONCLUSION: The CON group had a trend of better FS than LBP group. Exercising with VB improved BFS for LBP group significantly. ACKNOWLEDGEMENT: This study was supported by NSC 99-2622-B-037-001-CC3.

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2192  Board #238  MAY 31  8:00 AM - 9:30 AM
Effect of Acute Feedback on Landing Patterns in a Horizontal Land and Cut Maneuver
Sarah K. Leissring, Mitchell L. Stephenson, 1 Erich J. Petushek, 1 Bryanne Bellovay, 2 Alexander R. Wolfe, 2 Caitlin Glendenning, 2 Erika Purdy, 1 Bailey M. Hagner, 1 Randall L. Jensen, 2 FACSM. 1Northern Michigan University, Marquette, MI. 2Michigan Technological University, Houghton, MI.  

Anterior Cruciate Ligament (ACL) Injury prevention programs have assessed the effects of acute feedback on valgus angle and peak GRF in drop landing tasks. Knee valgus angle and peak ground reaction force (GRF) are two variables important to the mechanism and prevention of ACL injury. However, although studies have assessed effects of acute feedback on these two variables during drop jumps, studies have failed to study them during a cutting maneuver.

PURPOSE: To assess the effects of acute feedback on valgus angle and peak GRF during a horizontal land and cut maneuver.

METHODS: Nine division II women soccer players (Mean ± SD Age = 19.80 ± 0.63 years; Height = 163.86 ± 7.42 cm; Weight = 60.71 ± 6.88 kg) randomly performed 12 horizontal land and cut maneuvers, with 3 left cuts and 3 right cuts pre- and post-feedback. Feedback was based on script from previous studies as well as results from studies using the Landing Error Scoring System. A three-way repeated measures ANOVA was used to compare the differences in knee valgus angle and peak GRF. The independent variables were leg (preferred plant leg/preferred kicking leg), feedback (pre/post), and trial. Significance was set at p < 0.05.

RESULTS: Results of the three-way repeated measures ANOVA indicated significant main effects for valgus angle between the preferred plant leg/preferred kicking leg and pre/post-feedback. Values for the conditions were 13.80° ± 4.76° pre and 12.52° ± 4.79° post feedback for cuts on the preferred plant leg and 19.75° ± 4.07° pre and 18.34° ± 3.05° post feedback for cuts on the preferred kicking leg. There were no significant differences between trials and no significant interactions across conditions. There were no significant differences or interactions in GRF between legs, pre- and post-feedback, or trials. Values of GRF were 1068.25N ± 181.85N and 986.20N ± 159.32N pre- and post-feedback respectively for cuts on the preferred plant leg and 1126.81N ± 187.68N and 1073.76N ± 154.97N pre- and post-feedback respectively for cuts on the preferred kicking leg.

CONCLUSIONS: Knee valgus angle decreased with acute feedback while GRF were not affected by the same acute feedback given during a horizontal land and cut task. Therefore, acute feedback may be a useful tool for decreasing knee valgus angle during cutting tasks in ACL injury prevention programs.

2193  Board #239  MAY 31  8:00 AM - 9:30 AM
The Effects of Verbal Cuing on Muscle Coordination Patterns in the Step Up Exercise
Mischa U. Harris, 1 Darren E.R. Warburton, 2 James M. Wakeling, 2 1University of British Columbia, Vancouver, BC, Canada. 2Simon Fraser University, Burnaby, BC, Canada.  

In an effort to improve dysfunctional muscle activation patterns, clinicians often use verbal cues to guide differential muscle activation and joint positioning during rehabilitation. While verbal cuing has been shown to elicit changes in muscle recruitment patterns during single joint, open kinetic chain exercises, it is unknown what effect verbal cuing has on a multi-joint movement with increased degrees of freedom.

PURPOSE: To determine the effects of three different clinically common verbal behaviors on lower extremity muscle activation and coordination patterns during a step up exercise.

METHODS: Seven healthy males completed 1 un-cued control trial and 8 randomly assigned experimental trials after receiving cues to either preferentially recruit gluteal muscles, preferentially recruit vastus medialis, maintain hip and knee alignment or count backwards from a high number (distraction). Surface electromyograms (EMG) were recorded from the surface of seven muscles: vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF), semitendinosis, (ST) biceps femoris (BF), gluteus maximus (GMx), gluteus medius (G Md). EMG intensities were calculated using wavelet techniques. Muscle coordination patterns were then compared across trials using principal component analysis and repeated measures ANOVA with Tukey’s Post-hoc comparisons.

RESULTS: The gluteal and VM cue conditions were significantly different in comparison to the control, alignment and distraction conditions and also to each other (p<0.05). Both gluteal cues and VM cues elicited greater overall muscle activation and in particular greater ST and BF activity than the other conditions. The VM cue condition also showed greater VM, VL, RF, GMx and GMd activity and less ST and BF activity than the gluteal cue conditions.

CONCLUSION: Our results indicate that verbal cuing for preferential muscle recruitment can alter muscle coordination patterns in a step up exercise, but that the resulting changes do not represent the pattern that was cued. Verbal instructions to modify lower extremity alignment did not significantly change the coordination patterns compared to an un-cued control trial. Caution should be taken when attempting to use verbal cues to change muscle activation patterns. Supported by the BC Sports Med Research Foundation.

2194  Board #240  MAY 31  8:00 AM - 9:30 AM
Effect of Feedback on Peak Torque in a Female Population
Barbara L. Warren, FACSM, Nika Evans.  University of Puget Sound, Tacoma, WA.  

No relationships reported.

PURPOSE: The purpose of the study was to assess the effect of feedback on peak torque during isokinetic testing.

METHODS: Fourteen (7 athletes: mean age=20.7 years, height=178.5 cm, weight=74.7 kg; 7 non-athletes: mean age 20.0 years, height=168 cm, weight=64.1 kg) apparently healthy college-age females participated in the study. Each subject performed 2 familiarization and 4 experimental trials on a Cybex NORM isokinetic dynamometer. Each subject executed 10 reciprocal knee flexion/extension maximal contractions at velocities of 60 deg/s, 180 deg/s and 300 deg/sec with a 1 minute rest between velocity sets. Subjects were randomly assigned feedback conditions: none, visual, verbal, visual and verbal. A 2 (athlete or not) X 3 (velocities) X 4 (feedback conditions) repeated measures ANOVA (alpha <.05) was used to analyze the data.

RESULTS: For knee extension there were no significant interaction effects, but there were significant differences in the peak torque between velocities (F=574.8, p<0.0005). There were no significant differences in peak torque regardless of the feedback condition and no significant differences between athletes and non-athletes. For knee flexion, there was a significant interaction between velocity and athlete (F=6.755, p<.002), and a significant difference in peak torque by velocity (F=284, P<0.0005). Additionally, there was a significant difference in knee flexion peak torque between athletes and non-athletes (F=4.882, p<.032), but no significant difference in peak torque by feedback condition.

CONCLUSIONS: Feedback conditions did not affect peak torque in this population of females. Supported by Math and Science Summer Research Funds

2195  Board #241  MAY 31  8:00 AM - 9:30 AM
Impact of Instructor Cues on Changes in Cycling Form during a Spin Class
Jacilyn Olson, Ashley Bins, Jennifer Bliss, Addie Swyden, Michelle Gray, Ro Di Brezzo.  University of Arkansas, Fayetteville, AR.  (Sponsor: Barry Brown, FACSM)  

No relationships reported.

Many people attend group fitness classes as their regular mode of exercise; however, proper form may not be consistently emphasized in these classes. In spin classes, form is especially important due to the repetitive nature of the movement putting those with improper technique at increased risk of injury.

PURPOSE: The purpose of this study was to examine the impact of instructor cues on joint angle changes and rating of perceived exertion (RPE) during a spin class.

METHODS: Fifteen participants (8M, 7F) of various cycling backgrounds participated with mean (± SD) age, height, and weight of 22.6 ± 5.07 yr., 1.73 ± 0.10 m, and 66.94 ± 12.03 kg, respectively. Informed consent was obtained and reflective markers placed on the right and left sides of the body over anatomical landmarks aligned with lower and upper limb joint centers. The spin bike was set for individual comfort and was consistent for each trial. Each participant completed two testing sessions at least one week apart; order was randomized. During each session participants cycled following instructions from a recorded spin class (55 minutes). The two testing videos were exactly the same, except one version included instructor cues about proper form, while the other did not. Two video cameras were used to observe sagittal and frontal angles. Video of each participant was recorded at three 10-second periods during the class; the
beginning, middle, and end. Joint angles of interest were elbow, hip, knee, ankle, spine, and shoulders. Motion analysis software was used to calculate joint angles via inverse dynamics. A repeated measures MANOVA was used to analyze joint angles and RPE.

RESULTS: The MANOVA revealed a significant change in the group of variables throughout the course of the spin class ($F = 843.52, p < .001$). The overall measures of interest were not influenced by instructor cues ($F = 0.00, p = .99$). Significant joint angle changes were found at the hip ($F = 7.30, p = .02$) and left shoulder ($F = 7.40, p = .02$). RPE significantly increased as the class progressed ($F = 41.11, p < .001$).

CONCLUSIONS: Contrary to our hypothesis, instructor cues did not influence changes in joint angles during a spin class; class duration appeared to be more influential. The biomechanics of spin classes should continue to be studied, especially in regards to maintaining form throughout the classes.

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**2196 Board #242 May 31 8:00 AM - 9:30 AM**

The Reliability Of Percent Voluntary Activation During Submaximal And Maximal Isometric Muscle Actions.

Michael Cooper1, Ashley Walter2, Pablo Costa3, Eric Ryan4, Joel T. Cramer, FACSM5, Trent Herda1. 1University of Kansas, Lawrence, KS. 2University of Oklahoma, Norman, OK. 3California State University, San Bernardino, CA. 4University of North Carolina, Chapel Hill, NC. 5Oklahoma State University, Stillwater, OK.  
Sponsor: Joel T. Cramer, FACSM

(No relationships reported)

The interpolated twitch technique is a popular method used to assess percent voluntary activation (%VA) during submaximal and maximal isometric muscle actions, however, there is limited knowledge on the reliability of this technique at different contraction intensities.

PURPOSE: The purpose of this study was to examine the test-retest reliability of the %VA versus force relationships.

METHODS: Fourteen healthy men (mean±SD age=21±2.6 yrs) and 8 women (age=21±1.8 yrs) completed four maximal voluntary contractions and nine randomly-ordered submaximal isometric plantar flexions from 10 to 90% of the MVC. Transcutaneous electrical stimuli were delivered to the tibial nerve using a high-voltage constant-current stimulator (Digitimer DS7AH, Berhfordshire, UK) during two of the four MVC’s and during all submaximal isometric plantar flexions. Submaximal isometric step contraction percentages were calculated from the higher of the two initial MVCs that were performed without the transcutaneous electrical stimuli. Doublets were administered at a supramaximal stimulus intensity during the maximal and submaximal MVC plateau and then again 3-5 s after the maximal and submaximal MVC at rest. %VA was calculated for each maximal and submaximal MVC. The intraclass correlation coefficients (ICCs) and standard errors of measurements expressed as a percentage of the mean (%SEMs) were used for test-retest reliability, while paired samples t-tests were used to test the data.

RESULTS: Systematic variability was not present at any of the contraction intensities ($p > .05$). The ICCs ranged from 0.52 to 0.84, while the %SEMs ranged from 6.75 to 38.45%. The ICCs for %VA were 0.52 to 0.84 at contraction intensities ranging from 40% MVC (6.75 to 16.78% SEM), while the ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM). The ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM), while the ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM). The ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM). The ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM). The ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM). The ICCs were ≤ 0.74 at contraction intensities ranging from 40% to 100% MVC (6.75 to 16.78% SEM).

CONCLUSIONS: Although not statistically tested, the ICCs tended to be higher, while the %SEMs lower for contractions ≥ 40% MVC (Table 1). Future research in assessing muscle activation or predicting the true maximal force from the %VA versus force relationships may want to exclude contractions intensities below 40% MVC.

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**2197 Board #243 May 31 8:00 AM - 9:30 AM**

Quadriceps Strength and Corticospinal Excitability as Predictors of Disability Following Anterior Cruciate Ligament Reconstruction

Adam S. Lepley, Hayley M. Erickson, Jason Levine, Phillip A. Gribble, Brian G. Pietrosimone. University of Toledo, Toledo, OH.

(No relationships reported)

Disability is common in a proportion of patients following anterior cruciate ligament reconstruction (ACLr). Neuromuscular quadriceps deficits are a hallmark impairment following ACLr, yet the link between self-reported disability and quadriceps muscle dysfunction is not clearly understood.

PURPOSE: To evaluate the ability of a clinical measure of neuromuscular function, quadriceps strength, and corticospinal excitability to predict self-reported disability in patients with ACLr.

METHODS: Fifteen participants with a history of ACLr (11 Female, 4 Male; 172±9.8cm, 70.4±17.5kgs, 54.4±40.9 month post-surgery) whom had been medically cleared to fully participate in physical activity were examined. Quadriceps strength was assessed via maximal voluntary isometric contractions (MVIC) performed at 90° of knee flexion. Corticospinal excitability was assessed with active motor thresholds (AMT), which were elicited by stimulating specific areas on the motor cortex using Transcranial Magnetic Stimulation (TMS). AMT's were measured during a standardized contraction at 5% of an MVIC. A multiple linear regression model was used to determine the ability of strength and corticospinal excitability of the involved limb to predict disability measured with the International Knee Documentation Committee (IKDC) index score. The change in R2 to the model from the addition of each predictor variable was also analyzed.

RESULTS: The overall multiple regression model significantly predicted 66% of the variance in self-reported disability as measured by the IKDC ($R^2 = 0.66, P=0.01$; IKDC=.78MVIC -.24AMT +58.89). Initial imputation of MVIC into the model accounted for 61% ($R^2=0.61, P=0.01$) of the variance in IKDC. The subsequent addition of AMT in the model accounted for an insignificant increase of 5% ($R^2 = 0.05, P=0.19$) in the prediction capability of the model.

CONCLUSION: Quadriceps strength and corticospinal excitability predicted two-thirds of the variance in disability of patients with ACLr, yet, strength solely accounted for a significant portion of the predictive capability of the model. Maintaining quadriceps strength following ACLr may substantially influence patient’s perception of disability, however the impact of corticospinal excitability on both strength and disability remains unclear.

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**2198 Board #244 May 31 8:00 AM - 9:30 AM**

Does Gait Retraining To Decrease Vertical Loads Reduce Bony Loads In Runners?

Rebecca E. Fellin1, Irene S. Davis, FACSM2. 1University of Delaware, Newark, DE. 2Harvard Medical School, Boston, MA.

(No relationships reported)

In runners, tibial stress fractures (TSF) most often occur between the midshaft and distal third of the tibia. TSF incidence has been linked to excessive impact loads including tibial shock (TS) and vertical load rate (VALR). Gait retraining to decrease initial impacts has been demonstrated to reduce TS, as well as the VALR of the ground reaction force. However, external loads do not directly indicate loads within the tibia. These bony loads are the ones that need to be decreased to reduce injury risk.

PURPOSE: To assess tensile strain rates (TSR) and compressive strain rates (CSR) from the midshaft to the distal third of the tibia following gait retraining. We hypothesized that these tibial strain rates would decrease following gait retraining.

METHODS: To date, 5 subjects (32.2 ± 2.9 yr), running > 10 mil/wk, with high TS (>8 g’s) were recruited. They completed 8 sessions of gait retraining, which consisted of real-time visual feedback of their TS. Tibial joint contact force was calculated from a musculoskeletal model and input into a finite element model. Tibial peak principal strain rates were then calculated. VALR, TS, TSR and CSR were compared pre and post retraining. Due to the small n, data were analyzed descriptively.

RESULTS: TS decreased by 23-65% (F1 and all values of TS were within the normal range following gait retraining. 4/5 runners decreased TSR and CSR in the region of interest by 4-45% (F1). Although bony loads generally decreased, the changes were not tightly coupled with external load reductions.

CONCLUSION: External and bony loads appeared to decrease post gait retraining. These preliminary results suggest that reducing excessive external vertical loads may result in decreased tibial strain rates and TSF risk in runners.
Older adults adopt altered neuromuscular strategies to complete activities of daily living. One adaptation includes increased levels of agonist-antagonist muscle coactivation. It has been proposed that older adults increase coactivation to improve stability in response to losses in muscle mass associated with advancing age. However, no previous investigation has directly assessed the relationship between muscle mass and coactivation ratio (CAR).

**PURPOSE:** The purpose of this study was to examine the relationship between lean mass (LM) and muscle coactivation ratio. It was hypothesized that a negative correlation would exist between LM and CAR for the young adults (YA) and old adults (OA).

**METHODS:** Ten YA and 10 OA participated in this study. Age (YA: 22.9±1.4 yrs; OA: 60.9±3.1 yrs), height, mass, and LM (YA: 59.3±14.2 kg; OA: 40.7±6.6 kg) were recorded from each participant. Five downward stepping trials were performed by each participant while surface EMG (2000 Hz) was collected from the vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA) and the gastrocnemius (LG) of the right lower extremity. EMG data were then smoothed and rectified using root mean squared (RMS) with a 20ms smoothing window. The mean RMS value over the stance phase was calculated for each muscle and normalized to the peak value for each muscle across all trials of that subject. CAR at the knee and ankle were calculated as the quotient of the BF divided by the VL and the TA divided by the GM, respectively. A correlation analysis was conducted to examine the relationship between lean mass and CAR. An analysis of variance (ANOVA) was used to determine differences in CAR, total mass and LM. Alpha level was set at p<0.05.

**RESULTS:** OA had significantly less LM than YA (OA: 40.7±6.6; YA: 59.3±14.2; p=0.001). YA and OA adults exhibited similar CARs at the knee (OA: 0.6±0.21; YA: 0.3±0.21; p=0.025). Though no statistical comparison was made in the correlation analysis, young and old adults exhibited opposite relationships between LM and CAR at the knee.

**CONCLUSIONS:** These data suggest that the altered neuromuscular activation patterns in old adults are not solely the result of declines in the mechanical capacity of leg muscles.

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**Board #245**

**MAY 31 8:00 AM - 9:30 AM**

**Relationship between Lean Mass and Coactivation during Downward Stepping with Advancing Age**

Heidi Bastin1, Douglas Renshaw1, Nicholas I. Hanson2, Matthew R. Bice3, Michael J. Ryan4, Paul D. Reneau5, James Eldridge5, Douglas W. Powell1, 1Fairmont State University, Fairmont, WV. 2The Ohio State University, Columbus, OH. 3Southern Illinois University, Carbondale, IL. 4University of Texas of the Permian Basin, Odessa, TX.

(No relationships reported)

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**Board #246**

**MAY 31 8:00 AM - 9:30 AM**

**Eccentric Muscle Activation Patterns During a Five-time-sit-to-stand Movement**

Bradley S. Davidson1, Dana L. Judz1, Abby C. Thomas2, Jennifer E. Stevens-Lapsey1. 1University of Denver, Denver, CO. 2University of Colorado Anschutz Medical Campus, Aurora, CO. (Sponsor: Catherine M. Jankowski, FACSIM)

(No relationships reported)

Muscle dysfunction is common in patients with end-stage osteoarthritis (OA) and is exacerbated following total knee arthroplasty (TKA). This dysfunction may be problematic during eccentric tasks in which the knee extensors encounter compound duties: absorbing force and maintaining knee stability.

**PURPOSE:** To examine knee muscle coactivation, individual muscle activity, and associated ground reaction force (GRF) production in healthy participants and TKA patients during the eccentric phases of a five-time-sit-to-stand movement (FTSTS).

**METHODS:** Participants (n=20; age 24.1±1.6 yrs) performed FTSTS before and after TKA. Healthy participants (HP; n=9; age 61.6±9.9 years) performed FTSTS on one occasion. Electromyography (EMG) from vastus lateralis (VL), Vastus Medialis (VM), biceps femoris (BF), and tibialis anterior (TA) and the gastrocnemius (LG) were recorded from each limb. EMG data were analyzed using two-way ANOVAs and Tukey HSD for post hoc comparisons.

**RESULTS:** OA had significantly less LM than YA (OA: 40.7±6.6; YA: 59.3±14.2; p=0.001). YA and OA adults exhibited similar CARs at the knee (OA: 0.6±0.21; YA: 0.3±0.21; p=0.025). Though no statistical comparison was made in the correlation analysis, young and old adults exhibited opposite relationships between LM and CAR at the knee.

**CONCLUSIONS:** These data suggest that the altered neuromuscular activation patterns in old adults are not solely the result of declines in the mechanical capacity of leg muscles.
An overshoot (OS) in skeletal muscle deoxygenation dynamics during constant work-rate exercise is seen in pathologies where O$_2$ delivery is limited (Diederich et al., Circulation Research, 2002). Such a transient reduction in O$_2$ is expected to limit the maximum rate of capillary-to-myocyte O$_2$ diffusion. Whether this limitation is sufficient to slow O$_2$ uptake (VO$_2$) kinetics, however, is currently unclear.

PURPOSE: To determine the relationship between VO$_2$ kinetics and absolute skeletal muscle deoxygenation during reductions of inspired O$_2$ to attenuate O$_2$ delivery.

METHODS: Seven healthy males performed repeats of 8 min cycle ergometry from 5 W to 80 W lactate threshold in normoxia (N, F$\text{O}_2$=0.21), moderate hypoxia (MH, 0.16) and severe hypoxia (SH, 0.12). VO$_2$ was measured breath-by-breath (Minato Medical AE-300S). Deoxy-(hemoglobin+myoglobin) (HHb) dynamics were measured from rectus femoris and vastus lateralis us quantitative, time-resolved, near-infrared spectroscopy (Hamamatsu TRS-20), and corrected for adipose thickness.

RESULTS: The phase II VO$_2$ time constant (τ) was slowed (p = 0.02) as F$\text{O}_2$ decreased (N, 17 ± 3 (mean ± SD); MH, 22 ± 4; SH, 29 ± 9 s). The resting and baseline HHb increased (p = 0.03) as F$\text{O}_2$ decreased, and ΔHHb (end-exercise - baseline) was greater (p = 0.01) in SH (24 ± 13 μM) than N (16 ± 8 μM) and MH (18 ± 10 μM). There was no relationship between the increase in rVO$_2$ in hypoxia and relative OS incidence (N, 38 ± 6 μM); MH, 52 ± 7; SH, 43 ± 2; p < 0.01; p = 0.95), or OS area (r$^2$ = 0.04; p = 0.49), but the increase in rVO$_2$ was positively related to the increase in peak HHb (r$^2$ = 0.46; p < 0.01).

CONCLUSIONS: An overshoot in muscle deoxygenation in heart failure (Sperandio et al., AJP, 2009) or pulmonary arterial hypertension (Barbosa et al., EJAP, 2011) is suggested to reflect a mismatch in O$_2$ delivery-to-utilization that contributes to slowing VO$_2$ kinetics. While the peak HHb during the transient was related to slowed VO$_2$ kinetics in hypoxia, the OS incidence and OS area were not. This suggests that an overshoot in HHb per se is not evidence of a capillary-myocyte O$_2$ diffusion limitation to VO$_2$ kinetics. Rather, the absolute peak HHb (specifically, a reflection of a low capillary O$_2$) during the transient determined by quantitative NIRS may be a better index of an O$_2$ delivery limitation to VO$_2$ kinetics.

Supported by BBSRC, UK: BB/I00162X/1.

C-35 Free Communication/Poster - Oxygen Uptake Kinetics

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

2202 Board #428  MAY 31  9:00 AM - 10:30 AM

A Dynamic Overshoot In Skeletal Muscle Deoxygenation Is Not Evidence Of A VO2 Kinetic Limitation

T Scott Bowen1, Harry B. Rossiter, FACSM1, Alan P. Benson1, Tatsuro Amano2, Narihiko Kondo3, John M. Kowalchuk4, Shunsuke Koga5. 1University of Leeds, Leeds, United Kingdom. 2Kobe University, Kobe, Japan. 3The University of Western Ontario, London, ON, Canada. 4Kobe Design University, Kobe, Japan.

No relationships reported

Sprint interval training has been shown to improve skeletal muscle oxidative capacity, maximal oxygen uptake and insulin sensitivity, and reduce postprandial triglycerides.

PURPOSE: To determine the oxidative uptake and related cardiorespiratory responses and associated energy expenditure during an acute bout of sprint interval cycling (SIC).

METHODS: Twelve healthy, college-aged subjects, 6 men and 6 women, completed 2 SIC sessions with at least 7 d between trials. SIC was performed on a mechanically-braked cycle ergometer and involved a 5-min warm-up followed by four 30-s all-out sprints with 4 min active recovery. Work performed was quantified using an optical sensor to measure flywheel revolutions. Oxygen uptake was measured continuously by open-circuit spirometry during the last minute of warm-up and throughout the SIC session. The energy expenditure during each sprint was based on the estimated anarobic energy contribution to the sprints and the net aerobic energy calculated from measured oxygen uptake above rest.

RESULTS: The average work performed decreased during the four sprints for males (19.3 ± 2.7, 17.5 ± 3.5, 16.2 ± 4.0, and 14.3 ± 6.0 kJ) and females (11.6 ± 1.4, 11.1 ± 1.5, 10.6 ± 1.5, and 10.6 ± 1.9 kJ). Percent fatigue increased from sprint 1 to sprint 4 (29.8 ± 11.8, 34.6 ± 15.8, 38.5 ± 17.7, and 38.5 ± 17.7). Average aerobic, anaerobic, and total energy expended during the 18 min necessary to complete the SIC session were 130.8 ± 31.5, 72.6 ± 8.3, and 203.4 ± 38.2 kcal for males and 108.1 ± 16.9, 47.6 ± 6.4, and 155.7 ± 21.3 kcal for females. Peak oxygen uptake (ml/kg/min) during the 4 sprints was 35.3, 38.8, 38.8, and 36.8. Peak heart rate (bpm) during the 4 sprints were 164, 172, 177, and 175. Peak minute ventilation (L/min) during the 4 sprints were 75, 102, 107, and 101.

CONCLUSIONS: An acute bout of SIC elicits submaximal oxygen uptake and cardiorespiratory responses during each interval that approximates ~80% of estimated maximal values. The energy expended is much lower than that expended in moderate-intensity aerobic exercise training programs shown to improve aerobic capacity and insulin sensitivity, and reduce postprandial triglycerides, signifying the importance of the high-intensity nature of the exercise.

2203 Board #429  MAY 31  9:00 AM - 10:30 AM

Physiological Responses to an Acute Bout of Sprint Interval Cycling

Eric C. Freese, Nicholas H. Gist, Kirk J. Cureton, FACSM. University of Georgia, Athens, GA.

No relationships reported

Optimising And Validating A Computational Model Of The Influence Of Circulatory Dynamics On VO2 Kinetics

Alan P. Benson1, Bruno Grassi2, Harry B. Rossiter, FACSM1. 1University of Leeds, Leeds, United Kingdom. 2Università degli Studi di Udine, Udine, Italy.

No relationships reported

The dynamics of the circulation can dissociate muscle (VO$_{2m}$) and alveolar (VO$_2$A) O$_2$ uptake kinetics. Computational models to investigate this (e.g. Rossiter & Benson, MSSE 42:25-, 2010) are yet to be directly validated against experimental data, and the influence of the structural organisation of the venous vascular compartments on these kinetics has yet to be determined.

PURPOSE: To optimise and validate a computational model linking muscle and lung gas exchange kinetics, using simultaneously-measured VO$_{2m}$, muscle blood flow (Q$m$) and VO$_2$A from six healthy male subjects during moderate-intensity exercise.

METHODS: VO$_{2m}$ (by direct Fick) and Q$m$ (by thermodilution) were measured on transition from unloaded to 183 ± 20 W cycle ergometry (published in Grassi et al., JAP 80:988-, 1996). Baselines, steady-states and time constants (τ) for VO$_{2m}$ and Q$m$ were used as inputs for a model with a single 3 L venous volume (SCM; as in Barstow et al, JAP 68:979-, 1990) and an optimised multi-compartment model (MCM) with volumes draining the exercising muscle, the rest of the body, and a volume carrying mixed-venous blood to the lung. Error between model-predicted and experimental breath-by-breath VO$_{2m}$ was calculated as the sum of absolute differences in time delay (TD) and phase θ.

RESULTS: Experimentally-measured VO$_2$A kinetics were (mean ± SD): TD = 17.5 ± 1.8 s; θ = 18.7 ± 4.2 s. The SCM gave an error of 8.2 ± 9.6 s (TD = 16.6 ± 0.9 s; θ = 21.4 ± 12.2 s). With the MCM, separate muscle, body and mixed-venous volumes of 0.8 ± 0.7, 0.6 ± 1.1 and 1.7 ± 1.0 L respectively (total venous volume = 3.1 ± 1.0 L) improved predictions for TD (17.4 ± 1.9 s) and θ (20.9 ± 10 s) and significantly reduced error to 5.1 ± 7.6 s compared to SCM (paired t-test, p = 0.02).

CONCLUSIONS: These data validate a computational model linking the kinetics of VO$_{2m}$ and VO$_2$A against experimental measurements. Distributing blood between three venous vascular compartments significantly improved the accuracy with which the model reproduced experimentally-determined VO$_2$A kinetics, suggesting that both the structure and dynamics of the circulation should be accounted for when interpreting the pulmonary expression of VO$_2$m dynamics.

Supported by BBSRC, UK: BB/I00162X/1.
**Conclusion:**

Ventilatory dynamics during exercise are modified by obesity. Replacement of nitrogen by helium in inspired gas reduces the work of breathing.

**Purpose:**

To determine, in obese adolescents (OB), if respiratory muscles unloading via helium-\(\text{O}_2\) breathing would reduce the amplitude of the "slow component" of pulmonary \(\text{O}_2\) uptake (\(\text{VO}_2\)) kinetics and increase exercise tolerance.

**Methods:**

Seven male OB (age 16.7 ± 1.4 [x ± SD] years, body mass 101.5 ± 9.0 kg, body mass index 32.4 ± 4.7 kg/m\(^2\)) were evaluated. Experiments were conducted with subjects inspirating room air (CTRL) and a 21% \(\text{O}_2\) -79% helium mixture (HE). Two exercise protocols were performed on a cycle ergometer: an incremental exercise (for the determination of maximal \(\text{VO}_2\) and the gas exchange threshold [GET]), and a 12-min constant-load exercise (for \(\text{VO}_2\) kinetics analysis) at a work rate (122.6 ± 14.8 watt) corresponding to 120% of GET determined in CTRL.

**Results:**

A slow component of \(\text{VO}_2\) kinetics, with an amplitude constant corresponding to 10.2 ± 3.5% of the total amplitude of the \(\text{VO}_2\) response, was observed in CTRL; the amplitude was significantly lower in HE (1.3 ± 3.4%). The lower amplitude of the slow component in HE was associated with: lower heart rate (165.0 ± 13.5 b/min in CTRL vs. 158.0 ± 14.5 in HE); lower "gain" of the \(\text{VO}_2\) response (Delta \(\text{VO}_2\)/Delta work rate: 16.1 ± 1.0 mL/min/watt in CTRL vs. 14.2 ± 1.3 in HE); lower gas exchange ratio (0.93 ± 0.05 in CTRL vs. 0.89 ± 0.09 in HE); lower rates of value of perceived exertion for dyspnea/respiratory discomfort (6.4 ± 1.0 in CTRL vs. 3.9 ± 0.7 in HE) and for "leg effort" (7.5 ± 1.6 in CTRL vs. 5.4 ± 1.3 in HE).

**Conclusion:**

Respiratory muscles unloading via helium-\(\text{O}_2\) breathing determined, in obese adolescents, the virtual abolishment of the slow component of pulmonary \(\text{VO}_2\) kinetics during constant work rate exercise at 120% of GET, and clear signs of increased exercise tolerance. Respiratory muscles training may represent an option for increasing exercise tolerance in obese patients.

Supported by: Progetti di Ricerca Corrente, Italian Institute for Auxology (Milan).

**Board #252**

**MAY 31  9:00 AM - 10:30 AM**

**ATP Turnover And The Coupling Of Mitochondrial Oxidative Phosphorylation During Dynamic Exercise In Humans**


**Methods:**

During constant work rate (CWR) exercise above the lactate threshold (LT), the kinetics of oxygen uptake (\(\text{VO}_2\)) are supplemented by the \(\text{VO}_2\) slow component (\(\text{VO}_2\)sc), reflecting reduced work efficiency. The majority of the \(\text{VO}_2\)sc originates from the active locomotor muscles, yet the intracellular source of inefficiency is less clear. An increase in the \(\text{ATP}\) cost of power production (P/W) has been postulated, rather than a change in the \(\text{O}_2\) cost of resynthesis (P/\(\text{O}_2\)).

**Purpose:**

To determine ATP turnover rate during sub- and supra-LT CWR exercise in humans.

**Results:**

During MOD there was no discernable \(\text{VO}_2\)sc (0.07 ± 0.15 L/min). Conversely, during HVY the \(\text{VO}_2\)sc was larger (p<0.05) at 0.32 ± 0.11 L/min compared to MOD (18.6 ± 11.7 vs. 15.3 ± 8.02 mM.min\(^{-1}\); p<0.21), but increased between 3 and 8 min of HVY (24.1 ± 13.1 vs. 28.3 ± 9.46 mM.min\(^{-1}\); p<0.098; 17.0 ± 22.0 %). However, \(\Delta\text{ATP}_p\) was not related to the \(\text{VO}_2\)sc during HVY (r = 0.2; p>0.6). Three of seven participants exhibited a non-linear \(\text{PCR}/\text{VO}_2\) relationship.

**Conclusions:**

The rate of ATP turnover increased between 3 and 8 min of supra-LT, but not sub-LT, exercise. Importantly, this conclusion was reached without assumptions of intramuscular \(\text{PCR}/\text{VO}_2\) or \(\Delta\text{ATP}_p/\text{VO}_2\) relationships. However, the poor correlation between \(\Delta\text{ATP}_p\) and the \(\text{VO}_2\)sc suggests that reduced work efficiency in HVY exercise is not wholly consequent to augmented P/W, but that reductions in P/W may also contribute.

Supported by the BBSRC UK BB/K001625X/1.

**Board #253**

**MAY 31  9:00 AM - 10:30 AM**

**Acute Metabolic Responses during Postprandial Exercise of Incremental Intensity**

Jie Kang, FACSM, Joseph Rosenberg, Emily Raines, Nicholas Ratamess, Fernando Naclerio, Avery Faigenbaum, FACSM, *The College of New Jersey, Ewing, NJ.*

**Methods:**

Thirteen healthy volunteers including 10 men and 3 women completed a VO\(_2\)peak test and three experimental trials: 1) consumption of a test meal (M1), 2) exercise only (E), and 3) consumption of a test meal followed by exercise (M+E). All trials commenced in the morning after an overnight fasting and were preceded by a 10-min rest period (R) during which resting \(\text{VO}_2\), heart rate (HR), and respiratory exchange ratio (RER) were determined. Exercise protocol consisted of three successive 10-minute cycle exercises at 50, 60, and 70% \(\text{VO}_2\)peak in an ascending order. The test meal contained 725 kilocalories composed of 40%, 35% and 25% of carbohydrate, lipids and protein, respectively. Data collection including \(\text{VO}_2\), heart rate (HR), and respiratory exchange ratio (RER) were determined.

**Results:**

Resting oxygen uptake (\(\text{VO}_2\)) in l·min\(^{-1}\) was higher (p<0.05) in M than R (0.28±0.09 vs. 0.22±0.06). Exercising \(\text{VO}_2\) in l·min\(^{-1}\) was lower (p<0.05) at 50% \(\text{VO}_2\)peak in E than M+E (1.38±0.08 vs. 1.54±0.08), while no differences between E and E+M were seen at higher intensities. Respiratory exchange ratio was lower (p<0.05) in E than E+M at 50% (0.89±0.04 vs. 0.94±0.04), 60% (0.92±0.05 vs. 0.96±0.04) and 70% \(\text{VO}_2\)peak (0.95±0.04 vs. 0.98±0.04). No differences in delta efficiency were observed between M+E and E.

**Conclusion:**

Exercise during postprandial period elicits a greater increase in energy expenditure than exercise in a fasted state. However, this additive effect of meal and exercise seems intensity-dependent and is not caused by a decrease in metabolic efficiency of the exercising muscle. Postprandial exercise also results in a greater percentage of energy derived from carbohydrate regardless of exercise intensity.

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METHODS: Four women (mean ± SD: age 22 ± 2 years, height 167 ± 7 cm, mass 66 ± 5 kg) and eight men (age 23 ± 2 yr, height 179 ± 9 cm, mass 78 ± 10 kg) performed exhaustive constant-power cycle ergometer tests at two different severe intensity work rates (263 ± 78 W and 214 ± 64 W). Smoothed breath-by-breath VO$_2$ data were fitted to a two-component (primary response and slow component) model using iterative regression.

RESULTS: Times to exhaustion were 217 ± 27 s and 590 ± 82 s, respectively. The VO$_{2\text{max}}$ values were the same at the two different work rates (2973 ± 691 ml·min$^{-1}$ and 3011 ± 728 ml·min$^{-1}$). The amplitude of the primary response was greater (p < 0.05) at the higher work rate (2095 ± 716 ml·min$^{-1}$) than at the lower work rate (1857 ± 616 ml·min$^{-1}$) and the amplitude of the slow component was smaller (367 ± 177 ml·min$^{-1}$ vs 645 ± 347 ml·min$^{-1}$). In addition, the time delay before the emergence of the slow component was shorter at the higher work rate (92 ± 22 s vs 116 ± 42 s).

CONCLUSION: The results show that exercise intensity per se affects the VO$_2$ response profile within the severe intensity domain and suggest that metabolic demand drives the primary response of VO$_2$ kinetics within this domain.

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2209 Board #255 MAY 31 9:00 AM - 10:30 AM Heart Rate and Oxygen Uptake Kinetics Before and After Prolonged Spaceflight

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Routine assessments of the cardiovascular training state of the International Space Station (ISS) astronauts following flight have been limited to heart rate (HR) measurements during submaximal exercise tests. The kinetic responses to work rate change of HR and both respiratory and muscular oxygen uptake (RVO2 and MVO2, respectively) may be used to more accurately evaluate the efficiency and regulation of the cardiorespiratory system than simple examination of HR during steady-state work stages.

PURPOSE: To examine the influence of long-duration spaceflight on the kinetic responses of HR (Hpeak), RVO2 (Rpeak), and MVO2 (Mpeak).

METHODS: Seven astronauts (age: 48 ± 4 yr; ht: 172 ± 7 cm; wt: 73 ± 18 kg; ISS stay: 154 ± 27 d; preflight work load (WLpeak): 221 ± 64 W; preflight VO2peak: 2.6 ± 0.9 L/min) [means ± SD] performed exercise tests comprised of dynamic workload changes between 30-80 W on a cycle ergometer (Lode). These tests were performed before (L-170 ± 59 d) and twice after (early 214 ± 64 W) spaceflight. Breath-by-breath gas exchange was measured using the ISS Portable Pulmonary Function System. HR was determined by measuring ECG. Mpeak was computed using a 2-compartment model comprised of exercising and non-exercising parts. Time-series analysis was applied to determine the maximal cross-correlation function as indicators for the kinetic responses of Hpeak, Rpeak, as well as Mpeak. Friedman test for related samples was used to analyze differences across the time.

RESULTS: The kinetic responses for Hpeak were calculated as 0.479 ± 0.095 (L-170), 0.494 ± 0.119 (R-6) and 0.524 ± 0.098 (R+20), respectively. Mpeak was estimated as 0.432 ± 0.061, 0.371 ± 0.077, 0.365 ± 0.054, and Mpeak as 0.451 ± 0.091, 0.373 ± 0.087 and 0.401 ± 0.091, respectively. No significant differences in Mpeak (P = 0.37) were observed. Rpeak (P = 0.05), and Mpeak (P = 0.05) both bordered on significance.

CONCLUSIONS: Hpeak seems uninfluenced by long-duration spaceflight. Rpeak and Mpeak seem reduced postflight by trend. Thus, prolonged spaceflight may alter both Rpeak and Mpeak. The influence of other factors, such as the individual exercise training of the astronauts during weightlessness on these parameters, remains to be clarified.

The study was funded by the DLR (Deutsches Zentrum für Luft- und Raumfahrt), Germany (FKZ 50WB0726).

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2210 Board #256 MAY 31 9:00 AM - 10:30 AM Effects Of Caffeine On VO2 And VCO2 Kinetics During Supramaximal Cycling

Kenneth R. Dragoo$^1$, Kelly E. Johnson$^2$, Eliseo A. Gonzalez$^1$. $^1$Eastern Washington University, Cheney, WA. $^2$The University of Akron, Akron, OH. (No relationships reported)

The time course change in oxygen consumption (VO2) has been shown to remain unaltered following caffeine ingestion for moderate, heavy and severe domain exercise. However, carbon dioxide production (VCO2) kinetics remain unclear.

PURPOSE: To determine the effects of caffeine on VO2 and VCO2 kinetics during supramaximal cycling time-to-exhaustion (TTE) at 120% maximal oxygen consumption (VO2max).

METHODS: Seventeen subjects (23.3±3.4 yr, 171±10.12m and 75.3±13.8kg) voluntarily participated. A maximal graded exercise test and two supramaximal cycling tests were used to determine the TTE intensity. A familiarization session was conducted prior to the TTE with identical procedures. All subjects refrained from caffeine for 48h and vigorous exercise for 24h. The caffeine (C; spearmint flavored caffeinated gum) or placebo (P; spearmint flavored gum) was given in a double blind fashion for 5min followed by 20min seated rest and 10min warm up. Subjects then cycled at an unloaded resistance at 70revolutions per minute. The 120%VO2max intensity was applied withou notice. Subjects cycled until exhaustion. Breath-by-breath data for VO2 and VCO2 were fitted to the model X(t)=SS+A{1-exp[-(t-TD)/τ]} where X(t) is VO2 or VCO2 at time t, SS is the steady state at unloaded cycling, A is the amplitude, TD is the time delay, and τ is the time constant. Mean reaction time (MRT) was calculated as MRT=TD+τ. Full factorial analyses of variance were used to compare means.

RESULTS: VO2 t (P=52.8±16.1s, C=59.6±11.7s), VCO2 τ (P=70.7±14.5s, C=79.9±18.1s) and VCO2 MRT (P=79.3±16.8s, C=87.4±18.0s) were significantly different (p<0.05). VCO2 MRT (P=55.9±16.7s, C=61.8±11.0s) approached significance (p=0.059).

CONCLUSIONS: Caffeine may delay VO2 and VCO2 kinetics. Future research should study minute study period to determine if caffeine alters bodily CO2 stores, thereby delaying VCO2 kinetics.

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2211 Board #257 MAY 31 9:00 AM - 10:30 AM Slowed Muscle VO2 Kinetics With Raised Metabolism: Not Dependent On Blood Flow Or Recruitment Dynamics

Rob C.I. Wüst$^1$, James R. McDonald$^2$, Brian S. Ferguson$^3$, Yi Sun$^4$, Matthew J. Rogatzki$^3$, Jessica Spires$^5$, John M. Kowalchuk$^1$, L. Bruce Gladden, FACSM$^2$, Harry B. Rossiter, FACSM$^3$, 1University of Leeds, Leeds, United Kingdom. 2Auburn University, Auburn, AL. 3Case Western Reserve University, Cleveland, OH. 4The University of Western Ontario, London, ON, Canada. (No relationships reported)

The rate of adjustment (τ) of pulmonary oxygen uptake (VO2) is slowed when initiated from a higher versus lower metabolic rate (Bowen et al., Exp Physiol 96: 1049-61, 2011). Whether this is due to the intrinsic properties of newly recruited muscle fibers, slowed circulatory dynamics or the effects of a raised metabolism is currently uncertain.

PURPOSE: To determine muscle VO2 kinetics in canine muscle in situ, with independent experimental control over muscle recruitment, blood flow and metabolic rate.

METHODS: The gastrocnemius complex of 6 anaesthetized, ventilated dogs was surgically isolated and the tendon attached to a force transducer. Blood flow through the popliteal artery was measured using an ultrasonic flowmeter and inline venous oximetry. Tissue deoxygenation (HHbMb) was measured using near-infrared spectroscopy. Phase II VO2 and HHbMb dynamics were fitted to a mono-exponential model to give a time delay (TD), τ, and amplitude.

RESULTS: Upon stimulation onset, the TD for VO2 was greater (p<0.05) in S1 than in S2: 7±1 vs. 4±2 s. Similarly, TD for HHbMb (3±2 s) in S1 was shorter (p<0.002) than for VO2, but greater (p>0.05) than 0 s in all cases. However, τVO2 and τHHbMb were both smaller (p<0.05) in S1 (12±2 s and 11±4 s, respectively) as compared to S2 (18±3 s and 21±5 s, respectively). The VO2 amplitude was larger (p<0.01) in S1 than S2: 70±15 vs. 43±13 ml·kg$^{-1}$·min$^{-1}$.

CONCLUSIONS: Under conditions in which all muscle fibers were recruited and blood flow was maintained at the S2 steady-state value throughout, muscle VO2 kinetics were slower on transition from a raised metabolic rate; consistent with the proposal by Bowen et al. (2011) in humans. Despite increased mitochondrial enzyme activity following S1, the present data suggest that VO2 takes longer to achieve its steady state when contractions are initiated from a raised metabolic rate, where the muscle energetic state may be less favorable (i.e. less negative ΔG$\text{ATP}$).

Supported by BBSRC, UK. BB/F019521/1
During step-transitions in work rate (WR) within the moderate-intensity (MOD) exercise domain, pulmonary O2 uptake (VO2p) kinetics are slowed and VO2p gain (ΔVO2p/ΔWR) is greater when exercise is initiated from an elevated metabolic rate. High-intensity interval training (HIT) has been shown to speed VO2p kinetics, without affecting kinetics of local muscle deoxygenation ([HHbMb]), when step-transitions to MOD exercise are initiated from lower, light-intensity baseline metabolic rates. The effects of HIT on step-transitions initiated from elevated metabolic rates have not been established.

**PURPOSE:** To investigate the effects HIT on VO2p and muscle deoxygenation kinetics during transitions from low and elevated metabolic rates, within the MOD domain.

**METHODS:** Nine well-trained distance runners (25.7±3.5 yrs, 178.6±5.9 cm, 67.6±8.5 kg, 72.0±5.2 ml/kg/min) participated in this study. Runners completed two bouts of treadmill running (60 min, 175±10 W, mean±SE) at a constant speed (5.5±0.3 mph, mean±SE) for a total duration of 120 min. The first bout was completed in normoxia (N, FiO2=0.21) and the second bout in hypoxia (H, FiO2=0.13). Runners were randomly assigned to one of two order conditions, with one visit to the laboratory at each condition in a cross-over design. 

**RESULTS:** HIT led to a greater VO2max (43ml/kg/min→50ml/kg/min, p<0.05), and lower rVO2 for both the lower (LS: 24→15, ps<0.05) and upper steps (US: 45→25, ps<0.05).

**CONCLUSIONS:** These results indicate that the speed of VO2p kinetics in both the LS and US may be due, in part, to better matching of the muscle O2 utilization-to-microvascular O2 delivery relationship within the working muscle following 12 sessions of HIT. Supported by NSERC and UWO ADF.
RESULTS: There were no significant differences in VO2 (57.8±3.7; 58.0±3.1; 57.5±3.1 ml/kg/min, RER (0.88±0.3; 0.89±0.4; 0.87±0.3), or HR (169±1.14±8; 171.6±13.4; 170.1±14.9 bpm) between ZD, ST, and BF conditions.

CONCLUSION: Interestingly, there were no differences in the selected metabolic variables between the conditions. At 16 km/hr and a 1% grade, subjects were running at ~80% of their VO2max in each condition. Although the intensity utilized during this investigation may have reduced the ability to detect metabolic differences between conditions, it may also indicate that well-trained runners may spontaneously adapt to the most efficient running style regardless of shoe or barefoot condition as a result of years of consistent training.

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2216 Board #262 May 31 9:00 AM - 10:30 AM
Running Economy Differences in Shod and Barefoot States
Nicholas R. Klug, Sarah Jarvis, Bryan Haddock, FACSMM, California State University, San Bernardino, San Bernardino, CA.

(No relationships reported)

Abstract: Running with minimalist footwear or barefoot has become a popular alternative to traditional shoe running. The promoted benefits of barefoot running (BFR) range from biomechanical improvements to economic enhancements during competition.

PURPOSE: The purpose of this study was to examine running economy differences in the shod and barefoot states; the running economy protocol included flat and inclined modes. In addition, the mass affects of running on running economy was examined.

METHODS: Six males and 7 females participated in the study. The mean age was 22.2 ± 3.1 years, the average height was 167.2 ± 7.3 cm, the average mass was 59.5 ± 7.88 kg, and the average BMI was 21.2 ± 1.5 kg/m². Self-laced running shoes were worn. Both genders were considered. All participants underwent standardized running economy protocol that randomized four stages: running flat shod (FS), running flat barefoot (FBF), running inclined shod (IS) at, and running inclined barefoot (IBF); flat stages were performed at 7 mi/hr with no incline and inclined stages were performed at 6 mi/hr at 5% incline. Flat and inclined stages were compared independently of each other. Expired gases were measured and analyzed by a Medgraphics Ultima CPX metabolic cart.

RESULTS: The average VO2 for the economy tests were, 35.3 ± 3.2 ml/kg/min, 35.2 ± 3.2 ml/kg/min, 38.1 ± 3.0 ml/kg/min, and 37.1 ± 2.8 ml/kg/min for FS, FBF, IS, and IBF respectively. An independent sample t-test showed no significant difference between barefoot and shod running economy at a flat or an incline state (p>NS). No relationship between shoe weight and differences in running economy was observed (p>NS) CONCLUSION: Previous research looking at the affect of shoe mass would suggest that VO2 differences would occur between shod and barefoot states; however, this was not observed in the current study. In addition, inclined running was performed in an attempt to correct for differences in strike pattern, and observe mass affects of the shoe. Nonetheless, no differences or relationships due to shoe mass were observed.

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2217 Board #263 May 31 9:00 AM - 10:30 AM
Sex Differences In The Oxygen Uptake Kinetic Response To Moderate Intensity Exercise In Obese Adolescents
Mary K. Bowlen, R. Lee Franco1, Stacey L. Hall1, Ross A. Arena, FACSMM, Ronald K. Evans1, Edmond P. Wickham1, 1Virginia Commonwealth University, Richmond, VA; 2The University of New Mexico, Albuquerque, NM. (Sponsor: Edmund O Avedeo, FACSMM)

The pulmonary oxygen uptake (VO2) kinetic response to exercise provides insight into aerobic performance and overall efficiency of the cardiovascular, pulmonary, and muscular systems to meet oxygen demand upon initiation of exercise. Previously, investigators have reported no significant differences in the VO2 kinetic response to moderate intensity exercise in normal weight male and female children. However, the small sample size in conjunction with a large effect size may have confounded the interpretation of the time constant. Additionally, few studies have been devoted to investigating the VO2 kinetic response in obese adolescents.

PURPOSE: To determine if sex differences exist in the VO2 kinetic response to moderate intensity exercise in obese male and female adolescents.

METHODS: 102 obese subjects volunteered to participate. Male (n=25, 13.5±1.6 yrs, 40.6±6.1 %FAT) and female (n=77, 14.1±1.8 yrs, 41.5±3.8 %FAT) adolescents completed a graded exercise test with a 10W work step. VO2 was obtained from a 4 min treadmill walk at 3 mph (6% grade) where male and female VO2 peaks were, 4352 ± 599 ml/min, p<0.05). Results of linear regression analysis of the HHb response (normalized for differences in amplitude) using a sigmoid function indicated that the time to achieve 50% of the total amplitude was not significantly different between male and female adolescents. In addition, the mass affect of shoes on running economy was examined.

RESULTS: The phase II time constant was significantly different (P<0.014) between obese male and female adolescents (16.8±7.8 s vs. 21.8±8.9 s, respectively). Additionally, VO2peak was significantly greater (P<0.001) in males compared to females (2.7±0.4 vs. 2.4±0.3; L/min). The initial 4-min walking stage during the graded exercise test elicited a similar relative exercise intensity (90±18% of VO2peak) was averaged into 10s intervals and fit with a monoexponential equation to determine the phase II time constant.

CONCLUSION: In the current study, sex differences were observed in the VO2 kinetic response to moderate intensity exercise, which is indicative of a greater ability for obese adolescent males to intake, transport and/or utilize oxygen as compared to their female counterparts. A longer time constant may reflect a greater dependency upon anaerobic energy sources, therefore the initiation and maintenance of functional exercise may be more difficult in obese female adolescents.

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2218 Board #264 May 31 9:00 AM - 10:30 AM
Pulmonary O2 Uptake and Muscle Deoxygenation Responses to Repeated Bouts of Fast Ramp Exercise
Nicholas T. Kruse, Trent E. Cayot, Aaron G. Fosnough, Erin C. Garmyn, Sarah A. McGlinchy, Barry W. Scheuermann, The University of Toledo, Toledo, OH.

(No relationships reported)

Results of previous studies using a prior “priming” exercise to examine pulmonary (and muscle) O2 uptake (VO2) at the onset of a subsequent bout of exercise have provided considerable insight into metabolic regulation. While most studies use constant load exercise to examine VO2 kinetics, relatively few studies have examined VO2 kinetics during ramp exercise where the relationship between muscle perfusion and O2 uptake appear to be nonlinear; even fewer studies have examined VO2 responses to repeated bouts of ramp exercise. The use of near infrared spectroscopy (NIRS) to measure changes in muscle oxygenation during exercise has provided important mechanistic insight into the matching between O2 supply-to-O2 utilization.

PURPOSE: To determine VO2 and muscle deoxygenation (HHb) responses to repeated bouts of fast ramp exercise.

METHODS: Pulmonary VO2 and HHb of the vastus lateralis was measured on five (28.8±9.4 yrs, ± SD) healthy males during successive bouts of a fast ramp exercise (F1; F2) where the primary work function was initiated by 64 W/min. The “priming” bout (F1) was initiated from a baseline of 20 W cycling and continued to fatigue. F2 was initiated following 6 min of recovery cycling at 20W and continued to fatigue. VO2 and HHb were continuously measured during exercise and recovery.

RESULTS: Baseline VO2 was higher in F1 compared to F2; 1453 ± 209; F2: 1495 ± 247 ml/min, p=0.05). Although there was no difference in peak work rate between F1 and F2, VO2peak was higher in F1 versus F2 (F1: 4114 ± 497; F2: 4352 ± 999 ml/min, p=0.05). Results of linear regression analysis of the AVO2/AWR relationship revealed no difference between F1 (5.8±0.8 ml/min/W) and F2 (9.0±0.4 ml/min/W). Compared to F1, the increase in HHb from baseline to end exercise (i.e. ΔHHb) was greater during F2 than F1 (F1; 11.2 ± 7.7: F2: 16.3 ± 11.1 µM, p=0.05). Analysis of the HHb response (normalized for differences in amplitude) using a sigmoid function indicated that the time to achieve 50% of the total amplitude was not significantly different between F1 and F2.

CONCLUSIONS: A prior bout of priming exercise resulted in a higher peak VO2 during a subsequent bout of exercise, which may be associated with altered HHb responses. However, priming exercise did not lead to an appreciable change in either VO2 or HHb during submaximal exercise.

558

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The multiple Wingate protocol has previously been used to elucidate physiological responses to multiple supra-maximal efforts. To our knowledge though, it has not been used to contrast responses between trained and untrained individuals.

**PURPOSE:** To compare changes in power output and VO₂ over the course of multiple consecutive Wingate efforts in untrained individuals (UT) and trained cyclists (T). We hypothesized that T would produce more power and consume more oxygen, both in absolute terms and relative to power, than UT.

**METHODS:** All procedures were approved by the EMU-CHHS Human Subjects Review Committee. 11 UT (age 22 ± 4 yr, weight 83.8 ± 11.8 kg, VO₂peak = 40.05 ± 6.96 mL/kg/min) and 9 T (age 25 ± 4 yr, weight 77.8 ± 9.26 kg, VO₂peak = 59.56 ± 5.66) performed three consecutive Wingates with 4 min of rest between each bout. Exercise was performed on an electronically braked erometer (Velotron, Racermate WA) with a sampling rate of 10 Hz. Breath-by-breath metabolic gases were recorded using an Oxycron Mobile (Viasys, CA) and averaged over 5 s. Peak power (best 1 sec), average power, VO₂ and VO₂/Watt were analyzed for statistical differences between groups using 2-way ANOVA, and when appropriate, within groups by Wingate using ANOVA (SPSS 19.0; IBM, NY).

**RESULTS:** As anticipated, numerous variables were higher in T vs UT including, relative peak power (10.39 ± 0.87 W/kg vs. 8.80 ± 1.44 W/kg; p < .001), relative average power (8.36 ± 0.54 W/kg vs. 6.38 ± 0.84 W/kg; p < .001), relative VO₂ (4.38 ± 0.92 mL/kg/min vs. 2.93 ± 1.78 mL/kg/min; p < .001) and VO₂/Watt (5.02 ± 1.02 mL/min/W vs. 3.83 ± 0.81 mL/min/W; p < .001). Within groups, by Wingate, average power (absolute and relative) was significantly lower in UT by the third Wingate (p = .011), while average power in T tended to be lower (p = .14) and no interaction was observed. VO₂/Watt was significantly lower in the first bout for both the untrained and trained group (VALUES: p = .001, p = .002) compared to the second and third bouts.

**CONCLUSION:** During MWE, trained cyclists produce more power and consume more oxygen relative to power than untrained individuals. Despite these distinct differences between groups, there did not seem to be an interaction between training status and number of Wingates that would signify differential rates of fatigue.

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**METHODS:** Two training sites (Ft Jackson, SC and Ft Sill, OK). Trained observers (n=5-6) performed continuous observation of these companies during waking hours with novel smartphone-based PA tracking software. Each activity was coded for type and load carried. Intensity was rated as resting, light, moderate, vigorous, or maximum. Percent time (%T) spent in each activity type, load, and intensity were calculated. T-tests were used to determine whether PA differed between the BCT sites.

**RESULTS:** Recruits were followed 13.2±0.1 hr/day for 49.5±2.2 days at Ft Jackson and 11.8±0.1 hr/day for 46.6±2.2 days at Ft Sill. %T recruits from Ft Jackson and Ft Sill spent in each activity and load category is shown in Table 1. Recruits at Ft Sill spent more time cadence marching, running, doing mental tasks, obstacles/climbing, and carrying 11-34 kg (p < 0.05). Conversely, recruits at Ft Jackson spent more time stationary and engaging in combatives training (p > 0.05). There were no differences in %T spent in each intensity between soldiers at Ft Jackson and Ft Sill (p > 0.05).

**CONCLUSION:** We observed differences in the %T spent in various types of activities and load carried between the BCT sites, but no differences in activity intensity.
Table 1. Percent Time (%T, Mean ± SD) in each Activity and Load Category

<table>
<thead>
<tr>
<th>Activity</th>
<th>Ft Jackson (n=6)</th>
<th>Ft Sill (n=5)</th>
<th>t-test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary</td>
<td>39.9 ± 10.6</td>
<td>42.2 ± 7.9</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Zumba</td>
<td>3.4 ± 0.6</td>
<td>14.4 ± 0.3</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>Cadence March</td>
<td>3.2 ± 1.3</td>
<td>3.8 ± 0.9</td>
<td>0.041</td>
<td></td>
</tr>
<tr>
<td>Run</td>
<td>3.1 ± 0.4</td>
<td>1.6 ± 0.2</td>
<td>0.026</td>
<td></td>
</tr>
<tr>
<td>Walk</td>
<td>10.3 ± 0.9</td>
<td>8.2 ± 1.5</td>
<td>0.180</td>
<td></td>
</tr>
<tr>
<td>Menial Task</td>
<td>39.7 ± 5.1</td>
<td>37.6 ± 7.6</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Calisthenics</td>
<td>7.6 ± 1.1</td>
<td>3.9 ± 0.5</td>
<td>0.580</td>
<td></td>
</tr>
<tr>
<td>Obstacles/Climbing</td>
<td>5.4 ± 0.3</td>
<td>1.0 ± 0.1</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Load (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>85.1 ± 6.1</td>
<td>80.7 ± 3.5</td>
<td>0.192</td>
<td></td>
</tr>
<tr>
<td>5-10</td>
<td>11.5 ± 4.7</td>
<td>11.4 ± 4.2</td>
<td>0.400</td>
<td></td>
</tr>
<tr>
<td>11-22</td>
<td>3.2 ± 1.7</td>
<td>3.0 ± 1.8</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>23-34</td>
<td>0.2 ± 0.2</td>
<td>0.0 ± 0.6</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>0.1 ± 0.0</td>
<td>1.2 ± 0.2</td>
<td>0.110</td>
<td></td>
</tr>
</tbody>
</table>

2222 Board #268 MAY 31 8:00 AM - 9:30 AM
Leisure Time Physical Activity and Health-Related Quality of Life in Women
Mary K. Dinger, FACSM, Danielle R. Brittain. University of Northern Colorado, Greeley, CO.
(No relationships reported)
A positive relationship between health-related quality of life (HRQoL) and physical activity has been fairly well established in clinical populations. However, less is known about this relationship among healthy adults.

PURPOSE: The purpose of this study was to examine HRQoL among sufficiently and insufficiently physically active community dwelling women aged 50-75 years.

METHODS: Participants were 118 healthy women [age = 60.0 ± 6.9 years, Body Mass Index (BMI) = 26.1 ± 4.1 kg/m², body fat percent (%fat) = 35.0 ± 7.2%, 91% Caucasian] recruited from the Oklahoma City metropolitan area. They completed the long version of the International Physical Activity Questionnaire (IPAQ) and the Medical Outcomes Survey Short Form 36 (SF-36v2). Sufficiently active women accumulated ≥ 150 minutes of walking, moderate, or vigorous physical activity during leisure time the previous week, whereas, insufficiently active women accumulated < 150 minutes of these activities during their leisure time. HRQoL norm-based subscale scores were compared between the two groups.

RESULTS: Sufficiently active women accumulated ≥ 150 minutes of walking, moderate, or vigorous physical activity during leisure time the previous week; whereas, insufficiently active women accumulated < 150 minutes of these activities during their leisure time. HRQoL norm-based subscale scores were compared between the two groups.

CONCLUSIONS: Two of eight HRQoL norm-based subscales differed between sufficiently and insufficiently physically active women. Additional research is needed to continue examining the relationship between HRQoL and physical activity among healthy women.

2223 Board #269 MAY 31 8:00 AM - 9:30 AM
Quantitative Genetic Analysis Of Sports Participation In Portuguese Nuclear Families
Denisa Mendonça1, André Seabra2, Michele Souza2, Raquel Chaves2, Ana Seabra2, Daniel Santos2, Fernanda Santos2, Thayse Gomes2, Rui Garganta2, José Maia2, Instituto de Public Health (ISPUP), Institute of Biomedical Sciences Abel Salazar, University of Porto, Porto, Portugal, 2Research, Education, Innovation and Intervention in Sport, Faculty of Sport, University of Porto, Portugal (CIFID2), Faculty of Sport, University of Porto, Porto, Portugal.
(No relationships reported)
The number of studies that focus on familial aggregation and genetic contribution in the variation of the sport participation (SP) habits is very limited.

PURPOSE: To estimate familial aggregation and quantify the genetic and environmental contributions to the phenotypic variation on SP among Portuguese families.

METHODS: The sample consisted of 2375 nuclear families (parents and two offspring each) from different regions of Portugal with a total of 9500 subjects. SP assessment was based on a psychometrically established questionnaire. Phenotypes used were based on the participation in sports (yes/no), intensity of sport, weekly amount of time in SP and the proportion of the year in which a sport was regularly played. Familial correlations were calculated using FCOR in the SAGE 6.0 software. Heritability was estimated using variance-components methods implemented in SOLAR 4.0 software.

RESULTS: (1) Subjects of the same generation tend to be more similar in their SP habits than subjects of different generations. (2) All familial correlations (father, mother, and their different off-spring) were significantly greater than zero, ranging from 0.12 to 0.48. (3) In all SP phenotypes studied, adjusted for the effects of multiple covariates (age, sex and their interactions), the proportion of phenotypic variance due to additive genetic factors ranged between 40% and 50% (SP: h²= 50%; intensity of sport: h²= 40%; weekly amount of time: h²= 46%; proportion of the year: h²= 49%). (4) The proportion of variance attributable to environmental factors ranged from 50% for the participation in sports to 60% for intensity of sport.

CONCLUSIONS: In this large population-based family study, there was significant familial aggregation on SP. These results highlight that the variation on SP phenotypes have a significant genetic contribution although environmental factors are also important in the familial resemblance of SP, which points out the likely success of both individual and family-based lifestyle interventions in the promotion of SP.

2224 Board #270 MAY 31 8:00 AM - 9:30 AM
Do Kinesiology Majors Practice What They Preach?
Renee Zeltwanger, Mindy Mayol, Matthew D. Beekley, FACSM. University of Indianapolis, Indianapolis, IN.
(No relationships reported)
Kinesiology students should score better on indicators of health and fitness compared to other majors.

PURPOSE: The purpose of this study was to compare the health-and fitness results of Kinesiology majors to other non-Kinesiology majors.
RESULTS:

<table>
<thead>
<tr>
<th>Measure</th>
<th>KINS</th>
<th>Non-KINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>19.3±4.2</td>
<td>20.1±4.1</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>173.3±10.7</td>
<td>174.0±11.0</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>76.6±15.9</td>
<td>78.5±20.2</td>
</tr>
<tr>
<td>BMI</td>
<td>19.3±7.7</td>
<td>21.2±8.9</td>
</tr>
<tr>
<td>Blood Pressure (mm Hg)</td>
<td>122/73±14/12</td>
<td>123/76±11/8</td>
</tr>
<tr>
<td>Predicted Body Fat</td>
<td>21±8.9</td>
<td>23±7.9</td>
</tr>
<tr>
<td>Predicted VO2 Max (mL/kg min)</td>
<td>38±7.9</td>
<td>38±7.9</td>
</tr>
<tr>
<td>Sit and Reach (cm)</td>
<td>23±4.7</td>
<td>21±8.0</td>
</tr>
<tr>
<td>Grip Strength (lb; R+L)</td>
<td>72±27.8</td>
<td>71±26.5</td>
</tr>
<tr>
<td>Push-ups (1 min)</td>
<td>41±14.3</td>
<td>39±15.5</td>
</tr>
<tr>
<td>Curl-ups (1 min)</td>
<td>58±19.6</td>
<td>53±16.9</td>
</tr>
</tbody>
</table>

Blood measure

<table>
<thead>
<tr>
<th>KINS</th>
<th>Non-KINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose (mg/dL)</td>
<td>93.2±31.9</td>
</tr>
<tr>
<td>Triglyceride (mg/dL)</td>
<td>76.1±56.7</td>
</tr>
<tr>
<td>Cholesterol (mg/dL)</td>
<td>137.1±73.2</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>43.9±25.4</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>76.3±48.6</td>
</tr>
<tr>
<td>LDL/HDL ratio</td>
<td>2.61±1.71</td>
</tr>
<tr>
<td>HDL/LDL ratio</td>
<td>0.51±0.21</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Kinesiology students did not differ from non-Kinesiology majors for all major health and fitness-related parameters.

2225  Board #271  MAY 31  8:00 AM - 9:30 AM

Relationships Between Perceived Health and Objective Health Status of Rural Appalachian Adults

Wayne C. Miller, FACSM, Brian N. Griffith, Timothy O. Leonard, Gretchen D. Lovett, Jill D. Cochran, Haylee B. Heinsberg. West Virginia School of Osteopathic Medicine, Lewisburg, WV.  
(No relationships reported)

Appalachia is characterized by poor health behaviors, poor health status, and health disparities. Recent interventions have not demonstrated success in improving health status or reducing health disparities in the Appalachian region.

PURPOSE: Since one’s perception of personal health precedes his or her health behaviors, the purpose of this project was to evaluate the self-rated health of Appalachian adults in relation to objective health status and current health behaviors.

METHODS: Appalachian adults (n = 616) were surveyed regarding health behaviors - sugared drink consumer (drink ≥ 12 oz/d), or non-consumer (drink < 12 oz/d), fast food consumer (eating fast food ≥ 1 time/wk) or non-fast food consumer (eating fast food < 1 time/wk), smoking (smoker or non-smoker), exercise (exercise > 30 min 1 d/wk), blood pressure medication (yes, no), and self-rated health (0-100 scale). Blood pressure was measured through brachial artery auscultation and serum cholesterol measured via needle prick. Weight status was based on BMI: normal weight (NW: BMI < 18.5 and < 25.0), overweight (OW: BMI ≥ 18.5 and < 25.0), overweight (OW: BMI ≥ 25.0 and < 30.0), and obese (OB: BMI ≥ 30.0). Jaccard Binary Similarity coefficients, odds ratios, chi-square, and prevalence ratios were calculated to evaluate the relationships among self-rated health, objective health status, and health behaviors. Significance was set at p < 0.05.

RESULTS: Respondents reported being healthy, while being sedentary (56%), hypertensive (84%), OW (67%), or hyperlipidemic (79%). Between 55% and 99% of the respondents who considered themselves healthy had at least two disease conditions or poor health behaviors. Jaccard Binary Similarity coefficients showed the chance of somebody perceiving themselves as healthy when they were sedentary was 0.58, OW (0.47), OB (0.33), eating fast food often (0.32), rarely eating fruit (0.30), taking blood pressure medication (0.29), taking cholesterol medication (0.20) and depressed (0.23).

CONCLUSION: The association between perceived health and actual health in Appalachian adults is distorted. The public health challenge is to formulate messages and programs about health and health needs which take into account the current distortion about health in Appalachia and the cultural context in which this distortion was shaped.

2226  Board #272  MAY 31  8:00 AM - 9:30 AM

Physical Activity, Walking And Leanness: Analysis Of The Northern Ireland Sport And Physical Activity Survey

Marie H. Murphy, FACSM,1 Paul Donnelly,2 Simon Shibli,3 Charlie Foster,4 Alan Nevill.1 1University of Ulster, Co Antrim, United Kingdom. 2Sport Northern Ireland, Belfast, United Kingdom. 3Sheffield Hallam University, Co Antrim, United Kingdom. 4University of Oxford, Oxford, United Kingdom. 5University of Wolverhampton, Wolverhampton, United Kingdom.  
(No relationships reported)

PURPOSE: Walking is a popular form of physical activity shown to be associated with indicators of health. The purpose of this study was to determine the contribution walking makes to total weekly physical activity and the relationship between the volume and intensity of walking and leanness in the Northern Ireland population.

METHODS: 4563 adults participated in this cross-sectional survey of physical activity behaviour. Data was collected through face-to-face interviews using computer assisted personal interviewing. Self-reported height and weight was used to determine inverse body mass index (iBMI) as a measure of leanness. Data across all domains of physical activity including self-reported volume and intensity of walking (in bouts of 10 minutes or more) were analysed to determine their contribution to inverse BMI as our measure of leanness using an ANCOVA, having controlled for age, gender, socio-economic and smoking status.

RESULTS: Over 68% of the participants reported walking >10 minutes during the previous week but only 24% report walking at a brisk or fast pace. Time walking at a brisk or fast pace to get somewhere was identified as having the strongest positive association with being lean (F(1,459)=10.45, β=0.051 cm². kg⁻¹. min⁻¹ (SE=0.016), P=0.001).
CONCLUSION: In addition to increasing the amount of walking and the percentage of people walking regularly, public health messages encouraging an increase in walking pace may be valuable to increase in the proportion of the population meeting physical activity guidelines and gaining associated health benefits.

2227 Board #273 May 31, 8:00 AM - 9:30 AM
Motor Skill Competence and Physical Activity: Perceived Competence as a Mediator
Tao Zhang1, Zan Gao2, 1University of North Texas, Denton, TX; 2Texas Tech University, Lubbock, TX.

It has been well documented that the development of motor skill competence is a major correlate in promoting physical activity (PA) and perceived competence in middle to late childhood (Stodden et al., 2008). However, limited empirical evidence has supported the mediating effect of perceived competence on relationships between motor skill competence and PA among US children. Examining these relationships is necessary to develop effective strategies to promote students' PA.

PURPOSE: To test a hypothesized mediating effect of perceived competence on relationships between motor skill competence and PA among a sample of elementary school students.

METHODS: 294 students (152 boys, 142 girls, M age = 11.0 years) from three elementary school completed validated questionnaires assessing their perceived competence and self-report PA (William et al., 1998; Kowalski et al., 1997). Students’ motor skill competence in overhand throwing, basketball, and striking were assessed by PE Metrics™ (NASPE, 2010). After examining the correlations among the variables, the hypothesized model was tested using structural equation modeling (SEM; AMOS 16, Arbuckle, 2007).

RESULTS: Correlation analyses revealed a pattern of positive relationships among the study variables (r ranging from .12 to .40). The SEM analyses indicated that the hypothesized model produces a good fit to the data according to the various indices of fit: χ²/df = 1.93 < 5; CFI = .97; NFI = .94; RMSEA = .056 (Hu & Bentler, 1999). Specifically, the model accounted for 10.2% and 14.1% of the variances in perceived competence and PA, respectively. Path coefficients suggested that overhand throwing (β = .23) was directly and positively associated with perceived competence, which in turn significantly predicted PA (β = .38). The effect of overhand throwing on PA was mediated fully through perceived competence. No direct effect was found between basketball, striking and students’ PA.

CONCLUSIONS: The results highlight that overhand throwing significantly predicted students’ perceived competence, which in turn positively predicted their PA. However, basketball and striking didn’t emerge as predictors of students’ perceived competence and PA. The findings have practical implications for intervention strategies aimed at promoting students’ PA.

2228 Board #274 May 31, 8:00 AM - 9:30 AM
Likelihood of Meeting Physical Activity Guidelines Comparing those Who Walk Dogs and Those That Don’t Walk Them
Jesus Soares, Chantelle Owens, Jacqueline Epping, David R. Brown, FACSM, Tina Lankford. CDC, Atlanta, GA. (Sponsor: David R. Brown, FACSM)

In the UK, men not only have an increased risk of cardio-vascular diseases, fat related cancers and poor mental health, but also a low uptake of primary health care (PHC) services. Sporting settings offer health professionals a potentially exclusive channel to reach men, including those hard-to-reach-men (HTRM) not using PHC, with interventions designed to improve health. The English Premier (soccer) League (EPL) is attended by 11 million male fans and the basis for Premier League Health (PLH), the first nationally evaluated programme of health promotion for men in EPL clubs.

PURPOSE: To examine the initial reach and impact of PLH on the health behaviour of men.

METHODS: Health interventions delivered in clubs (N=16) including, educational activities on match days for fans and weekly lifestyle classes. Interventions were delivered at soccer stadia/training venues and community facilities and led by health professionals who received specific training on men’s health activities. After ethics/consent, men completed validated self-report measures for demographics and health behaviours. Differences in measures were identified pre vs post-intervention (3 months).

RESULTS: Among PLH recruits, 2214 provided pre-intervention data; 84% (1714/2214) were white British aged 18-44, 78% (n=909/1159) did not see themselves as unhealthy, but only 6% (n=58/1044) used PHC regularly. In a sub-sample providing lifestyle data, the percentage failing to meet recommendations for healthy behaviours was: physical activity, 85% (n=1106/1301); daily consumption of fruit/vegetables, 88% (n=948/1072); weekly alcohol units, 29.9% (n=203/679); body mass index (BMI), 63% (n=570/893) and smoking, 33.4% (n=222/1262). Significant increases were found for mean sessions of physical activity pre (2.06±1.52) v post-intervention (3.06±1.28), p=0.000 (n=185); daily consumption of fruit/vegetables pre (2.06±1.44) v post (2.97±1.20), p=0.000 (n=154); weekly decreases in alcohol units pre (17.4±14.18) v post (12.69±9.94), p=0.000 (n=105); and BMI pre (27.27±4.37) v post (26.65±4.03), p=0.003 (n=91).

CONCLUSIONS: A national programme of men’s health delivered in EPL soccer clubs reached men not meeting health guidelines and HTRM not using PHC regularly. Positive change was found for men’s selected health behaviours.

2229 Board #275 May 31, 8:00 AM - 9:30 AM
Initial Effects of a National Men’s Health Programme Delivered in English Premier League Football Clubs
Andy Pringle, Stephen Z POLSKY, Andy Daly-Smith, James McKenna, Steven Robertson, Alan White. Leeds Metropolitan University, Leeds, United Kingdom.

PURPOSE: To describe translation science methodology in adapting ACP, an evidence-based community PA program in Brazil, for implementation with Latino communities in the US.

METHODS: Abstracts were retrieved through a systematic search of 10 databases from 1990 to 2011 and hand searching of reference lists. The primary inclusion criterion for review was having published data for total time spent in PA to compare dog owners who walk their dogs versus those who do not. We used a random effects model to estimate the unadjusted odds ratio and corresponding 95% confidence interval (CI) of persons who met PAGs when comparing dog owners who walk dogs versus those that do not. We used Comprehensive Meta Analysis Software for calculations.

RESULTS: Among 236 relevant articles (including 2 under review) there were eight cross-sectional studies and one cohort study that met the inclusion criterion and which allowed calculation of odds ratios. For these studies there were 6980 dog owners aged 18 to 81 years old, with 41% being male, and among whom 63.9% (n=4463) actually reported walking their dogs. All the studies, except one, relied on self-reported PA measures. Based on total weekly time spent in PA, 2710 (60.7%) met the recommended PA guidelines among those who walked their dogs, and 950 (37.7%) among those who did not walk their dogs. The random effects estimated odds ratio was 2.74 with a 95% CI: 2.16-4.22.

CONCLUSION: Our systematic review of published articles revealed that across 9 published studies almost 2 in 3 dog owners report walking their dogs, and they are more than two and one-half times more likely to have met recommended levels of PA when considering total weekly PA. Further research need to consider whether adjustment for covariates affects this association. However, dog walking may be a viable strategy for dog owners to help reach recommended levels of PA to enhance their health.

2230 Board #276 May 31, 8:00 AM - 9:30 AM
Adaptation Of The Academia Da Cidade Program (acp) For Implementation In The United States: Academia Fit

PURPOSE: To describe translation science methodology in adapting ACP, an evidence-based community PA program in Brazil, for implementation with Latino communities in the US.
METHODS: An assets-based community engagement model was used to identify key partnerships, including the American Council on Exercise (ACE®) and local parks and recreation departments. Guided by socio-ecological framework, a community-based participatory research model was used to create a sustainable community program through which free PA classes could be taught in public spaces by Spanish-speaking instructors. A program logic model was used to identify inputs and activities that would contribute to successful program implementation and the building of community capacity to support long-term program maintenance. The RE-AIM framework is being used to evaluate reach and the public health impact of the program.

RESULTS: Key informant interviews (n=16) conducted with local stakeholders identified needs, facilitators, and barriers to offering a free Spanish-language community PA program. A fitness advisory panel (n=9) was established to provide input on program development, sustainability, and cultural appropriateness. ACE education materials were translated into Spanish, culturally adapted, and delivered as part of a 14-week program to 25 Spanish-speaking community members recruited to a newly established Academy (Academia Fit). Environmental audits were conducted in 70 public sites to assess their suitability for hosting free PA classes; 23 were selected as meeting criteria. To date, 10 newly certified instructors have taught free PA classes in 9 public settings averaging 17 hours per week; and 553 community residents have participated in the classes, with 123 participants enrolled in a year-long evaluation study. Complete data on the public health impact of Academia Fit will be available in Fall 2012.

CONCLUSION: Through leveraging existing local resources, ACP has been successfully translated to a Mexico-US border community. Funded by a research grant (1R18DP002138-01) from the Centers for Disease Control and Prevention.

2231 Board #277 MAY 31 8:00 AM - 9:30 AM
Physically Active Residential Communities And Schools (PARCS) - A Service-learning University-community Partnership To Promote Health
Sarah N. Herreraha, Stephanie Greerca, Rachel Swinfonda, Brian Culp, NiCole R. Keith, FACSM. IUPUI, Indianapolis, IN.

(Purpose relationships reported)

Physically Active Residential Communities and Schools (PARCS) is a 9-year-old community-based exercise partnership between an urban university and public school community. Exercise Science and Fitness Studies majors deliver exercise options to adult participants as part of service learning required throughout the curriculum. Participants with physician referrals attend for free and others attend at a membership price of $20/year. Public schools are host sites.

PURPOSE: To describe the experiences of university students who have completed one semester of service learning at a PARCS site and the demographics of adult participants who received exercise programming from students.

METHODS: A team comprised of student research assistants, a behavioral scientist, an exercise physiologist, and a physical educator reviewed de-identified student reflections to find common themes and created a system that was used to code each reflection. We conducted the coding by hand, individually reading reflections to identify themes and then discussed themes for each reflection at team meetings. Two varying team members coded each reflection and all members discussed results. This process occurred for 3 months until all transcripts were coded and discussed. We coded 120 student reflections. Identified student themes included pre-conceptions, contextual comparisons, first impressions, influence on learning, academic understanding, professional development, and change recommendations. IBM SPSS Statistics 19 was used to describe PARCS participants' demographics.

RESULTS: Students pre-conceptions included descriptions of people who were unhealthy, uneducated, and unlike themselves. Students found PARCS participants to be informative sources of learning. Students discussed personal strengths and weaknesses within the framework of their academic and professional preparation. Future recommendations were similar. Of the PARCS participants (N=1352), 74% were female, 38% were white, 51% were black, 79% had a household income of < $40,000 per year, and 89% had a high school diploma or higher.

CONCLUSION: Results show partnerships such as PARCS provide students with the opportunity to have practical experiences, work with a diverse population and give exercise opportunities to a community in need.

2232 Board #278 MAY 31 8:00 AM - 9:30 AM
Walking To Meet The 2008 Physical Activity Guidelines In Knee OA: The MOST Study
Daniel K. White1, Catrine Tudor-Locke, FACSM1, David Felson1, K.Doug Gross1, C.Elizabeth Lewis4, James Tomer3, Michael Nevin6, Tuhina Neogi1, 1Boston University, Boston, MA. 2Pennington Biomedical Research Center, Baton Rouge, LA. 3MGH Institute of Health Professions, Boston, MA. 4University of Alabama Birmingham, Birmingham, AL. 5University of Iowa, Iowa City, IA. 6University of California San Francisco, San Francisco, CA. (Sponsor: Catrine Tudor-Locke, FACSM)

(Purpose relationships reported)

PURPOSE: Physical activity (PA) provides health benefits even to those with knee osteoarthritis (OA) and therefore national organizations promote PA, and specifically walking for population. However, PA guidelines include minimal intensity and duration requirements, and it is unknown whether people meet these specific parameters by walking.

METHODS: The Multicenter Osteoarthritis Study (MOST) is a cohort of older adults who have or who are at high risk of knee OA. Participants were not enrolled if they were unable to walk. StepWatch activity monitor to record steps/day over 7 days. Intensity was categorized as sedentary, light, moderate, or vigorous. To examine if participants, walking guidelines was met by walking at minimal intensity and duration.

RESULTS: Of 1795 participants who wore the monitor for at least 3 days (age 67 ± 8 yrs, BMI 31 ± 6 kg/m2, 60% women), over 90% walked at minimal intensity, however only 33% met a single minimal duration bout. PA guidelines were fully met by 7% of men and 5% of women.

CONCLUSIONS: An overwhelming majority of people with or at high risk of knee OA appear capable of walking at minimal intensity to meet PA guidelines, however, only a third walked at a minimal duration, and few met PA guidelines by walking. Since intensity does not seem to be a limiting factor, promotion efforts should focus on accumulating more bouts at a minimal duration to facilitate achievement of PA guidelines by walking.

2233 Board #279 MAY 31 8:00 AM - 9:30 AM
Potential for Enhanced Safety to Stimulate More Bicycling
James F. Sallis, FACSM1, Lianne Dillon1, Terry L. Conway1, Lawrence D. Frank1, Brian E. Saelens2, Kelli Cain1, James E. Chapman3, Joni Mayer4, 1University of California, San Diego, San Diego, CA. 2California Department of Public Health, Sacramento, CA. 3University of British Columbia, Vancouver, BC, Canada. 4University of Washington, Seattle, WA. 5Urban Design for Health, Seattle, WA. 6San Diego State University, San Diego, CA.

(Nature relationships reported)

About half of all trips in the US are 2 miles or less, a feasible distance for bicycling. Bicycling for leisure or transportation can increase physical activity, reduce chronic disease, improve air quality, and reduce greenhouse gas emissions. Yet, fewer than 1% of trips are taken by bicycle in the US. Many studies show that concern about traffic dangers is the primary barrier to bicycling, and US investments in safe bicycling infrastructure are minimal compared to other countries.

PURPOSE: The present study examined correlates of projected increases in cycling if perceived safety from cars was improved.

METHODS: Participants were 1780 adults aged 20-65 recruited from the Seattle, WA and Baltimore, MD regions (48% female; 25% ethnic/racial minority). The outcome variable was based on this item: “How often would you bike if you thought it was safe from cars?”. The difference between current and projected biking frequency was the estimated impact of improving safety from cars. Multivariate mixed models were conducted to examine demographic and built environment correlates of projected cycling increases.

RESULTS: For the whole sample, bicycling at least once per week was projected to increase from 5% to 39% if bicycling was safe from cars. Ethnic/racial minority groups reported greater projected increases (p<0.009) in cycling compared to whites. Scores on the item “safe to ride bike in neighborhood” were inversely related (p<0.001) to projected increases in cycling. Street connectivity was positively related (p=0.007) to projected increases in cycling.

CONCLUSION: Implementing measures used widely outside the US to improve bicyclists’ safety from cars would primarily benefit minority groups who cycle less but have higher rates of chronic diseases, as well as those who currently feel least safe. Bicycling improvements are also projected to be largest in areas with connected streets that provide many alternative routes so bicyclists can avoid busy streets. Improving bicycle safety appears to target subgroups who could benefit most.

Supported by NIH grant HL67350.
RESULTS: run-in phase and after each supplementation phase. At each test, bronchoprovocation was elicited with eucapnic voluntary hyperventilation (EVH), a surrogate exercise challenge involving DHA or placebo capsules for 3 weeks. Following a 2-week washout, subjects received the opposite supplement for 3 weeks. Subjects were tested in a laboratory following an initial 2-week supplementation with fish oil. An optimal formula for fish oil has not been determined, although previous studies have suggested that, in terms of reducing inflammation, docosahexaenoic acid (DHA) may be the more potent omega-3 fatty acid in fish oil.

PURPOSE: To determine whether supplementation with DHA can attenuate hyperpnea-induced bronchoconstriction (HIB) in adults with asthma as compared to placebo.

METHODS: Nine subjects (18-30 years; 6 males, 3 females) with asthma and HIB participated in a randomized, double-blind, placebo-controlled crossover trial where they received either

RESULTS: There were no significant changes (p > 0.05) in the maximum drop in FEV1 among the pre-supplementation (21.07 ± 2.65 %), placebo (17.20 ± 3.27 %), and DHA supplementation (17.83 ± 2.44 %) phases. The pre-EVH concentration of 8-isoprostane was not significantly different (p > 0.05) among the pre-supplementation (3.08 ± 1.50 µg/L), placebo (2.18 ± 2.43 µg/L), and without a program (M= 1.88 ± 2.03 µg/L). There were significant differences (p < 0.05) for walking days per week, with the employees with a program having the highest number of days (M= 3.46 ± 3.57) compared to those without a program (M= 3.28 ± 2.28). Program participation was influenced by support, with the high support campus reporting the highest percentage of employees participating in health promotion activities (75.5%), followed by the medium support campuses (41%) and low support campus (20%).

CONCLUSIONS: Overall findings indicate that support was highly related to program participation, and increased levels of walking. Despite the differences, employees were not meeting minimum requirements for physical activity. Therefore, health promotion directors on university campuses should strive to increase physical and social support and implement best practices to increase physical activity among employees to improve health outcomes, reduce absenteeism and increase productivity.

Free Communication/Poster - Respiratory

Acute Protection Against Hyperpnea-Induced Bronchoconstriction By Terbutaline In Athletes
Pascale Kippelen1, Aldona S. Greenwood1, Andrew J. Simpson1, Lee M. Ronner, FACSM1, Sandra D. Anderson2. 1Royal Prince Alfred Hospital, Camperdown, NSW, Australia. 2Brunel University, Uxbridge, United Kingdom.

Exercise-induced bronchoconstriction (EIB) is highly prevalent in elite athletes. Short-acting inhaled beta2-agonists are widely prescribed to prevent EIB in asthmatic patients. The pathophysiology of EIB, however, seems to differ between asthmatic patients with EIB and otherwise healthy athletes with EIB.

PURPOSE: To assess if inhaled terbutaline can protect against hyperpnea-induced bronchoconstriction (HIB) in recreationally active athletes.

METHODS: We conducted a randomized double-blind placebo-controlled study of the effects of inhaled terbutaline (0.5 mg) and placebo administered as dry powder at different study days in 11 summer sports recreational athletes (age range 19-33 years) with documented EIB. Forced expiratory volume in 1 sec (FEV1) was measured at baseline, 15 min after inhaling terbutaline or placebo, and at intervals up to 30 min after an 8 min eucapnic voluntary hyperpnea (EVH) test (a surrogate for exercise). Data were analysed with repeated measures ANOVA and paired t-tests.

RESULTS: Terbutaline induced a slight but significant bronchodilation at rest (mean ± SD FEV1 increase 0.24 ± 0.15 L, p<0.001) and fully prevented hyperpnea-induced bronchoconstriction in 7 out of 11 (64%) subjects. The percentage protection afforded by terbutaline was 36 ± 22% (range 0-88%), with a mean FEV1 fall post-EVH of 14 ± 4% in the placebo condition versus 9 ± 5% in the terbutaline condition (p<0.05).

CONCLUSIONS: Pre-treatment with inhaled terbutaline prevents hyperpnea-induced bronchoconstriction in a majority of recreational summer sports athletes. However, the degree of bronchoprotection afforded by terbutaline is lower in athletes than previously reported in asthmatic patients with EIB.

Funded by the World Anti-Doping Agency.

Post-Exercise Airway Response To Atropine In Healthy Elite Swimmers

PURPOSE: To assess if inhaled atropine can protect against exercise-induced bronchoconstriction in healthy elite swimmers.

METHODS: Nine healthy swimmers (18-30 years, 2 females, 7 males) with documented EIB participated in a randomized, double-blind, placebo-controlled study where they received either inhaled terbutaline (0.5 mg) or inhaled atropine (0.3 mg) in a crossover design at each study day. Subjects were tested before and 30 min after an 8 min eucapnic voluntary hyperpnea (EVH) test (a surrogate for exercise).

RESULTS: Terbutaline induced a slight but significant bronchodilation at rest (mean ± SD FEV1 increase 0.24 ± 0.15 L, p<0.001) and fully prevented hyperpnea-induced bronchoconstriction in 7 out of 11 (64%) subjects. The percentage protection afforded by terbutaline was 36 ± 22% (range 0-88%), with a mean FEV1 fall post-EVH of 14 ± 4% in the placebo condition versus 9 ± 5% in the terbutaline condition (p<0.05).

CONCLUSIONS: Pre-treatment with inhaled terbutaline prevents hyperpnea-induced bronchoconstriction in a majority of recreational summer sports athletes. However, the degree of bronchoprotection afforded by terbutaline is lower in athletes than previously reported in asthmatic patients with EIB.

Funded by the World Anti-Doping Agency.

Determine whether supplementation with DHA can attenuate hyperpnea-induced bronchoconstriction (HIB) in adults with asthma as compared to placebo.

METHODS: Nine subjects (18-30 years; 6 males, 3 females) with asthma and HIB participated in a randomized, double-blind, placebo-controlled crossover trial where they received either DHA or placebo capsules for 3 weeks. Following a 2-week washout, subjects received the opposite supplement for 3 weeks. Subjects were tested in a laboratory following an initial 2-week run-in phase and after each supplementation phase. At each test, bronchoprovocation was elicited with eucapnic voluntary hyperventilation (EVH), a surrogate exercise challenge involving rapid breathing. Prior to and following the EVH challenge, the forced expiratory volume in one second (FEV1) and concentrations of 8-isoprostane and the DHA metabolite protectin D1 in exhaled breath condensate were measured. Repeated measures ANOVA assessed differences among the study phases; significance was held at p < 0.05.

RESULTS: There were no significant changes (p > 0.05) in the maximum drop in FEV1 among the pre-supplementation (21.07 ± 2.65 %), placebo (17.20 ± 3.27 %), and DHA supplementation (17.83 ± 2.44 %) phases. The pre-EVH concentration of 8-isoprostane was not significantly different (p > 0.05) among the pre-supplementation (3.08 ± 1.50 µg/L), placebo (2.18 ± 2.43 µg/L), and without a program (M= 1.88 ± 2.03 µg/L). There were significant differences (p < 0.05) for walking days per week, with the employees with a program having the highest number of days (M= 3.46 ± 3.57) compared to those without a program (M= 3.28 ± 2.28). Program participation was influenced by support, with the high support campus reporting the highest percentage of employees participating in health promotion activities (75.5%), followed by the medium support campuses (41%) and low support campus (20%).

CONCLUSIONS: Overall findings indicate that support was highly related to program participation, and increased levels of walking. Despite the differences, employees were not meeting minimum requirements for physical activity. Therefore, health promotion directors on university campuses should strive to increase physical and social support and implement best practices to increase physical activity among employees to improve health outcomes, reduce absenteeism and increase productivity.
higher rate than the general population. Vagal activity has been shown to be increased in high level athletes and is known to promote bronchoconstriction. The goal of this study was to determine the direct effects of parasympathetic tone on airway responsiveness in healthy elite swimmers.

METHODS: Bronchial response to exercise was measured in 7 healthy collegiate swimmers from a local NCAA Division 1 University team (4 males, 3 females) on 2 different occasions. To provoke EIB, the athletes exercised for 8 minutes on a cycle ergometer at 90% of their maximal heart rate while breathing dry air. In one of the visits, the athletes received intravenous saline (placebo). In the other visit, they received intravenous atropine (0.04 mg/kg), given in divided doses (0.01 mg/kg every 30 seconds) between minutes 8 and 10 of exercise to selectively achieve parasympathetic blockade at the end of the exercise challenge. Airway conductance was measured by body plethysmography before and 3, 6, 10, 15, 20 and 30 minutes after the exercise challenge. A one-way repeated measures ANOVA was used to identify differences in bronchial response after exercise with and without parasympathetic blockade.

RESULTS: Postexercise airway conductance as percent of pre-exercise values showed significant changes over time (p<0.05), significant differences among the 2 experimental conditions (p<0.05) and a significant condition x time interaction (p<0.05). Airway conductance was significantly lower for placebo, as compared with atropine at 6, 10, and 30 minutes post-exercise (p<0.05). The lowest values for airway conductance occurred during the placebo trial at 3 minutes post-exercise (88% pre-exercise). The highest values for airway conductance occurred during the atropine trial at 30 minutes post-exercise (173% pre-exercise).

CONCLUSION: Parasympathetic blockade results in airway dilation in healthy elite swimmers. These data suggest that vagal mechanisms play a major role in post-exercise airway response and possibly the development of exercise-induced bronchoconstriction in competitive swimmers.
These data suggest that IMT reduces respiratory muscle demand and decreases oxygen extraction by the active muscles, which may reflect IMT-induced changes in respiratory and limb locomotor muscle oxygen delivery.

2241 Board #287 MAY 31 8:00 AM - 9:30 AM Effects of Inspiratory Muscle Training on 15-Km Time Trial Physiological Responses in Trained Cyclists Courtenay McFadden,1 Lorie R. Brilla, FACSM,1 David N. Suprak,1 Kathleen M. Knutzen, FACSM.2 1Western Washington University, Bellingham, WA. 2University of California at Bakersfield, Bakersfield, CA.

PURPOSE: Inspiratory muscle training (IMT) has shown some performance improvements in athletes. The effects of IMT on peak anaerobic power and mean anaerobic power in bicycle racers, specifically during the last 30 seconds of a simulated 15-km time trial were examined. Physiological responses and time were monitored during the time trial to determine IMT influence.

METHODS: Eighteen males and eight females who randomly divided into a training (T) or placebo (P) group had testing of maximal inspiratory pressure (MIP) to set IMT workloads. T performed each set at 85% of their MIP while P performed each set at 15% of their MIP. Each group performed 5 sets of 12 repetitions of IMT for 6 weeks, 5 days per week, using a spring loaded resistive device. A 15-km time trial, with the last 30 seconds of the time trial being a 30 second Wingate Anaerobic Test was performed pre and post IMT. Every five minutes during the time trial, heart rate (HR), arterial oxygen-hemoglobin saturation (SaO2) via pulse oximeter, and ratings of perceived exertion (RPE) were measured. Overall 15-km time was also collected. A repeated measures ANOVA group by time was applied.

RESULTS: There were no significant interaction effects (P>0.05). Mean anaerobic power increased in both groups (P<0.05; P: 529.6 ± 124.6 watts to 574.4 ± 99.3 watts; T: 612.3 ± 81.7 watts to 632 ± 81.7 watts). SaO2 values increased in both groups (P<0.05; P: 94.8 ± 2.1% to 95.3 ± 1.8% T: 93.8 ± 1.9% to 95.1 ± 1.6%), and MIP increased (P<0.05) in both the P (110 ± 40cmH2O to 150 ± 40cmH2O and T (130 ± 30 cmH2O to 160 ± 20 cmH2O).

CONCLUSIONS: Since both groups showed improvements in mean anaerobic power, MIP, and SaO2, it cannot be concluded that IMT helped the subjects improve these factors. However, the placebo condition may have not been a true placebo effect since the subjects improved their MIP, as well as the higher intensity training group.

2242 Board #288 MAY 31 8:00 AM - 9:30 AM Effects of an Inspiratory Muscle Training Program on Cardiopulmonary Capacity of Collegiate Cross-Country Runners Justin Severance, Stephen Lux, Marlene Wenta. Alma College, Alma, MI.

PURPOSE: The purpose of this study was to investigate the effects of inspiratory muscle training (IMT) on VO2max, Maximum Voluntary Ventilation (MVV), Vital Capacity (VC), Inspiratory Capacity (IC), and Expiratory Reserve Volume (ERV) on highly trained endurance athletes.

METHODS: Eight (3 female, 5 male) Division III collegiate cross-country runners (mean age = 20 years) participated in the study. Baseline measurements were taken for VO2max and MVV, IC, and ERV using a maximal graded exercise test and spiroometry, respectively. Four subjects were randomly chosen to undergo IMT in conjunction with standard cross-country conditioning, with the remaining 4 subjects comprising the control group with no IMT. The training regimen consisted of 6-weeks of progressive inspiratory muscle training using a Smith’s Inspiratory Muscle Trainer. VO2 and pulmonary function measurements were taken pre-IMT training, mid-IMT training (2 weeks) and post-training.

RESULTS: Pre-test results indicated a mean VO2max of 66.5 ml/kg/min for the experiment group and 61.0 ml/kg/min for the control group. Average pulmonary function results for the experimental and control groups were; MVV of 157.3L/min v 150.7L/min, VC of 4.87L v 4.82L, IC of 2.93L v 2.88L, ERV of 1.93L v 1.95L, respectively. Post-test results showed a mean VO2max of 61.15 ml/kg/min for the experimental group and 65.7 ml/kg/min for the control group. The average pulmonary function post-test results for the experimental and control groups were; MVV of 165.1L/min v 167.3L/min, IC of 2.93L v 2.70L, VC of 4.87L v 4.75L, ERV of 1.97L v 2.05L, respectively.

CONCLUSIONS: There was no significant difference (p>0.05) in cardiopulmonary capacity measures between the experimental and control group. Similar results have been reported in previous research on this topic, which supports the necessity for further investigation into cardiopulmonary limitations during exercise in elite, endurance-trained athletes.

2243 Board #289 MAY 31 8:00 AM - 9:30 AM Pulmonary Adaptations To Swim And Inspiratory Muscle Training In Sub-elite Swimmers Joshua Weavil,2 Ren-Jay Shei1, Martin Lindley1, Timothy D. Mickleborough, FACSM1.1Indiana University, Bloomington, IN. 2Loughborough University, Loughborough, United Kingdom.

PURPOSE: We have previously shown that there are no significant differences in respiratory changes between elite swimmers undergoing a 12 week swim training (ST) program and those undergoing the same ST program and flow-resistive inspiratory muscle training (IMT). The aim of this study was to assess respiratory muscle and pulmonary function of 24 competitively trained sub-elite swimmers assessed at the beginning and end of an intensive 12-week ST program using the same IMT device we used previously (RT2 trainer, DeVilbiss).

METHODS: Swimmers (n=8) combined ST with either IMT set at 80% sustained maximal inspiratory pressure with progressively increased work-rest ratios until task failure for 3 d/wk. (ST + IMT), or ST with sham-IMT (ST + SHAM-IMT, n=8), or acted as controls (ST only, n=8). Measures of pulmonary and respiratory muscle function were assessed at the beginning and end of the 12-week study period.

RESULTS: There were no significant differences (p>0.05) in respiratory muscle and pulmonary function between groups at baseline, or at the end of the 12-week study for the ST + SHAM-IMT and ST group only. However, while no significant changes (p>0.05) in pulmonary function, except for forced inspiratory time in 1-sec (%∆, +15%), were observed within the ST + IMT group at the end of the 12 week study program compared to baseline, significant increases (p<0.05) were observed in a number of respiratory muscle function variables at the end of the 12-week study, such as maximal inspiratory pressure (%∆, +90%), sustained maximal inspiratory pressure (%∆, +42%), maximal inspiratory muscle power output (%∆, +61%), inspiratory time of contraction (%∆, +34%), and maximal voluntary ventilation in 12-sec (%∆, +39%).

CONCLUSIONS: This study has demonstrated that there are substantial differences in respiratory muscle function between sub-elite swimmers undergoing a competitive ST program only and those undergoing IMT in conjunction with the same ST program. This is in contrast to our previous study which showed no appreciable differences between ST + IMT and ST only in elite swimmers. Whether the enhanced respiratory muscle function in the ST + IMT group in the present study translates into improved swimming performance using this specific inspiratory muscle training has yet to be determined.

2244 Board #290 MAY 31 8:00 AM - 9:30 AM Ventilatory Efficiency, Body Composition, Dyspnea, And Exercise Mode In Lean And Obese Females Jeffrey E. Herrick, Erik P. Kirk, Curt L. Lox, Brandon L. Sharp. Southern Illinois University Edwardsville, Edwardsville, IL.

PURPOSE: In patients with exercise-induced dyspnea, the most commonly reported physiologic barrier of exercise adherence. Little research has investigated the relationship between ventilatory efficiency, regional adiposity, exercise mode, and dyspnea in females.
PURPOSE: This study compared ventilatory efficiency and perceived dyspnea between lean (LN) and obese (OB) females during randomized sub-maximal cycle ergometer (CE) and treadmill (TM) exercise. We also investigated the relationships between total (BF) and truncal adiposity (TA), truncal lean (TL), and cardiopulmonary outcomes.

METHODS: Twenty females participated (Mean ±SE: LN n=10, BMI=22.8±0.6, OB n=10, BMI=38.6±1.4 kg/m²). BF, TA, and TL were assessed via iDXA. Subjects completed randomized sub-maximal TM and CE exercise to 6 METS or 75% of predicted HRpeak, the termination point of the first randomized test was utilized for the second. V̇E/V̇CO₂ slope was determined as the slope of the rise in V̇E (L·min⁻¹·BTPS) to the increase in V̇CO₂ (L·min⁻¹·STPD).

RESULTS: There were between group differences (p≤0.05) in BF (LN 29.6±1.7, OB 46.4±1.4 %Fat), TA (LN 8.5±0.8, OB 25.6±2.6 kg), and TL (LN 20.7±0.6, OB 24.6±1.0 kg). There were no differences in exercise durations or VO₂max between group or mode. V̇E/V̇CO₂ was different between groups on the bike and between modes within OB (CE LN 23.6±1.2,OB 27.8±0.5; TM LN 23.8±0.5, OB 25.9±0.7 V̇E/V̇CO₂). OB minute ventilation (LN 37.8±3.5, OB 61.3±1.8 L·min⁻¹) and respiratory rate (RR LN 27.2±2.2; OB 32.4±1.5 breaths·min⁻¹) was greater during CE. OB reported greater exercise dyspnea than LN during CE (LN 1.6±0.36, OB 3.2±0.38 Borg Dyspnea Scale) which was associated with TA (p≤0.00, r=0.796), BF (p≤0.00, r=0.781), and TL (p≤0.00, r=0.731).

CONCLUSIONS: Our results suggest that weight bearing exercise (treadmill walking) supported an increased ventilatory efficiency over non-weight bearing exercise (cycle ergometer) which our obese female group perceived as lower exercise induced dyspnea. Thus, prescribing weight bearing exercise to obese females may limit dyspnea and in turn support greater exercise adherence.

2245 Board #291 MAY 31 8:00 AM - 9:30 AM
Prevalence And Determination Of Expiratory Flow Limitation During Exercise In Men And Women
Joshua R. Smith, Craig A. Hamms, FACSM. Kansas State University, Manhattan, KS.

(No relationships reported)

Expiratory flow limitation (EFL) can occur in healthy young men and women during exercise. Women, however have been reported to have smaller lungs and airways than height and aged matched men potentially leaving them more susceptible to EFL.

PURPOSE: We questioned whether the prevalence of EFL during exercise was greater in women compared to men.

METHODS: Data from healthy men (n=74, 23.3±4.4 yrs) and women (n=76, 21.8±3.7 yrs) were examined from previously published studies from our lab. All subjects completed either a progressive treadmill or cycle test to exhaustion. Subject’s maximal flow volume loop (MFVL) was compiled from several effort graded vital capacity maneuvers before and after exercise. The MFVL, along with inspiratory capacity maneuvers were used to determine total lung volumes, expiratory flows and to quantify EFL. To determine relative airway size and lung volume; referred to as the dysanapsis ratio (DR). The subjects were divided into groups based upon the appearance of ≥ 5% EFL at max exercise.

RESULTS: EFL was present in significantly more women (60/76, 79%) than men (18/74, 24%). Both women with EFL (W-EFL) and without EFL (W-NEFL) had significantly lower VO₂max, forced vital capacity (FVC), and DR (indicating smaller airways) than men with EFL (M-EFL) or with no EFL (M-NEFL). W-EFL had similar (p>0.05) VO₂max as W-NEFL, but significantly lower FVC (3.93±0.56 vs 4.23±0.32 l) and DR (0.19±0.04 vs 0.23±0.02). M-EFL had higher (p<0.05) VO₂max (57.4±4.0 vs 49.7±7.3 ml/kg/min) than M-NEFL but similar (p>0.05) FVC, and DR.

CONCLUSION: EFL during exercise is more prevalent in women compared to men and can largely be explained by smaller lung volumes and airways in women. In women, EFL is largely due to smaller airways; while in men, EFL is likely due to higher ventilation associated with greater aerobic capacity.

2246 Board #292 MAY 31 8:00 AM - 9:30 AM
Expiratory Flow Limitation during Maximal Exercise in Young Competitive Swimmers Following One-Year of Swim Training
Kosuke Kojima, Daniel P. Wilhide, Masataka Ishimatsu, Brian V. Wright, Joel M. Stager. Indiana University, Bloomington, IN.

(No relationships reported)

Expiratory flow limitation (EFL) during maximal exercise in prepubescent children has been principally explained by disproportionate growth of the lung-airway system and a conflict between ventilatory demand and capacity. Previous research comparing prepubescent swimmers and controls has shown that swim training improves the conductive properties of the airways independent of growth (Couvert et al., 1997).

PURPOSE: To examine how an additional 1-year of swim training influences pulmonary function and metabolic demands of maximal exercise, and consequently the degree and prevalence of EFL in young children.

METHODS: Ten healthy young competitive swimmers (5 boys and 5 girls; 10.3 ± 1.1 years; 145.0 ± 7.3 cm; 39.3 ± 8.8 kg, an average of two years of competitive swimming experience)

Pulmonary function values were collected during a set of maximal inspiratory and expiratory maneuvers performed pulmonary function and VO₂max tests before and after the 2010/2011 season. Pulmonary function values were collected during a set of maximal inspiratory and expiratory maneuvers for the determination of the maximal flow-volume loop (MFVL). Metabolic variables and minute ventilation were collected each minute during an incremental exercise test to exhaustion on a cycle ergometer. The degree of EFL was determined by the percentage of the exercise tidal flow-volume loop that overlapped the expiratory portion of the MFVL. In order to compare pre- and post-training data (boys and girls were combined due to no sex-based differences), a paired two-sample t-test was used.

RESULTS: After an additional 1-year of swim training, absolute VO₂max (L·min⁻¹) increased by 13.2% (p<0.05). Peak expiratory flow (PEF) increased by 13.7 % (p=0.01). There were no significant increases in any other resting pulmonary function variables. At maximal exercise, PEF of tidal volume was increased by 10.6 % (p<0.01). There were no significant increases in any other resting pulmonary function variables. At maximal exercise, PEF of tidal volume was increased by 10.6 % (p<0.01). There were no significant increases in any other resting pulmonary function variables. At maximal exercise, PEF of tidal volume was increased by 10.6 % (p<0.01).

CONCLUSION: Despite an increase in demand during maximal exercise and an additional year of swim training, pulmonary function was similar in these children to their prior measures. When compared to previous data and sedentary control values from the literature, young swimmers continue to show unique adaptations to swim training.

2247 Board #293 MAY 31 8:00 AM - 9:30 AM
Assessment of Pulmonary Restriction in Athletes with Cervical Spinal Cord Injury: a Method Comparison
Lee M. Romer, FACSM1, Christopher R. West2, Ian G. Campbell1. 1Brunel University, Uxbridge, United Kingdom. 2University of British Columbia, Vancouver, BC, Canada.

(No relationships reported)

Pulmonary restriction is rarely assessed by the criterion standard method of total lung capacity (TLC) below the lower 5th percentile of the able-bodied (AB) predicted value (lower limit of normal; LLN). More often, restriction is inferred using a vital capacity (VC) below the LLN and a normal-to-high forced expiratory volume in 1 second (FEV1)-to-VC ratio. SCI causes a greater loss of expiratory relative to inspiratory muscle strength, and therefore a disproportionate reduction in VC compared to TLC. Accordingly, there may be a greater chance of classifying pulmonary restriction in individuals with SCI.

PURPOSE: To determine whether the VC method results in a greater misclassification of pulmonary restriction in SCI vs. AB.

METHODS: Twelve Paralympic athletes with cervical SCI (injury level, C5-C7) and twelve AB controls matched for age, stature, and body-mass were assessed for TLC (body-plethysmography), FEV1, and VC (spirometry), and maximal inspiratory and expiratory mouth pressures (Pimax and Pmin).

RESULTS: All participants with SCI exhibited a VC<LLN, whereas significantly fewer (8 of 12) participants with SCI exhibited a TLC<LLN (p=0.046) and a normal-to-high FEV1-to-VC ratio. For the AB group, no participant exhibited a VC or TLC<LLN. Percent-predicted VC was lower than percent predicted TLC in SCI (p=0.013), whereas percent predicted VC was higher than percent-predicted TLC in AB (p=0.001). Percent-predicted Pmax was higher than Pmin in SCI (p=0.001) but not AB (p=0.146).

CONCLUSION: A VC-LLN with normal-to-high FEV1 does not accurately predict pulmonary restriction in athletes with cervical SCI. When using spirometry to infer pulmonary restriction in athletes with cervical SCI we recommend using a VC below 60% of the AB predicted value.
RESULTS: Bonferroni adjusted post hoc tests showing EA the potential to uncover the mechanism(s) underlying the link between ventilatory responses to exercise using specific genetic knock-out mice in future studies.

6.2 ± 0.3 ml/kg, V were calculated and corrected for changes of T.

RESULTS: PURPOSE: Previous studies of the dynamics of transdiaphragmatic pressure have shown progressive increase in diaphragmatic strength with workload (WL). Esophageal measurement of electrical activity of the diaphragm (EA) may elucidate whether neural respiratory drive follows a similar pattern or is adapted differently to the changing ventilatory demands during exercise.

RESULTS: PURPOSE: To determine if voluntary hyperventilation between short bouts of intermittent, intense exercise would affect acid-base status resulting in an increased work capacity.

RESULTS: | VE | VA | VCO2 | VO2 | PCO2 (H+) |
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NB mean power output was significantly higher during B2(600 ± 61W) and B3(521 ± 59W) when compared to B2(552 ± 58W) and B3(490 ± 55W) of VH. Despite a significant increase in estimated VA (calculated from VT with an assumed VD), VE and VO2, no significant differences was obtained in PCO2 (and consequently pH) immediately prior to B2 and B3.

CONCLUSION: Possibly the intensity of the exercise was severe enough to stimulate involuntary ventilation to near maximum, as indicated by the low mean PCO2 immediately prior B3 with NB. The increased ventilatory cost during VH trial my help to explain the decreased power output during this trial.

Supported by the Research Institute, Iowa State University

2250 Board #296 MAY 31 8:00 AM - 9:30 AM
Electrical Activity of the Diaphragm in Trained Subjects During Progressive Cycling to Exhaustion Trials

Previous studies of the dynamics of transdiaphragmatic pressure have shown progressive increase in diaphragmatic strength in driagmatical workload (WL). Esophageal measurement of electrical activity of the diaphragm (EA) may elucidate whether neural respiratory drive follows a similar pattern or is adapted differently to the changing ventilatory demands during exercise.

RESULTS: Trial 1 mean ±SD EA were 39 ±22 µV, 55 ±17 µV, 64 ±18 µV and 67 ±13 µV for WL of 40, 55, 70 and 85%, respectively. For trial 2, these were 40 ±19 µV, 50 ±21 µV, 60 ±19 µV and 60 ±6 µV for 40, 55, 70 and 85% WL. Bland-Altman plots of EA showed subject differences between trials showed bias of 13 µV and limits of agreement of -30 - 56 µV, largest relative differences being for EA,45%. Patterns of changes were similar within subjects, and repeated measures ANOVA showed EA differences among WL for both trials (P<0.05), with Bonferroni adjusted post hoc tests showing EA,40%<EA,75%, and EA,45%<EA,95% for trial 1, and EA,40%<EA,75% for trial 2 (P<0.05).

CONCLUSIONS: Results showed poor within subject agreement over time for EA. Possible causes include probe placement and subject variation over time. In contrast, trends in EA changes with workload were similar within subjects. In general, EA increased from WL of 40% to 55% and 70%. On average, a plateau at 85% WL was indicated in agreement with previous studies of EA, but individual subjects showed no clear pattern of changes in EA from 70 to 85% WL. Esophageal EA measurement equipment was sponsored by the manufacturer.
METHODS: 26 young adult male smokers (age 25.1 ± 4.5 yr, BMI 25.4 ± 5.9) were assessed for breath CO concentration, CPD, and by FTND. Smokers and 25 non-smokers (age 23.8 ± 4.1 yr, BMI 24.5 ± 2.6) were assessed for CRF by VO2 max, composite 1-repetition maximum (1RM) strength by bench press, leg press and machine row, and arterial stiffness by arterial tonometry. RESULTS: Smokers exhibited lower absolute (2.39 ± 0.49 vs. 2.97 ± 0.67 L/min, p = 0.004) and relative (29.1 ± 12.2 vs. 40.4 ± 2.0 mL/kg/min, p < 0.0001) VO2 max, and total (825 ± 39.5 vs. 989 ± 49.6 L, p = 0.011) and relative (4.6 ± 0.1 vs. 6.1 ± 1.0 Lbs/kg body weight, p = 0.0001) 1RM. CO was highly related to FTND (R = 0.62, p = 0.0003) and CPD (R = 0.56, p = 0.0006). CO significantly predicted total 1RM (R = -0.51, p = 0.009), VCO2 (R = 0.55, p = 0.033), subendocardial viability ratio (R = 0.44, p = 0.02), HR max (R = -0.39, p = 0.047). FTND significantly predicted VCO2 (R = -0.46, p = 0.03), aortic augmentation index (R = -0.35, p = 0.048), aortic systolic pressure (R = 0.36, p = 0.03), and central pulse height (R = -0.35, p = 0.049). Both CO and FTND predicted HR max (CO: R = -0.61, p = 0.007, FTND: R = -0.65, p = 0.036) and VE CO2 (CO: R = -0.52, p = 0.023; FTND: R = -0.50, p = 0.03). CONCLUSION: Preliminary results suggest that cigarette smoking negatively impacts CRF and strength fitness in young adult males. Additionally, higher CO levels are associated with lower muscle strength. CO and FTND are associated with both complementary and unique indices of exercise capacity and vascular function, suggesting studies would benefit most from determining CO levels and administering FTND tests.
CONCLUSION. Testosterone levels, rather than dietary factors, predict sprint performance in elite soccer players, but not IGF1 and RQ that are related only to the macronutrients ingested. Then further the physical testing the hormonal evaluation is fundamental to predict the performance in soccer.

2255 Board #301 MAY 31 9:00 AM - 10:30 AM
Correlation Of VO2max Between The Bruce Protocol And Yo-yo Test In Mexican Professional Soccer Players
Alejandro Soría-Contreras1, Johanna Yvette Silva-Laguna1, Angélica Becerra-Magaña1, Juan Ricardo López y Taylor1, Juan Antonio Jiménez-Alvarado1, Rubens Valenzuela-Lazo2, Edna Jiuregui-Ulloa2, 1Universidad de Guadalajara, Guadalajara, Mexico. 2Club Deportivo Leones Negros, Guadalajara, Mexico.

The maximal oxygen uptake (VO2max) has been considered the most important determinant of aerobic endurance in soccer players. On the other hand, Bangsbo in 1994, using the Yo-Yo Test, assessed the maximum aerobic capacity in professional soccer teams, demonstrating the importance of intermittent resistance in soccer players.

PURPOSE: To evaluate the results of VO2max in soccer players with two different indirect test and analyze the correlation between them

METHODS: A total of 54 Mexican professional soccer players aged 26 years (SD=2.12) were evaluated. Weight was 74.5 Kg. (SD=2.5) and height 177.3 cms. (SD=6.8). Each player was submitted to a VO2max testing using the Bruce protocol and the Yo-Yo intermittent protocol and the Endurance Level 2 test.

RESULTS: The mean VO2max obtained by treadmill running was 55.0 ml / kg / min (SD = 4.6). VO2max obtained by Yo-Yo test was 55.1 ml / kg / min (SD = 2.9). We found a r = 0.297 and a p=0.25.

CONCLUSIONS: This study reports that the average VO2max level of players was found in the lower limit (Reilly 1993, 56 to 69 ml/kg/min). By comparing the average data from the Bruce protocol with the Yo-Yo test, the results where similar, however there was no correlation between both tests. This study shows that the aerobic capacity of these players was deficient and need more aerobic training. We found that both tests are useful for the assessment of football because they measure different characteristics of the cardio respiratory fitness. More research and evaluations regarding this issue are suggested in order to increase the performance of the players.

2256 Board #302 MAY 31 9:00 AM - 10:30 AM
Relation Between The H:Q Ratio And Age And Lower Limb Dominance In Young Soccer Players
Tomas Maly, Frantisek Zahaika, Lucia Mala. Charles University, FFES, Prague, Czech Republic.

During the game, strength and power movements are accumulated on both lower extremities (LE). This occurs in an asymmetrical manner and may gradually leads to higher shifts of myodynamic characteristics and strength asymmetries of LE. The hamstrings to quadriceps (H:Q) ratio has been used in several studies to examine the similarity between H:Q moment-velocity patterns and to assess knee functional ability and muscle balance, but mainly in adults in players. However, less is known about the bilateral difference in H:Q ratio among different age groups.

PURPOSE: The purpose of the study was to find out the level of H:Q ratio and differences in terms of age and limb dominance.

METHODS: Elite players of 4 age categories (U16=16, U17=18, U18=17 and U19=19) were tested on the isokinetic dynamometer Cybex at three velocities (60, 180, 300 °.s-1) for the dominant (DL) and non-dominant leg (NL) during the knee flexion and extension. The ratio between peak muscle torque of hamstring to quadriceps for both legs (H0:Q0; H1:Q1) was evaluated. Three-way Mixed-design ANOVA with two between subject effect (age (A), laterality (L)) and one within subject effect (velocity) was used for evaluation of H:Q differences between the factors.

RESULTS: The factors of A and L do not significantly influence the level of H:Q in young elite players (age: F135,4 = 1.07, p>0.05, ηp2=0.024, laterality: F1,135 = 0.278, p=0.05, ηp2=0.002). Similarly, the effect of interaction between A and L was not significant (p>0.05). With increasing angular velocity, significant changes in H:Q ratio appeared (H:Q60 = 56.80, H:Q180=60.83, H:Q300=61.75). H:Q1= 32.71, p<0.001, ηp2=0.199. Post-hoc analysis showed a significant difference in H:Q0 compared to H:Q1 (p<0.001), while no significant difference was found between H:Q180 and H:Q300 (p>0.05).

CONCLUSIONS: Neither calendar age, nor limb dominance have significant impact on the level of H:Q ratio in young elite players, on the contrary, the speed of the movement during knee flexion and extension has a significant effect. In the individual assessment, we have revealed strength asymmetries that should be eliminated by means of appropriate sports training.

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2257 Board #303 MAY 31 9:00 AM - 10:30 AM
Effects of a Water Exercise Training Program on Biochemical Parameters and Aerobic Fitness in Indoor Soccer Players
Dulila Tusset1, Mabel Olkoski1, Kenji Fuke1, Silvana Matheus1, Félix Soares2, Rafael Portella1, Edovando da Rosa1, Rômulo Barcelos1. 1University of Brasilia, Brasilia, Brazil. 2Federal University of Santa Maria, Santa Maria, Brazil.

A total of 54 Mexican professional soccer players aged 26 years (SD= 2.12) were evaluated. Weight was 74.5 Kg. (SD=2.5) and height 177.3 cms. (SD=6.68). Each player was submitted to a VO2max test using the Bruce protocol and the Yo-Yo intermittent protocol and the Endurance Level 2 test. The VO2max obtained by treadmill running was 55.0 ml / kg / min (SD = 4.6). VO2max obtained by Yo-Yo test was 55.1 ml / kg / min (SD = 2.9). We found a r = 0.297 and a p=0.25.

CONCLUSIONS: This study reports that the average VO2max level of players was found in the lower limit (Reilly 1993, 56 to 69 ml/kg/min). By comparing the average data from the Bruce protocol with the Yo-Yo test, the results where similar, however there was no correlation between both tests. This study shows that the aerobic capacity of these players was deficient and need more aerobic training. We found that both tests are useful for the assessment of football because they measure different characteristics of the cardio respiratory fitness. More research and evaluations regarding this issue are suggested in order to increase the performance of the players.

2258 Board #304 MAY 31 9:00 AM - 10:30 AM
Effects of Season-Long High-Intensity Interval Training on Conditioning of High School Soccer Players
Neal F. Howard, Stasinos Stavrianeas. Willamette University, Salem, OR.

High-intensity interval training (HIIT) has been put forth as a viable alternative to more traditional endurance conditioning for the improvement of aerobic conditioning.

METHODS: We hypothesized that HIIT will compare favorably to traditional soccer conditioning over the course of a high school soccer season.

METHODS: High school junior varsity soccer players were split into control (n=17) and experimental (n=17) groups during the 10-week study. The HIIT consisted of 4-6 30 second “all-out” sprint efforts with 4.5 minute recovery, 3 times a week. The control group performed endurance training for the same duration. The groups did not differ in any other aspect of their training. Participants completed the yo-yo intermittent recovery test level 1 (IR1), a 40-yard dash, vertical jump, agility test, and a sit-and-stand test, in 2 different testing sessions (pre and post season).

570

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RESULTS: Both control (n=10 at post) and experimental groups (n=8 at post) showed significant increase in IRT1 test performance pre and post training (720±99.6 m vs. 1196±80.0 m, p<0.001 and 480±67.6 m vs. 880±161.6 m, p<0.045 respectively), with no significant difference between groups (p=0.854). Both experimental (n=5) and control (n=9) groups showed a significant difference in the 40-yard dash between pre and post training (5.48s vs. 5.17s, (5.6%) p<0.005 and 5.73s vs. 5.36s (6.4%), p<0.001 respectively). There was no difference between experimental and control groups between pre (p=0.550) and post (p=0.089). There was no difference in vertical jump between experimental (n=7, p=0.803) and control (n=12, p=0.954) groups pre and post testing. Similarly, there was no difference in the agility test between the experimental (n=7, p=0.683) and control (n=12, p=0.094) groups pre and post test. Finally, there was no difference in the sit-and-reach test for the experimental group pre to post (n=7, p=0.798). There was, however, a significant decrease in the control group (n=12, 29.13 cm vs. 27.75 cm, p=0.024).

CONCLUSION: Our results indicate that HIIT is an adequate training stimulus offering similar endurance improvements to more traditional soccer training.

2259

Board #305  MAY 31  9:00 AM - 10:30 AM

Short Duration High-Intensity Interval Training Improves Aerobic Conditioning of Female College Soccer Players

Tannin Kuefner, Andrea Rowan, Stanislos Stavrianas. Willamette University, Salem, OR.

(No relationships reported)

High-intensity interval training (HIIT) has been shown to improve aerobic conditioning at a considerable savings in time compared to the more traditional endurance training.

PURPOSE: We hypothesized that maximal oxygen consumption (VO2max) and performance in the Yo-Yo Intermittent Recovery Test 1 (IRT1) between the HIIT group and the endurance training group will be similar between over a short 4-week training period.

METHODS: Following a valid VO2max test and the IRT1, female Division III college soccer players were matched and randomly assigned to the HIIT (n=7) or the END (n=6). The HIIT consisted of 5 30-second “all-out” sprint efforts with a 4.5 minute active recovery, twice per week. The END completed a 40-min run at 80% of VO2max twice per week. All other aspects of the training were identical for the two groups. Comparisons of VO2max and IRT1 test data between groups (END vs. HIIT) or between conditions (pre- vs. post-training) were made using Student’s t-test and ANOVA (α=0.05).

RESULTS: The distance covered during the IRT1 test was significantly different between the pre- and post-tests (1680±480 m vs. 1895±524 m respectively, p=0.002). The differences were true for the HIIT group (pre-test: 1857±423 m vs. post-test: 2131±436 m, p=0.011) and END group (pre-test: 1473±494 m vs. post-test: 1613±510 m, p=0.042). There were no significant differences between the HIIT and END groups for the pre-test (p=0.108) or the post-test (p=0.076). The 4-week training program resulted in significant improvements in team VO2max values between the pre- and post-training tests (50.66±3.52 ml•kg•min•-1 vs. 52.71±3.24 ml•kg•min•-1 respectively, p=0.002). There were no differences in VO2max between the SPR and END groups for the pre-test (p=0.493) and the post-test (p=0.362). Improvements in VO2max between the pre- and post-tests were 2.36 ml•kg•-1•min•-1 (4.73%) for the HIIT group and 1.66 ml•kg•-1•min•-1 (3.42%) for the END group.

CONCLUSIONS: Our results indicate that HIIT as little as twice per week offers an adequate aerobic training stimulus at considerable time savings.

2260

Board #306  MAY 31  9:00 AM - 10:30 AM

Response of Plasma Creatine Kinase After Pre Season Compared with an Official Soccer Game

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(No relationships reported)

Plasma creatine kinase (CK) concentration has been widely used as an indicator of skeletal muscle damage in sports. The increase of CK concentration occurs 4 hours after the exercise, reaching the peak after 48-72 hours.

PURPOSE: The aim of this study was to evaluate serum CK concentration in professional soccer players after ten days of intense physical training compared with an official soccer game.

METHODS: Ten professional soccer players (25 ± 3.63 yrs, 78.52 ± 6.97 kg and 8.18 ± 2.95 % fat) participated in this study. Plasma CK concentration was measured in three moments, at the beginning of pre season (baseline), ten days of intense physical training (780 minutes) with aerobic and anaerobic resistance exercises (post-training) and 48 hours after an official soccer game (post-game). CK was checked using Reflotron Plus (Roche). Data were analyzed by one way ANOVA and Tukey’s post hoc test.

RESULTS: The values of CK was significant higher (p<0.05) comparing the baseline (177.83 ± 70.46 U/l) with post-training (542.40 ± 224.35 U/l) and post-game (627.40 ± 399.10 U/l). There was, however, a significant decrease in the control group (n=12, 29.13 cm vs. 27.75 cm, p=0.024).

CONCLUSIONS: The ability among players to sustain muscular activity following intense bouts of muscular exertion that may frequently occur during soccer match play may play an important role in successful performance and injury prevention. Muscular fatigue results in decreased muscular torque production and consequently may hinder playing performance. Research findings have suggested that various positions in elite level soccer players may be functionally unique in regards to the distances covered and metabolic demands imposed during match play.
RESULTS: vs. 173 ± 10 bpm), protein use, fat use, and carbohydrate use did not differ from T1 to T2 (p > 0.05). Energy expenditure (16.6 ± 1.9 vs 17.4 ± 2.2 kcals /min) approached a significant absolute VO2 peak.

CONCLUSIONS: It is accepted that some sports (cycling/endurance running) have demonstrable changes in energy substrate utilization in training and competition phases. However, less is known about team sports.

PURPOSE: To assess changes in energy substrate utilization in a group of well-trained college soccer players pre and post competitive season.

METHODS: Participants for this study were 20 male soccer players, 19.2 ± 1.5 years of age, who were members of an NCAA Division II soccer team. Average height for field players was 175.6 ± 4.9 cm, weight was 71.8 ± 7.9 kg. Body Mass Index (BMI) was 23.3 ± 2.3 kg/m2, and body fat, assessed with the 7-site skinfold test, was 10.3 ± 4.4%. For physiological testing, participants ran the Yo-Yo Intermittent Recovery Test (YIRT) while wearing a portable metabolic cart (Viasys, Oxycon) to measure oxygen use. The YIRT is a 20-metre shuttle test with a progressively increasing pace. Athletes start out at a relatively slow pace and then quickly increase their speed according to the pace set by the beeps. Each bout of intense running (a 2x20m shuttle) is followed by 10 seconds of active recovery prior to the athlete resuming a sprint (Bangsbo et al.) Substrate utilization was estimated using indirect calorimetry methodology, and values for fat, carbohydrate, and protein use were calculated as absolute units (grams per test). Dependent samples t-tests were used to determine whether physiological parameters changed from Time 1 (pre-season) to Time 2 (end of season).

RESULTS: The majority of parameters did not significantly differ from T1 to T2. Average number of shuttles was 12 ± 3 at T1 and 13 ± 3 at T2 (p > 0.05). Average heart rate (171 ± 11 bpm vs. 173 ± 10 bpm), protein use, fat use, and carbohydrate use did not differ from T1 to T2 (p > 0.05). Energy expenditure (16.6 ± 1.9 vs 17.4 ± 2.2 kcals/min) approached a significant difference (p = 0.09). Peak VO2 was the only parameter that differed significantly between T1 and T2 (57.6 ± 6.7 ml/kg/min vs 62.3 ± 6.2 ml/kg/min); the athletes had a higher VO2 at T2 (p < 0.01).

CONCLUSIONS: No differences in energy substrate use were found during field based VO2 peak testing in male collegiate soccer players across a competitive season, despite changes in absolute VO2 peak.
In sport performance today it is vital to maximize performance to stay a top competitive athlete. In softball, this is very prevalent and is seen through a variety of hitting performance enhancements. Implementing a weighted bat prior to maximum swing performance has traditionally been utilized but recent research has shown a decrease in bat swing velocity.

**PURPOSE:** The purpose of this study was to determine the influence of different weighted warm-up bats on swinging performance in varsity softball players.

**METHODS:** Ten active varsity participating Division I female softball varsity athletes volunteered to participate. The order of the three warm-ups were randomized at the beginning of the testing session and all conditions were completed in one visit. Subjects performed a self-selected warm-up (instructed to simulate their on-deck warm-up routine) with a normal weight (NW); 29oz, heavy (HW); 45ozs or light-weight (LW); 13oz bat immediately following 5 maximum bat swings using a normal weight bat. Following each condition a 3 mins washout/rest period was given prior to the following condition. This washout/rest period allows adequate time decreased fatigue between conditions. Each swing in conditions was analyzed to assess swing kinematics and bat speed using Vicon Nexus Software. The swing with the highest motion capture clarity was used for analysis of the trajectory and velocity of a marker placed on the most distal portion of the bat.

**RESULTS:** A 1x3 repeated measures analysis of variance was used to analyze mean differences. There were no significant (p>0.1) differences in maximal bat swing velocity following NW (56.97 ± 14.82mph), LW (48.34 ± 20.47mph) and HW (51.22 ± 22.70mph).

**CONCLUSIONS:** These results indicate that warming up with different weighted bats has no effect on bat swing velocity. However, there is a practical trend that supports previous research that HW warm-up demonstrates a decreased bat velocity compared to NW warm-up. Considering the current data is 3D, it may be considered to be a more precise estimate of bat swing velocity, which also supports the 2D linear velocity that has previously been investigated. Further research investigating the time point of maximum bat swing velocity during the swing should be performed to see if the warm-up bat has any influence on the joint mechanics rather than just bat velocity.

**Board #313**

**May 31, 9:00 AM - 10:30 AM**

**The Influence of Different Weighted Warm-up Bats on Swinging Performance**

Nicole C. Dabbs, John C. Garner, Robert C. Hicks, Harish Chandar, Cade Wilderson, Jordan Young. The University of Mississippi, University, MS. (Sponsor: Mark Loflin, FACSM)

(no relationships reported)

In sport performance today it is vital to maximize performance to stay a top competitive athlete. In softball, this is very prevalent and is seen through a variety of hitting performance enhancements. Implementing a weighted bat prior to maximum swing performance has traditionally been utilized but recent research has shown a decrease in bat swing velocity.

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**CONCLUSIONS:** These results indicate that warming up with different weighted bats has no effect on bat swing velocity. However, there is a practical trend that supports previous research that HW warm-up demonstrates a decreased bat velocity compared to NW warm-up. Considering the current data is 3D, it may be considered to be a more precise estimate of bat swing velocity, which also supports the 2D linear velocity that has previously been investigated. Further research investigating the time point of maximum bat swing velocity during the swing should be performed to see if the warm-up bat has any influence on the joint mechanics rather than just bat velocity.
CONCLUSIONS: The 78% unexplained relationship of PAP to TTH confirmed that TVJ does not sufficiently explain how high a player can jump. The lack of a strong correlation confirmed the use of separate tests for either TVJ Power or TTH. TTH does not only prove to be more practical, but also more cost efficient. Measuring how high an athletic can jump can simply be done with a pre-measured wall and chalk on the subjects’ finger tips.

2271  Board #317  MAY 31  9:00 AM - 10:30 AM
Changes in Body Mass and Absolute and Relative Bench Press, Squat and Leg Press Strength in NCAA Division I Football players
Jerrod C. Grace1, Ali Boohani1. 1Tennessee State University, Nashville, TN.  1Oklahoma City University, Oklahoma City, OK.
(No relationships reported)
PURPOSE: The purpose of this study was to determine whether there were changes in body mass (BM) and absolute and relative bench press (BP), squat (SQ), and leg press (LP) strength over the course of 3 years in NCAA Division I football players. METHODOLOGY: Collegiate football players (N=29, ages 18-24) were tested yearly for BW, 1 repetition max (RM) on BP, SQ and LP. Data was collected over 3 years in March, approximately 3 months after the end of the college football season. A Repeated Measures ANOVA was used to analyze results. Post-hoc data was analyzed using paired t-tests.
RESULTS: Repeated measures ANOVA indicated significant differences in BW (p<0.001), BP (p<0.001), BP/RM (p<0.001), SQ/RM (p<0.003), SQ/RM (p<0.017), LP (p<0.001), LP/RM (p<0.001). Post-hoc analysis yielded a significant increase from year 1 to 2 in BM (p<0.001), BP (p<0.001), SQ (p<0.001), SQ/RM (p<0.001), LP (p<0.001). There was no significant increase in BP/RM from year 1 to 2 (p=0.280). There was a significant decrease in BM from year 2 to 3, but there was a significant increase in BP (p<0.001), BP/RM (p<0.001), SQ (p<0.001), SQ/RM (p<0.001), LP (p<0.001). There was no significant change in absolute BP, SQ and LP in the first year indicate increased muscle mass and an adaptation to the strength and conditioning program at the university. This may be attributed to a change in diet, increased muscle mass and increased neural adaptation to strength training. Second year decrease in BM and increase in absolute and relative BP, SQ and LP might be attributed to decreased body fat percentages and improved tissue quality.

2272  Board #318  MAY 31  9:00 AM - 10:30 AM
Testosterone And Cortisol With Relation To Mood State In Professional Spanish Basketballers
Xavi Schelling i del Alcázar1, Julio Calleja-González2, Nicolás Terrados Cepeda1, Jeffrey M. Mjaanes3, Holly J. Benjamin, FACSM4, 1Basquet Manresa, Barcelona, Spain. 2Faculty of Physical Activity and Sport Sciences, UPV-EHU, Vitoria, Spain. 3University of Oviedo, Oviedo, Spain. 4Rush University Medical Center, Chicago, IL. 5University of Chicago, Chicago, IL.
(No relationships reported)
PURPOSE: To describe the trends in Total Testosterone (TT) and Cortisol (C) and their relation to mood state during a complete season in elite spanish basketball players.
METHODS: We studied eleven male players of a professional basketball team (n=11; 27.4±6.3 years; 92.9±9.9 kg; 23.9±1.1 BMI). Samples were taken in the morning, in fasting state, every 4-6 weeks, after a 24-36 hour break following the last game played. Seven samples were collected since August to April from each player. Blood samples of preseason’s 1st month were compared the next days. Correlation between TT, C and POMS-SF were assessed in the following months: August to September (p=0.011), October to November (p=0.001), November with December (p=0.011), December to January (p=0.001), January to February (p=0.001), February to March (p=0.001) and March to April (p=0.001).
RESULTS: TT concentration showed significant variations between blood samples: September Vs. August (+2.6 nMol/l, p=0.027). In October TT correlated with POMS’s Total Punctuation (PT) (R=0.846; p=0.001), Tension (R=0.676; p=0.022), Depression (R=0.814; p=0.002) and Confusion (R=0.715; p=0.013). TT concentration correlated in October with PT (R=0.765; p=0.010), Tension (R=0.817; p=0.004), Depression (R=0.709; p=0.022) and Aggressivity (R=0.843; p=0.002); and in November with PT (R=0.685; p=0.020), Tension (R=0.611; p=0.046) and Depression (R=0.745; p=0.008).
CONCLUSIONS: The physiological effect of playing professional level basketball is reflected by total testosterone concentrations and mood state. Preseason phase is the one which implies the most significant hormonal and psychological variations, where the total testosterone increases may show an anabolic state. POMS reflects better current stress than fatigue state. Therefore, testosterone could be an indicator of the athlete’s physiologic state and may serve as a future clinical marker for preventing overload or overtraining states. POMS, on the other hand, can help to evaluate the psychological stress level of players.

2273  Board #319  MAY 31  9:00 AM - 10:30 AM
Comparison of Physical Performance and Muscle Imbalances of First and Second Division Spanish Basketball Teams
Valter Di Salvio1, Carlos González-Haro2, Mattia Modonutti3. 1University of Rome “Foro Italico”, Rome, Italy.  2School of Medicine, University of Zaragoza, Zaragoza, Spain. 3ASPIRE, Academy of Sports Excellence, Doha, Qatar.
(No relationships reported)
PURPOSE: To describe the differences in physical performance and muscular imbalances of male basketball players of 1st and 2nd division Spanish leagues. Little information is available in the literature that compares muscular imbalances and physical performance between 1st and 2nd division leagues.
METHODS: Twelve 1st division and twelve 2nd division Spanish professional basketball players (age: 30.2 ± 3.1 and 22.7 ± 5.1 yr, BMI: 24.1 ± 1.3 and 23.3 ± 1.4 kg·m-2) carried out muscular imbalance and physical performance tests. Stabilometry (normality <20% error) and Isokinetic test (concentric and eccentric peak force, HCON/ECC and HCON/ECC = mean-1SD, bilateral imbalance = mean+1SD) tests were measured on the first day. Peak power in leg press and jump tests (CMJ, CMJas, 3-CMJ and 5-RJ) were measured on the second day. Results were compared by an equal or unequal variance Student’s t-test for unpaired data after a F-test. Statistical significance was set at p<0.05.
RESULTS: No differences were observed neither in Stabilometry for both right and left legs nor in the Isokinetic test (concentric and eccentric peak force, HCON/ECC and HCON/ECC) within and between teams. A higher HCON/ECC (61.8 ± 12.2 vs. 50.8 ± 7.9%, p<0.05) and HCON/ECC (91.0 ± 5.9 vs. 66.0 ± 7.8%, p<0.001) in right leg for 1st team was observed. Players’ frequency in high levels of imbalance was similar on 1st vs. 2nd team (HCON/ECC, HCON/ECC and bilateral deficit). Force and load to achieve peak power in leg press were higher on 1st vs. 2nd team (2969 ± 382 vs. 2270 ± 332 N, 276 ± 36 vs. 212 ± 29 kg, p<0.01). There were no significant differences neither in speed nor in power although the latter one was higher for 1st team (1235 ± 122 vs. 1046 ± 207 W). There were no differences in height neither CMJ nor CMJas between teams; peak power and force on 1st team were higher than on 2nd team for both CMJ (4747 ± 130 vs. 4224 ± 582 W, p<0.05; 2538 ± 313 vs. 1897 ± 380 N, p<0.01) and CMJas (8625 ± 786 vs. 5083 ± 1007 W, p<0.001; 2682 ± 342 vs. 2048 ± 464 N, p<0.05), despite no differences in body mass. There were no significant differences in 3-CMJ and 5-RJ between teams.
CONCLUSION: Muscular imbalances were similar between both teams. 1st team showed higher levels of strength and power than 2nd team.

2274  Board #320  MAY 31  9:00 AM - 10:30 AM
Seasonal Progression in Fitness Variables in Elite Junior Basketball Players
Julio Calleja-Gonzalez. Faculty of Sport Sciences, University of the Basque Country, Vitoria, Spain. (Sponsor: Holly Benjamin, FACSIP)
(No relationships reported)
PURPOSE: Tests of athletic performance are widely used in team sports to assess the progression of various fitness characteristics in players over the course of a season. However, no scientific data exists analyzing these parameters in top level junior players. The aim of the present study was to evaluate seasonal variation in anthropometric and physiological variables, and identify differences between the first and reserve team in the elite Spanish junior basketball players.
METHODS: Fifteen top-level junior male players (Spanish National Junior team) (mean± SD), age (17 ± 0 years), height (197.0 ± 4.4 cm), body mass (88.9 ± 8.3 kg) participated in this study. All the players completed the same training program (5 h per day, four years). The subjects were divided into two different categories: first team player (FT) (n=7) and reserve team player (RT) (n=8). Four times during the season (Sep., Dec., March and June) each player performed lower-limb power test, course Navette (60 yard shuttle run) test (CN) and explosive arm strength test (SEAT). In addition anthropometrical data were recorded.

RESULTS: No significant changes were observed in body composition. At the end of the training program the values were: [ABK: 49.2 ± 7.5 Vs. 57.7 ± 6.5 cm; 46.3 ± 10.0 Vs. 56.1 ± 4.4 cm]; [HF: 2.14 ± 0.3 Vs. 2.18 ± 0.4 m; 2.01 ± 0.3 Vs. 2.59 ± 0.4 m]; [CN: 11.9 ± 1.6 Vs. 12.5 ± 1.4 paliers; 11.6 ± 1.6 Vs. 12.9 ± 1.4 paliers]; [SEAT: 7.0 ± 0.7 Vs. 7.6 ± 0.8 m; 7.3 ± 0.7 Vs. 7.8 ± 1.2 m], FT and RT respectively. Significant pre- and post-training intra-group increases in maximum speed, strength and endurance were noted (P<0.05).

CONCLUSIONS: The progression of both groups during the season was quite similar, with no significant differences in any anthropometric or physiological variables between them. At the end of the season and close to the international championship all players got the best results. All players obtained the best results towards the end of the season.

2275 Board #321 MAY 31 9:00 AM - 10:30 AM
Specific Short-sprint Assessment For Beach Volley Defensive Actions

Methods: Seventeen sub-elite beach volleyball players (29±6 yrs; 1.85±0.09 m height; 78.56±13.44 kg weight) were assessed for short-sprint and jump ability on the beach volleyball court (three trials each test). The sprint test consisted in sprinting to the net in diagonal, departing from the center of the court (Velleman PMD10® light gates were used to switch on the timing Chronojump Bosco System®), touch a contact sensor situated at 4 m in diagonal, coming back to the starting point and continue sprinting to the other touch sensor located on the opposite corner, and finally return to the starting point (final test time). The jump test consisted in performing a counter movement jump (CMJ) on a rigid surface. Coefficient of variation (CV) was calculated and Pearson product-moment correlation was used to compare short-sprint ability and jump ability. We also used a t-test to determine the difference of the mean between regional (RP) and national (NP) ranked players.

Results: CV was less than 2% in both tests. Significant correlations were found between SSABVT time and CMJ flight time (r=-0.81; p<0.05). The NR players needed 0.26 sec less (p<0.01) than RP in SSABVT and jumped 0.036 sec more (p<0.05) than RP.

Conclusion: SSABVT constitute a reliable and valid test for short-sprint ability assessment on the sand court. NR players perform significantly better the specific sprints on the sand than RP, but not the CMJ.
Ice hockey has evolved to become more physically demanding and played at a higher intensity than in the past. However, a time motion analysis (TMA) of various movements performed during a varsity ice hockey game has not been reported.

**PURPOSE:** To describe the frequency and time spent performing different movement patterns during an ice hockey game.

**METHODS:** A convenient sample of 18 male varsity ice hockey players belonging to the same team agreed to participate. The mean (±SD) age, height and body mass of the players was: 22.1±1 yrs; 179.7±6.3 cm; and; 84.3±6.7 kg, respectively. A digital camera (GoPro™ Hero; 720p, 60fps) was mounted to the arena wall and was used to videotape an in-season game. The video files were downloaded and analyzed using Dartfish computer software. Three categories of movements (forward, backward and other) were separated into 9 different movement activities.

**RESULTS:** Forwards and defencemen had a mean shift time of 53 and 54s, respectively. The mean frequency of movements per shift and mean time per movement (in brackets; ±SD) during a complete ice hockey game for centers was: forward gliding = 7.7 (4.9±3.6s); moderate intensity forward skating = 4.7 (1.6±1.0s); high intensity forward skating = 0.2 (3.4±1.5s); backward gliding = 0.6 (1.5±1.2s); struggling for the puck or position = 1.2 (1.7±0.8s); and standing occurred 1.9 (1.8±1.4s) times per shift. Forward: forward gliding = 7.3 (4.3±3.3s); moderate intensity forward skating = 4.6 (1.8±1.0s); high intensity forward skating = 0.2 (3.5±1.2s); backward gliding = 0.8 (1.9±1.0s); backward moderate skating = 0.1 (1.9±0.3s); struggling for the puck or position = 0.6 (1.6±1.0s); and standing occurred 1.4 (2.1±1.6s) times per shift. Defense: forward gliding = 6.9 (4.1±2.9s); moderate intensity forward skating = 2.3 (1.5±0.6s); high intensity forward skating = 0.1 (3.2±1.0s); backward gliding = 3.4 (2.8±1.7s); backward moderate skating = 0.1 (1.8±0.7s); struggling for the puck or position = 0.5 (1.3±0.7s); and standing occurred 2.9 (2.2±1.4s) times per shift.

**CONCLUSION:** Time motion analysis of a varsity ice hockey game revealed that the movement activities performed by players varied in time and depended on player positions. High intensity movements were least frequently performed and for shorter periods of time.

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**2279 Board #325**

**May 31 9:00 AM - 10:30 AM**

**Time Motion Analysis of Varsity Ice Hockey**

Gordon J. Bell, Alex Game, Jessie Gill, Ben Davis, Pierre Gervais, Gary Snydmiiller. *University of Alberta, Edmonton, AB, Canada.* (Sponsor: Darren Delorey, FACSM)

(No relationships reported)

Ice hockey has evolved to become more physically and played at a higher intensity than in the past. However, a time motion analysis (TMA) of various movements performed during a varsity ice hockey game has not been reported.

**PURPOSE:** The purpose of this study was to determine the frequency and time spent performing different movement patterns during an ice hockey game.

**METHODS:** A convenient sample of 18 male varsity ice hockey players belonging to the same team agreed to participate. The mean (±SD) age, height and body mass of the players was: 22.1±1 yrs; 179.7±6.3 cm; and; 84.3±6.7 kg, respectively. A digital camera (GoPro™ Hero; 720p, 60fps) was mounted to the arena wall and was used to videotape an in-season game. The video files were downloaded and analyzed using Dartfish computer software. Three categories of movements (forward, backward and other) were separated into 9 different movement activities.

**RESULTS:** Forwards and defencemen had a mean shift time of 53 and 54s, respectively. The mean frequency of movements per shift and mean time per movement (in brackets; ±SD) during a complete ice hockey game for centers was: forward gliding = 7.7 (4.9±3.6s); moderate intensity forward skating = 4.7 (1.6±1.0s); high intensity forward skating = 0.2 (3.4±1.5s); backward gliding = 0.6 (1.5±1.2s); struggling for the puck or position = 1.2 (1.7±0.8s); and standing occurred 1.9 (1.8±1.4s) times per shift. Forward: forward gliding = 7.3 (4.3±3.3s); moderate intensity forward skating = 4.6 (1.8±1.0s); high intensity forward skating = 0.2 (3.5±1.2s); backward gliding = 0.8 (1.9±1.0s); backward moderate skating = 0.1 (1.9±0.3s); struggling for the puck or position = 0.6 (1.6±1.0s); and standing occurred 1.4 (2.1±1.6s) times per shift. Defense: forward gliding = 6.9 (4.1±2.9s); moderate intensity forward skating = 2.3 (1.5±0.6s); high intensity forward skating = 0.1 (3.2±1.0s); backward gliding = 3.4 (2.8±1.7s); backward moderate skating = 0.1 (1.8±0.7s); struggling for the puck or position = 0.5 (1.3±0.7s); and standing occurred 2.9 (2.2±1.4s) times per shift.

**CONCLUSION:** Time motion analysis of a varsity ice hockey game revealed that the movement activities performed by players varied in time and depended on player positions. High intensity movements were least frequently performed and for shorter periods of time.
INTRODUCTION: Cheerleading involves the performance of skills requiring a high degree of muscular strength, endurance, flexibility, balance, and determination. Despite the trend of cheerleaders performing increasingly difficult and athletic skills, very little is known about their physiological fitness levels.

PURPOSE: The purpose of the study was to create a physiologic profile of the fitness status of male and female collegiate cheerleaders.

METHODS: Eight females (age: 19.4 ± 1.1 yrs; ht: 156.3 ± 6.9 cm; wt: 55.3 ± 8.6 kg) and four males (age: 24.2 ± 2.6 yrs; ht: 182.8 ± 9.9 cm; wt: 83.4 ± 10.6 kg) volunteered to participate in this study. Each subject completed a treadmill test to maximal oxygen levels using the Bruce Protocol, Hydrostatic weighing, and a Wingate Anaerobic Test (WAnT) on a cycle ergometer.

RESULTS: Maximal oxygen consumption for the males was 47.3 (±1.1 ml/kg/min) and 47.9 (±6.1 ml/kg/min) for the females. Absolute values were 4.3 (±0.1 L/min) for males and 2.3 (±0.4 L/min) for the females. The maximal heart rates achieved were 204.7 (±13.6 bpm) for the males and 191.2 (±4.9 bpm) for females. It was determined that the percent body fat for the males was 9.2 (±5.8%) and 16.0 (±4.6%) for the females. The findings for the WAnT indicated a mean power of 8.625 (±0.8 W/kg) for the males and 7.23 (±0.69 W/kg) for the females with peak power of 14.9 (±2.57 W/kg) and 11.34 (±2.18 W/kg), respectively.

CONCLUSION: When compared to norms from the ACSM’s Guidelines for Exercise Testing and Prescription 8th ed (2010), the relative maximal oxygen consumption was above the 70th percentile for males and above the 65th percentile for females for the 20 to 24 year old. According to norms for 18-25 year old (Niemann, 2007) the results for the WAnT placed 10 of 12 subjects in this group of cheerleaders in the elite category for both peak and mean power/kg. This physiological profile of the fitness level of cheerleaders suggests that the ability to generate power is developed to a greater extent than aerobic fitness.

INTRODUCTION: Vision training is an emerging area of interest for sports performance. This study examined the effects of vision training on softball performance.

PURPOSE: The purpose of the study was to determine if a 5-week program of vision training, designed to train saccades, accommodation, vergence of the eye, hand eye coordination and peripheral vision, enhanced skills related to softball in a group of female collegiate softball players.

METHODS: Sixteen healthy softball athlete’s age (18-22 years), from a Division II collegiate setting were randomly assigned into treatment or control groups. Treatment consisted of 20 sessions of vision training conducted over five weeks. Eye training was conducted following a specific program using equipment from the Eye Metrix, Inc (Maryland Heights, MO, USA) with exercises changing every session. The subjects from the control group did not participate in any vision training. All subjects maintained their usually softball practice schedule. Study design was a 2 x 2 factorial with group (experimental group and control group) and time (pre- and post- testing). The dependent variables included colored line perception test and background alteration, vertical saccades, horizontal saccades and hand eye coordination/peripheral vision assessment. The testing and training occurred at Fairmont State University in the Feaster Center.

RESULTS: There was a significant group by test interaction for all measures involving saccades and accommodation and vergence with the experimental group improving on all visual dependent variables. There were no significant differences between groups in the ability of players to hit balls colored with different lines. Softball players scored significantly higher (p≤0.05) in their ability to hit balls coming at them with a red background. However, no difference was observed using either a black or green background.

CONCLUSIONS: Although eye training significantly improved visual characteristics in a group of collegiate female softball players, this improvement did not appear to translate into enhanced batting abilities within laboratory conditions.

INTRODUCTION: It has been considered that prolonged fatigue has negative influence on maintaining physical condition, it would be essential for athletes to continuously monitor their state of physical fatigue. Although resting heart rate (HR) has long been recognized as an objective index of physical fatigue, recent studies suggest that heart rate variability (HRV) would be a better tool for monitoring a state of physical fatigue. To date, however, little is known whether measuring HRV would be efficient for elite athletes to monitor their state of physical fatigue.

PURPOSE: To examine the relationships between HRV indices and physical fatigue in elite athletes.

METHODS: Sixteen Japanese national badminton team players (23.2±2.9 yrs) volunteered to participate in the study. Measurements were carried out during the national team training camps on two different days, each separated by three months. In each measurement, all data were collected in the morning just after the players’ waking time. Beat-to-beat heart rate was recorded for five minutes under the controlled breathing of 15 breaths per minute. Frequency domain heart rate variability indices were obtained using spectral analysis. The spectral power in the low-frequency (LF: 0.04-0.15Hz) and the high-frequency (HF: 0.15-0.40Hz) bands were calculated. In addition, normalized units (LFnu and HFnu) were obtained. Whereas HF is known to represent parasympathetic activity, LFnu and HFnu represent an evaluation of the autonomic nervous system balance. The subjects were also asked to fill in a questionnaire in which they estimated their subjective feeling of fatigue on a visual analog scale.

RESULTS: There was a significant difference in subjective feeling of fatigue between the measurements (54.7±4.8 vs. 62.6±3.8 mm, p<0.05). The changes in subjective feeling of fatigue between the measurements were significantly correlated with the changes in HFnu (r=0.70, p<0.01). In contrast, no significant correlation were observed between the changes in subjective feeling of fatigue and the changes in HR (r=0.06, P>0.05).

CONCLUSION: These results suggest that measuring changes in HRV indices such as HFnu might be more efficient than measuring changes in HR for elite athletes to objectively monitor their state of physical fatigue.
C-39  Free Communication/Poster - Thirst and Behavior
MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2285  Board #331  MAY 31  9:00 AM - 10:30 AM
Age-related Changes In Hydration Status During Intermittent Exercise In The Heat
Heather E. Wright1, Joanie Larose1, Stephen G. Hardcastle2, Ronald J. Sigal1, Pierre Boulay3, Glen P. Kenny1, 1University of Ottawa, Ottawa, ON, Canada. 2CANMET Natural Resources Canada, Sudbury, ON, Canada. 3University of Calgary, Calgary, AB, Canada. 4Champlain Diabetes Regional Coordination Centre, Ottawa, ON, Canada.

(Association for Exercise and Sport Medicine, American College of Sports Medicine)

Aging is associated with a progressive decrease in thermoregulatory and cardiovascular function. When combined, these age-related changes are thought to decrease the body’s ability to maintain core temperature at safe levels, during heat exposure. This can be exacerbated by reductions in hydration. However, the differences in hydration between young and older individuals during exercise in the heat and how this may affect core temperature are unclear.

PURPOSE: To examine the effects of intermittent exercise in a hot/dry environment on the changes in hydration status in healthy young, middle-aged, and older males.

METHODS: Five young (Mean±SD: Y: 27.6±4.4 yrs), five middle-aged (M: 45.2±3.0 yrs), and five older (O: 61.2±4.3 yrs) healthy males, matched for weight and body composition, performed four successive bouts of 15-min cycling at a constant rate of metabolic heat production (400 W) in dry heat (35°C, 20% relative humidity). Each exercise bout was separated by 15 minutes of rest with a final rest period of 60 minutes. Rectal temperature (T<sub>r</sub>) was measured continuously. Blood and urine samples were obtained prior to exercise (PRE) and following the final recovery for the analysis of hematological parameters (e.g., hemoglobin, hematocrit) and osmolality, and urine specific gravity (USG), respectively.

RESULTS: The change in T<sub>r</sub> from PRE to the end of exercise (Y: 0.36±0.15, M: 0.55±0.21, O: 0.58±0.23°C) and final recovery was similar between age groups. Similar hydration status measures, including changes in weight (Y: -1.2±0.1, M: -1.2±0.2, O: -1.2±0.1 kg), plasma (Y: 0.1±0.8, M: -7.8±2.6, O: -7.1±4.0%) and blood volumes (Y: -2.8±2.4, M: -5.8±1.5, O: -4.0±1.6%), plasma osmolality (Y: +4.5±5.7, M: +3.7±2.6, O: +3.8±2.5 mOsm/L kgH<sub>2</sub>O), and USG (Y: +0.006±0.007, M: +0.007±0.005, O: +0.005±0.007), were observed between groups.

CONCLUSION: Preliminary data indicate that young, middle-aged, and older male adults show similar changes in hydration status following intermittent exercise in the heat. Support: Workplace Safety and Insurance Board of Ontario and Canada Foundation for Innovation-Leaders Opportunity Fund (held by G.P. Kenny).

2286  Board #332  MAY 31  9:00 AM - 10:30 AM
Predetermined Drinking Plans Impact Blood Sodium Concentration And Body Weight During A Half Marathon
Nicole Mitchell1, James Winger2, Jonathan Dugas3, Amy Luke1, Lara Dugas1, Loyola University Chicago, Maywood, IL. 2The Vitality Group, Chicago, IL. 3University of Calgary, Calgary, AB, Canada.

(Association for Exercise and Sport Medicine, American College of Sports Medicine)

Exercise-associated hyponatremia (EAH) is caused by ingesting fluids beyond thirst, resulting in dilution of blood sodium concentrations ([Na<sup>+</sup>]). Runners can decrease the likelihood of EAH by following their bodies’ natural drive to drink, commonly known as drinking to thirst<sup>1</sup>. ACSM recommends that runners lose no more than 2% of their starting body mass, to protect them from dehydration and poor performance. We sought to investigate the relationships between predetermined drinking plans, body mass changes and changes in blood sodium levels during a half marathon race.

METHODS: 94 runners completed a pre-race drinking plan survey, 67 runners completed both pre and post-race body mass and blood sample measurements. Blood samples were used to determine serum [Na<sup>+</sup>].

RESULTS: No runners finished the race hyponatremic. The majority of runners (52%) indicated that they planned to drink according to a predetermined schedule (SCHED). 37% of runners planned to drink only when thirsty (DTT), with 11% of runners planning to drink as much as possible (MAP). The DTT group was significantly younger (p<0.001), predominantly female (58%) and had the least running experience (5.5 yrs vs. 12.5 yrs, p<0.05). Runners in these three groups differed in their [Na<sup>+</sup>] change during the race (DTT: 2.7±2.7 mmol/L, SCHED: 1.4±2.0 mmol/L, AMAP: 0.8±4.5 mmol/L, p = 0.08) but did not exhibit statistical difference in their race times (DTT; 121.3±22.2 min, SCHED; 124.8±20.2 min, AMAP; 139.4±22.6 min; p = 0.14).

However the running time for the DTT group represents almost 11 min faster than the combined mean race time of the other 2 groups. Alternatively runners losing ≥2% of starting body mass on average ran 10 min faster (p = 0.06) compared to runners with a more modest body mass loss and experienced greater differences in their [Na<sup>+</sup>] (3.2 μEq/L in [Na<sup>+</sup>] vs. 1.1 μEq/L for group losing <2% body mass, p = 0.002).

CONCLUSIONS: Pre-race hydration plan has a measurable effect on post-race parameters of fluid and electrolyte balance. Drinking to thirst or losing ≥2% of starting body mass may protect runners from EAH through favorable [Na<sup>+</sup>] changes and may have favorable outcomes on running performance. These findings bring into question current drinking recommendations and advice given to recreational runners. No external funding.

2287  Board #333  MAY 31  9:00 AM - 10:30 AM
Hydration Status, Perceived Thirst and RPE of South-East Asian Soccer Players during Consecutive Days Training
John O’Reilly, Stephen H. Wong, FACSM, Peng Hua Sun. The Chinese University of Hong Kong, Shatin, NT, Hong Kong.

(No relationships reported)

There is little, if any, data published in the literature on the hydration status of South-East Asian soccer players during consecutive days of regular season training. Furthermore, the relationship between heart-rate and self-perception measures for exercise and thirst has not been well established in soccer players.

PURPOSE: (1) To assess the sweat rate (SR) and hydration status of South-East Asian professional soccer players during consecutive days of in-season training. (2) To investigate the relationship between rate of perceived exertion (RPE), heart-rate (HR) & perceived thirst (PT) amongst South-East Asian soccer players during consecutive days training.

METHODS: 14 healthy, male professional soccer players from the Hong Kong football league (mean ± SD: age 24.1 ± 3.5 years, height 1.78 ± 0.07 m, body mass (BM) 72.6 ± 12.1 kg) took part in two soccer-specific, in-season training sessions of similar intensity on consecutive days (T1 & T2). Environmental conditions (Temp: 27 °C, RH: 85%, Wind speed: 1.03 - 1.20 m/sec) were similar on both occasions. Ad libitum drinking was permitted at all times. Each participant was individually assessed to establish their pre- and post-training hydration status by urine specific gravity (USG) as well as their fluid consumption (FC) and SR for each training session. RPE and PT were measured periodically during both training sessions.

RESULTS: Although the mean percentage body mass losses were within recommended ranges (i.e. <2%) on both days, 5 players began T1 in a dehydrated condition (USG > 1.020), while 7 players commenced T2 dehydrated. The relationship between SR and FC was significant in T1 (SR vs. FC: 1.39 ± 0.54 L/hr vs. 0.85 ± 0.20 L/hr, p<0.01), but not in T2 (SR vs. FC: 1.54 ± 0.46 L/hr vs. 1.02 ± 0.23 L/hr, p>0.05). There were no significant differences observed in USG during either between or within training sessions (p>0.05). A positive correlation was observed between PT and RPE during both training sessions (T1: r = 0.986, T2: r = 0.988, p<0.01).

CONCLUSIONS: RPE provides an accurate estimate of PT and work intensity during soccer specific exercise. Not all South-East Asian soccer players commence training in a euhydrated condition. Training on consecutive days in a hot and humid environment does not significantly alter USG in South-East Asian professional soccer players.
A key tenant in adherence to ACSM fluid intake guidelines is accurate assessment of fluid volume lost during exercise.

**PURPOSE:** To determine how accurately runners estimate their sweat losses.

**METHODS:** Twenty heat-acclimatized female (age = 41 ± 9 y, VO2max = 52 ± 8 mL/kg/min, body fat = 23 ± 4%) and 19 male (41 ± 12 y, VO2max = 61 ± 9 mL/kg/min, body fat = 14 ± 5%) runners from the southeastern US completed a challenging outdoor road run between August and early September (WBGT = 24.1 ± 1.5 °C) that allowed a finishing time of approximately 1 h. Runs began at approximately 06:45 or 18:45. Runners filled 8 oz race aid station paper cups with a volume of fluid they felt they would be equivalent to their sweat losses before and after running.

**RESULTS:** Total sweat losses and losses by percent body were significantly greater (p < 0.01) for men (1797 ± 449 mL, 2.3 ± 0.6%) than women (1155 ± 258 mL, 1.9 ± 0.4%), but post-run sweat loss estimation accuracy did not differ between males (underestimation = 46.9 ± 27.3%; 95% CI = 33.8-60.0%) and females (underestimation = 52.1 ± 18.4%; CI = 43.5-60.7%). Collectively, runners’ predictions (738 ± 470 mL) were less than half of actual sweat losses (1468 ± 484; p < 0.001). Pre- and post-run sweat loss estimations did not differ and were strongly correlated (r = 0.88). Nine runners (5 female and 4 male) reported they had assessed their post-run body weights in the previous month. However, there was no difference (p = 0.55) in the accuracy of runners who had assessed body weight change before and after a run (underestimations = 53.6 ± 18.2%) and those who had not (underestimations = 48.3 ± 24.4%).

**CONCLUSIONS:** These results suggest inadequate fluid intake during runs or between runs may stem from underestimations of sweat losses. Further, runners who attempt to assess sweat losses through changes in body weight may be making sweat loss calculation errors or do not accurately translate changes in body weight on a scale to physical volumes of water in race aid station caps.

**Board #335**

**MAY 31 9:00 AM - 10:30 AM**

**Drinking According to Thirst does not Prevent Dehydration in Sub-optimally Hydrated Young Soccer Players**

Giannis Arnaoutis, Stavros A. Kavouras, FACSFM, Yiannis P. Kotsis, Costas N. Bardis. Harokopio University, Athens, Greece.

(No relationships reported)

Maintenance of fluid balance is essential for health, athletic performance and thermoregulation. Although there are a lot of studies evaluating hydration status in adults, limited data concerning hydration levels in athletic youth exists.

**PURPOSE:** To assess hydration status in male young soccer players during a summer sports camp and to investigate if ad libitum water intake will prevent further dehydration in the hypohydrated children.

**METHODS:** Initial hydration status was assessed in 107 young soccer players (age: 13 ± 2 y, weight: 52.2 ± 8.5 kg, height: 1.58 ± 0.08 m). Seventy-two out of the 107 children agreed to undergo additional testing for two more separate training days, in order to calculate dehydration changes in body weight, while water drinking was allowed ad libitum. Hydration status of the participants was assessed in the morning and after the training session, via urine specific gravity (USG), urine color and changes in total body weight. Mean environmental temperature and humidity was 27.2 ± 2°C and 57 ± 9% respectively.

**RESULTS:** According to USG values (≤ 1.020), 95 out of 107 of the children (88.7%) were dehydrated prior to practice. Likewise, according to the urine color chart, 93.7% (100 out of 107) were also classified as dehydrated. The prevalence of dehydration was maintained in both training days, with 95.8% and 97.2% of the children being dehydrated (USG ≥ 1.020) after the end of the 1st and the 2nd training session respectively. Remarkably, despite fluid availability, mean weight loss of -0.35 ± 0.04 kg after the 1st practice and -0.22 ± 0.03 kg after the 2nd practice was observed among the subjects. Specifically, 54 out of the 66 children (81.8%) with pre-exercise USG > 1.020 reduced their body weight after 1st training session, while similarly, 47 out of the 63 dehydrated children (74.6%) also further reduced their body weight after the end of the 2nd training session. Correlation between pre-exercise USG values and changes in body weight failed to reveal any relationship (p > 0.05).

**CONCLUSION:** Approximately 80% of the dehydrated soccer players dehydrated more during soccer practice, regardless of fluid availability. These findings indicate that drinking according to thirst during practice, did not prevent further dehydration in sub-optimally hydrated young soccer players.

**Board #336**

**MAY 31 9:00 AM - 10:30 AM**

**Are All Milks Equal? Comparing The Rehydration Potential Of Popular Milk Based Beverages.**

Sarah Jansen, Christopher Irwin, Ben Desbrow. Griffith University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSFM)

(No relationships reported)

**PURPOSE:** To examine varieties of milk regarding their ability to rehydrate following exercise-induced fluid losses.

**METHODS:** Six male participants (age 25.7 ± 5.9 y, height 178.9 cm ± 6.3 cm, body mass 75.2 kg ± 5.5 kg [mean±SD]) lost 2.1 ± 0.3% body weight through intermittent cycle exercise before consuming a different beverage on four separate occasions. Drinks included Cow’s milk (0.6 cal·mL⁻¹), Soy milk (0.6 cal·mL⁻¹), a milk based liquid meal replacement - Sustagen (1.1 cal·mL⁻¹) and a Sports Drink (0.3 cal·mL⁻¹). Beverages were consumed over 1 h in total volumes equivalent to 150% of body weight loss during exercise. Body weight, blood and urine samples and measures of gastrointestinal tolerance were obtained before and for 4 h after beverage consumption.

**RESULTS:** Net fluid balance at conclusion of the trial was significantly enhanced on the Sustagen trial compared to the Sports Drink (Sustagen = -0.59 ± 0.36 kg vs Sports Drink = -1.25 ± 0.44 kg, p = 0.039), which was largely a result of significant differences in total urine output (p < 0.01) between treatments. There was a tendency for improved fluid retention with the Soy (−0.83 ± 0.39 kg) and Cow’s (−0.85 ± 0.41 kg) milk treatments relative to the Sports Drink trial however this was not statistically significant. Overall measures of gastrointestinal tolerance and haematological markers exhibited no difference between milk-based trials.

**CONCLUSION:** Milk-based drinks are more effective rehydration options compared to traditional sports drinks. The consumption of a high calorie milk-based liquid meal replacement maximises the recovery of fluid losses following exercise and should be recommended to individuals requiring rapid fluid restoration.

**Board #337**

**MAY 31 9:00 AM - 10:30 AM**

**Voluntary Fluid Intake With Milk Or Chocolate Milk In Boys Exercising In The Heat**

Alhelci Mateos Roman, Luis F. Aragon-Vargas, FACSFM, ¹Club Deportivo Suprissa, San José, Costa Rica, ²UNIVERSIDAD DE COSTA RICA, San José, Costa Rica.

(No relationships reported)

**PURPOSE:** To compare fluid balance (FB) and voluntary intake (VI) in 10- to 14-year-old boys, when they combine milk or chocolate milk with water during exercise in the heat. In addition, palatability and gastrointestinal (GI) symptoms were assessed.

**METHODS:** Thirty-one boys from a junior soccer team (12.6 ± 1.4 y.o., 42.69 ± 2.09 kg and 147.8 ± 10.0 cm) (Mean ± S.D.), exercised in a controlled environment chamber (31.6 ± 0.36°C dry bulb and 47.3 ± 2% relative humidity), at 67.4 ± 1% HRmax, using a cycle ergometer and a treadmill. They alternated 20 min of exercise with 10 min of rest on four consecutive times, for a total of 2h in the chamber. Ad libitum fluid intake was monitored from the simultaneous presentation of water and partially skimmed milk (session A), or water and partially skimmed chocolate milk (session B); the drinks had a temperature of 15.9 ± 0.12°C. Fluid balance was calculated from differences in nude body weight. Palatability and GI symptoms were reported upon arrival, and before, during, and after the exercise session.

**RESULTS:** Initial conditions were the same for sessions A and B (p = 0.05). No significant difference was found between sweat rates during session A (460.8 ± 217.4 mL·h⁻¹) and session B (459.8 ± 229.4 mL·h⁻¹) (p = 0.98). FB was the same for both sessions (0.76 ± 0.80% BW vs. 0.77 ± 0.76% BW, p = 0.94). A significant difference was found for time: a positive FB was observed during the first hour of exercise, but not during the second hour. VI was the same for both sessions (p = 0.87), but different over time: boys drank more fluid during the first hour (573 ± 213 mL and 526 ± 203 mL for sessions A and B, respectively) than during the second hour (307 ± 137 mL and 343 ± 138 mL for A and B, respectively) (p < 0.001). Chocolate milk showed the highest
venous occlusion.

RESULTS: There were no significant differences either between contraction types or with or without occlusion (P>0.05).

METHODS: Female and male subjects (n=46, 24 ± 6 yrs) participated in morning (AM) and afternoon (PM) laboratory visits while otherwise maintaining activities of daily living without exercise over three days. After the first day of FL, 24 hr of euhydration was followed by 24 hr dehydration via FR. Mean ± SD peak outdoor temperature was 32 ± 4°C and 18 ± 13.5°C during hot and temperate conditions, respectively. Body mass (BM), perceived thirst, urine osmolality (UOsm), urine color (UC), urine specific gravity (USG), and plasma osmolality (POsm) were measured.

RESULTS: The frequency distribution for FL subjects with UOsm >700 mOsm/kg during hot weather was 55%, 59% (for AM, PM) and 75%, 63% (for AM, PM) during temperate conditions. Males had significantly higher UOsm (818 ± 117 vs. 733 ± 117 mOsm/kg in females, p < 0.02) and POsm (291 ± 4 vs. 287 ± 4 mOsm/kg in females, p < .001) across all time points and environmental conditions. During 24 hr FR, males lost a greater %BM compared to females (2.3 ± 0.6 vs. -1.9 ± 0.7 %, p < 0.05) but thirst, UC, and USG were not different by gender. From 16 to 24 hr of FR, thirst rating, UOsm, POsm, and %BM loss increased significantly (p <0.001) in all subjects while UC and USG did not change.

CONCLUSIONS: Hydration status in young adults suggests no greater incidence of dehydration during daily living when weather conditions are hot vs. temperate. However, men exhibit greater hypertonicity of urine and plasma compared to women.

Funded by a grant from The Coca-Cola Company, Atlanta, GA

The use of low-fat milk as a safe and effective post-exercise rehydration beverage has been recently investigated in the adult population; however, there is a paucity of information on milk’s rehydration ability in children after exercising in the heat.

METHODS: This study tested the hypothesis that due to higher electrolyte content, milk will be more effective than both water and a carbohydrate/electrolyte solution (CES) in replacing electrolyte losses in children following exercise in the heat.

METHODS: Fourteen 8- to 10-year old heat-acclimated children (8 girls, 6 boys) performed three exercise trials in a warm environment (35°C, 50% relative humidity) consisting of two 20-min cycling bouts at 60% VO2peak followed by consumption of either water (W), CES, or skim milk (SM). Each beverage was consumed in a volume equal to 100% of their body weight losses and beginning immediately after exercise. Urine samples were collected before, during, and after exercise, as well as during the 120 min following drink consumption.

RESULTS: Participants ingested 399 ± 97 ml of fluid. Children remained in a net negative balance for Na+ and Cl− at the end of the 120 min recovery period for all beverages. No difference was found between beverages for Na+ balance; however, children maintained a more positive Cl− following the consumption of SM (-1412 ± 484 mg; p<0.05). Similarly, K+ balance was significantly greater in the SM trial compared with both the W (-1530 ± 561 mg; p<0.01) and CES (-1412 ± 484 mg; p<0.05) trials; no significant difference between the W and CES trials. Children were able to return to a net positive K+ balance following the consumption of SM (182 ± 170 mg), whereas they remained in a net negative K+ balance during the CES (-270 ± 179 mg) and W (-399 ± 228 mg) trials.

CONCLUSIONS: SM was effective at maintaining a more positive electrolyte balance for both K+ and Cl− in comparison to W and a C.

Supported by a Grant from the Agri-Science Cluster Initiative®

*This initiative includes: Dairy Farmers of Canada, Agriculture and Agri-Food Canada and the Canadian Dairy Commission.

C-40 Free Communication/Poster - Vascular Function and Arterial Stiffness

MAY 31, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2294 Board #340 MAY 31 8:00 AM - 9:30 AM

Effect Of Milk Intake On Electrolyte Balance In Children After Exercise In The Heat
Kim Volterman, Joyce Obeid, Boguslaw Wilk, FACS, Brian W. Timmons. McMaster University, Hamilton, ON, Canada.

(No relationships reported)

The use of low-fat milk as a safe and effective post-exercise rehydration beverage has been recently investigated in the adult population; however, there is a paucity of information on milk’s rehydration ability in children after exercising in the heat.

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CONCLUSIONS: SM was effective at maintaining a more positive electrolyte balance for both K+ and Cl− in comparison to W and a C.

Supported by a Grant from the Agri-Science Cluster Initiative®

*This initiative includes: Dairy Farmers of Canada, Agriculture and Agri-Food Canada and the Canadian Dairy Commission.
Pro-inflammatory conditions associated with aging, poor dietary habits, obesity and increased levels of oxidative stress have been linked to endothelial dysfunction. While the long-term benefits of exercise on vascular function are well known, muscle injury is often a consequence of performing exercise. Post-injury inflammatory responses may contribute to vascular dysfunction, as markers of inflammation have been shown to increase arterial stiffness, impair endothelial-dependent vasodilation, and decrease the expression of endothelial nitric oxide synthase.

PURPOSE: To examine the effect of eccentric exercise-induced injury on endothelial dependent and independent vascular responses.

METHODS: Ten healthy male subjects (26.6 ± 1.2 yrs, ± SD) performed 50 maximal eccentric contractions to induce injury to the biceps brachii. Subsequent changes in maximal isometric strength and vascular responses were assessed at 1, 24, 48, and 96 hrs post injury. Endothelial-dependent and -independent vasodilation were measured in the brachial artery using the flow-mediated dilation (FMD) approach and sublingual NTG (0.4 mg) administration, respectively. Mean blood velocity was measured by Doppler ultrasound and subsequently used to calculate muscle blood flow and shear stress (expressed as the area under the curve, SSACC).

RESULTS: Eccentric exercise resulted in impaired maximal isometric strength for up to 96 hours (p<0.05). Compared to pre-injury values, FMD decreased within 1 hr of injury (Pre: 8.4 ± 0.9; 1 hr post; 5.12 ± 0.7 %FMD, p<0.05) and remained lower (p<0.05) for up to 96 hrs. Similarly, the vasodilatory response to NTG was also impaired for 96 hours following eccentric-induced muscle injury (Pre: 26.3 ± 2.1; 1 hr post; 20.7 ± 1.5 %, p<0.05). Injury resulted in a decrease (p<0.05) in SSACC immediately following exercise which remained impaired for 48 hrs. Resting blood pressure and muscle blood flow remained similar throughout the duration of the study.

CONCLUSIONS: These results suggest that muscle injury leads to impaired local endothelial and vascular smooth muscle function. The lower shear stress following injury may contribute to the reduced FMD response but the mechanism responsible for the attenuated endothelial-dependent vasodilation requires further investigation.

2296
Board #342
MAY 31 8:00 AM - 9:30 AM
Influence of Self-reported Physical Activity on Arterial Stiffness in Adolescents
Megumi Sugino, Hajime Miura, Saori Manouka, Yukimi Maki. Univ. of Tokushima, Tokushima, Japan.

Insufficient physical activity may play a pathophysiological role in the development of atherosclerosis in middle-aged to older men. However, few attempts have been so far been made to identify the role of physical activity on arterial function in adolescents but adults.

PURPOSE: The aim of this study was to explore the effect of current life style of physical activity on arterial stiffness in adolescents.

METHODS: 183 healthy male high school students were divided into two groups: 83 were in the active group who participated in sports or athletic clubs in addition to physical education class and 100 were in the control group who took only physical education class. The brachial systolic and diastolic blood pressure (SBP, DBP), heart rate (HR) and brachial to ankle pulse wave velocity (baPWV) were measured using a volume-plethysmographic apparatus while the subjects were in the supine position. In order to estimate the energy expenditure of physical activity (PA), the International Physical Activity Questionnaire with the short format was adopted.

RESULTS: In the active group, both baPWV and PA significantly differed from those in the control group (p<0.001). However, no significant differences in age, height, weight, body mass index (BMI), %fat, SBP, DBP, HR, and PA were found between the two groups. The 9 independent variables that had correlations with selected variables (age, height, weight, BMI, %fat, SBP, DBP, HR, and PA) were examined by regression modeling to determine their relative influence on the baPWV. In the final model, SBP, PA, weight, and age accounted for 43.5% of the variation in baPWV. The standardized beta estimates were β = 0.544 (p=0.0001) for SBP, β = -0.371 (p=0.0001) for PA, β = -0.145 (p=0.05) for weight, and β = 0.129 (p=0.05) for age.

CONCLUSIONS: These results suggested that spending more time engaging in physical activity has a favorable effect on arterial stiffness in adolescents as well as middle-aged to older men.

2297
Board #343
MAY 31 8:00 AM - 9:30 AM
Acute Effect of Moderate and High Intensity Resistance Exercise on Arterial Stiffness
Thomas Black. Springfield College, Springfield, MA.

INTRODUCTION: Cardiovascular disease is the leading cause of death in the western world. The stiffness of large arteries has been identified as a major independent risk factor for cardiovascular disease. Resistance exercise (RE) is included in a well-rounded exercise prescription for the general public and for persons with a variety of diseases in accordance with ACSM guidelines. However, researchers have found evidence indicating that RE may increase arterial stiffness.

PURPOSE: The current study was designed to determine the effect on moderate and high intensity RE on arterial stiffness (AS).

METHODS: Twelve young healthy males, age (21.5 yr ± 1.5), training age (6 yr ± 1.8), weight (88.5 kg ± 7.9), height (177.2 cm ± 3.3), and % body fat (15.9 % ± 5.3), who regularly resistance trained were recruited for the study. Each subject completed both the moderate and high intensity bout on two separate occasions in a randomized order. Pulse wave velocity (PWV) was used to estimate AS and was measured at baseline, 10 min post, 20 min post, and 30 min post. Heart rate was measured during each bout and was used as a marker of sympathetic nervous system activity. A total body RE workout was completed during each bout and consisted of four free weight exercises. A total body RE workout was completed during each bout and consisted of four free weight exercises.

RESULTS: Significant increases (p < .05) in PWV were observed up to 30 min following RE, however, no significant differences (p < .05) were found between the two intensities. The differences in PWV observed are as follows: BL (M = 5.66, SD = .82), 10 min post (p = .00; M = 6.17, SD = .94), 20 min post (p = .04; M = 5.95, SD = .89 and 30 min post (p = .04; M = 5.93, SD = 1.01). The moderate intensity RE (M = 156.65 bpm, SD = 12.08) produced a significantly higher (p < .05) HR as compared to the high intensity RE (M = 143.17 bpm, SD = 11.53).

CONCLUSION: AS was elevated for up to 30 min following a bout of RE and is not dependent on intensity. Whether or not the AS elevation is pathologic and identifying the mechanisms involved warrants further investigation.

2298
Board #344
MAY 31 8:00 AM - 9:30 AM
Effects of School-Based Exercise Training on Endothelial Function and Pulse Wave Velocity in Obese Adolescents

INTRODUCTION: Cardiorespiratory fitness was measured using maximal oxygen uptake with metabolic gas analysis and body composition was determined by bioelectrical impedance. We measured carotid-femoral pulse wave velocity and reactive hyperemia index as indices of vascular function.

METHODS: Twenty one obese adolescents (13±1yr) were randomly assigned to a school based exercise training (ET)(12weeks, 50 minutes, 5day/week) group (n=11) and a non exercise control (CON) group (n=10). Cardiorespiratory fitness was measured using maximal oxygen uptake with metabolic gas analysis and body composition was determined by bioelectrical impedance. We measured carotid-femoral pulse wave velocity and reactive hyperemia index as indices of vascular function.

RESULTS: Waist girth was significantly decreased in ET group than CON group (ET 94.41±6.17 to 92.62±6.13 cm vs. CON 92.62±7.80 to 94.27±6.23cm, p<0.05). Cardiorespiratory fitness was significantly increased in ET group than CON group (ET 32.35±6.49 to 39.24±6.63 vs. CON 34.59±5.47 to 38.36±5.46 ml/kg/min, p<0.05). Body mass index and selected CVD risk factors were not improved in ET group. Reactive hyperemia index was significantly increased in ET group (ET 1.60±0.45 to 1.87±0.58 vs. CON 1.73±0.39 to 1.41±0.26%, p<0.05) but carotid-femoral pulse wave velocity did not significantly decrease in ET group (ET 5.77±4.50 to 5.40±0.53 vs. CON 5.12±0.53 to 5.05±0.54m/s, NS). Change in cardiorespiratory fitness was associated with change in reactive hyperemia index after adjusted for changes in waist (r=0.46, p<0.05).

CONCLUSIONS: These results show that school-based exercise improved endothelial function, and this was associated with improved cardiorespiratory fitness in obese adolescents.
A reduction in large arterial compliance has been shown to occur with age and physical inactivity and is considered an independent risk factor of cardiovascular disease. Low compliance is associated with various pathological states such as hypertension, left ventricular hypertrophy, and congestive heart failure. The relationship between sex, aging, and physical activity remains unclear.

PURPOSE: The purpose of this study is to determine if physical activity of cardiovascular influence arterial compliance similarly in men and women.

METHODS: Thirty-six subjects, 16 men (M), 20 women (W), were categorized as younger (Y, 40-59yrs old) or older (O, 60-79yrs old). Nineteen subjects (6 YM, age= 46.8±2.6yrs, 2 OM, age=61±4yrs; 9 YW, age= 48 ± 4yrs, 3 OW, age=67.3±8.4) were considered highly active based on self-reported vigorous physical activity> 200 min/wk and 17 subjects (4 YM, age=50.5 ± 4yrs, 4 OM, age=70.5±7.4yrs; 4 YW, age 54.3±5.6, 5 OW, age=65.6±5.8yrs) were considered sedentary 8 YW, actively active – with activity confirmed by an activity monitor worn for 7 days. Resting cardiovascular measurements including large arterial compliance, blood pressure, and heart rate were recorded. Statistical analysis included a 2x2x2 Analysis of Variance with p<0.05.

RESULTS: Compliance was greater in highly active subjects compared to the sedentary or moderately active subjects (18.2 ± 4.2 vs. 13.5 ± 3.8 mL/mmHgX10) and it was greater in men when compared to women (17.9 ± 4.4 vs. 14.6 ± 4.3 mL/mmHgX10). There was no difference in compliance between age groups though power was low due to a small n. There were no significant interactions between activity, sex, and age on compliance. There was a significant simple effect for sex by activity in women, as compliance was greater in active women compared to inactive women (16.9 ± 3.9 vs. 11.6 ± 2.6 mL/mmHgX10).

CONCLUSIONS: Arterial compliance differs as a function of physical activity in an aging population demonstrating the highly active to be at a reduced risk of cardiovascular disease. Oddly, women, particularly the inactive women show the greatest risk for cardiovascular disease as compared with other groups. Thus, the converse,habitually high levels of physical activity may pose a greater benefit for women than for men.
RESULTS: FMD was impaired in PCOS when compared to matched control women (6.2±0.4 vs. 10.5±1.0%; P<0.0005). When FMD was adjusted for individual differences in BMI, VAT, SAT and cardiorespiratory fitness, the difference in FMD between groups remained (6.4±0.5 vs. 9.4±1.0%; P<0.01).

CONCLUSION: These findings indicate that FMD is impaired in PCOS women independent of global adiposity, specific fat deposition or volume, or cardiorespiratory fitness. Endothelial dysfunction is likely directly mediated by PCOS and further exploration of potential moderators of endothelial function associated with the PCOS is warranted.

2303  Board #349  MAY 31  8:00 AM - 9:30 AM  Exercise Training Reduces Peripheral Pulse Wave Velocity in Young Prehypertensives

Darren T. Beck, Jeffrey S. Martin, Darren P. Casey, Randy W. Braith, FACSFM, University of Florida, Gainesville, FL. University of Missouri, Columbia, MO, Mayo Clinic, Rochester, MN.

(Purpose not reported)

PURPOSE: To determine the separate effects of resistance and endurance exercise training on arterial function in young prehypertensives.

METHODS: Forty-three prehypertensive subjects were recruited and randomly assigned to either a resistance training (n=15), endurance training (n=13), or control group (n=15). Additionally, fifteen sedentary matched normotensive time controls were studied. Training groups completed an eight week exercise training regimen. Carotid to Femoral (C-F), Carotid to Radial (C-R), and Femoral to Dorsalis Pedis (F-D) pulse wave velocity (PWV) were measured via electrocardiogram gated applanation tonometry before and after exercise training or time matched control.

RESULTS: Pulse wave velocity before and after exercise training and time control

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<td>C-F, msec</td>
<td>10.41±0.25*</td>
<td>9.39±0.36†</td>
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<td>C-R, msec</td>
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| F-D, msec | 82.4 ± 2.3 ml/kg/min | 76.9 ± 1.3 ml/kg/min; P<0.05) and VC (control: 0.72 ± 0.03; SMTC: 0.66 ± 0.02 ml/min/100g/mmHg; P<0.05) in S rats. Contrary to our hypothesis, no changes in total hindlimb muscle blood flow (control: 104 ± 12; SMTC: 102 ± 13 ml/min/100g; p>0.05) and VC (control: 0.72 ± 0.07; SMTC: 0.72 ± 0.09 ml/min/100g/mmHg; p>0.05) in S rats. Contrary to our hypothesis, no changes in total hindlimb muscle blood flow (control: 98 ± 6; SMTC: 95 ± 6 ml/min/100g; p>0.05) and VC (control: 0.72 ± 0.03; SMTC: 0.66 ± 0.02 ml/min/100g/mmHg; p>0.05) were observed in ET rats. Individual hindlimb muscle blood flow and VC were not significantly different following SMTC in S rats. Similarly, the great majority of the individual hindlimb muscles from ET rats exhibited no significant differences in blood flow (27 out of 28) and VC (25 out of 28) between control and SMTC.

CONCLUSIONS: Young prehypertensives increased peripheral pulse wave velocity when compared to matched normotensives. Additionally, both resistance and endurance exercise training reduced peripheral pulse wave velocity in young prehypertensives.

2304  Board #350  MAY 31  8:00 AM - 9:30 AM  Effect of Resistance Training and/or a Hypocaloric Diet on Endothelial Function in Hypercholesterolemic Obese Women

Javier Ibáñez Santos, Irene Madariaga, Ana Grijalba, Marisol García-Ucunt, Miguel Izquierdo, Esteban Gorostiaga, CEIMD, Pamplona, Spain, Hospital de Navarra, Pamplona, Spain, Universidad de Navarra, Pamplona, Spain.

(No relationships reported)

The pathogenesis of endothelial dysfunction in obesity remains uncertain; the relative roles of insulin resistance, circulating NEFA, or adipocyte- associated cytokines are being delineated. In this context, the effects of resistance training (RT) and/or a hypocaloric diet on the relationship between those metabolic variables and the endothelial function of obese women with hypercholesterolemia remain to be elucidated.

PURPOSE: To evaluate the effect of a twice-weekly RT program and/or a hypocaloric diet on the endothelial function in hypercholesterolemic obese women.

METHODS: The design was a 16 week randomized controlled trial. Thirty three participants were assigned to 3 groups: Control group (C, n= 8); Diet group (D, n= 12) with a caloric restriction of 500 Kcal/day; and Diet + RT group (D +T, n= 13) with a caloric restriction as diet group and a 16-week supervised RT program of 2 sessions/week. Endothelial function (measured by high-frequency ultrasonography), and basal circulating levels of insulin, glucose, NEFA, leptin, adiponectin and IL-1Ra were measured baseline and at week 16.

RESULTS: FMD was impaired in PCOS when compared to matched control women (6.2±0.4 vs. 10.5±1.0%; P<0.05) and SMTC (S: 5.7 ± 0.5; ET: 2.0 ± 0.3 mM; P<0.05) conditions. Consistent with previous reports, SMTC had no effects on p<0.05) in S rats. Contrary to our hypothesis, no changes in total hindlimb muscle blood flow (control: 98 ± 6; SMTC: 95 ± 6 ml/min/100g; p>0.05) and VC (control: 0.72 ± 0.03; SMTC: 0.66 ± 0.02 ml/min/100g/mmHg; p>0.05) were observed in ET rats. Individual hindlimb muscle blood flow and VC were not significantly different following SMTC in S rats. Similarly, the great majority of the individual hindlimb muscles from ET rats exhibited no significant differences in blood flow (27 out of 28) and VC (25 out of 28) between control and SMTC.

CONCLUSIONS: The pathogenesis of endothelial dysfunction in obesity remains uncertain; the relative roles of insulin resistance, circulating NEFA, or adipocyte- associated cytokines are being delineated. In this context, the effects of resistance training (RT) and/or a hypocaloric diet on the relationship between those metabolic variables and the endothelial function of obese women with hypercholesterolemia remain to be elucidated.

CONCLUSIONS: These findings indicate that FMD is impaired in PCOS women independent of global adiposity, specific fat deposition or volume, or cardiorespiratory fitness. Endothelial dysfunction is likely directly mediated by PCOS and further exploration of potential moderators of endothelial function associated with the PCOS is warranted.

2305  Board #351  MAY 31  8:00 AM - 9:30 AM  Exercise Training and Skeletal Muscle Blood Flow: Functional Role of Neuronal Nitric Oxide Synthase (nNOS)

Daniel M. Hirai, Steven W. Copp, Scott K. Ferguson, Clark T. Holdsworth, David C. Poole, FACSM, Timothy I. Musch, FACSM. Kansas State University, Manhattan, KS.

(No relationships reported)

Exercise training induces multiple adaptations within skeletal muscle which enhance hemodynamic control. Increased nitric oxide (NO) bioavailability via upregulation of endothelial NO synthase (eNOS) function is intrinsic in this process. However, it is also possible that training-induced upregulation of nNOS function contributes importantly to the NO-mediated training response.

PURPOSE: To test the hypothesis that selective nNOS inhibition would reduce blood flow and vascular conductance (VC) in hindlimb skeletal muscle of exercise trained rats during submaximal treadmill running.

METHODS: Male Sprague-Dawley rats (4-5 mo; 456 ± 5 g) were assigned randomly to either sedentary (S; n=8) or exercise trained (ET; n=8) groups. ET rats performed treadmill exercise 60 min/day, 5 days/wk for 6-8 wks at a speed of up to 35 m/min. Blood flow and VC were determined during submaximal treadmill running at 20 m/min via radioisotopically labeled microspheres before and after administration of the selective nNOS inhibitor S-methyl-L-thiocitrulline (SMTc, 2.1 µmol/kg i.a.).

RESULTS: ET rats had greater VO2peak (82.4 ± 13.9 ml/kg/min) than S rats (76.9 ± 13.9 ml/kg/min; p<0.05). During submaximal whole-body exercise, ET rats had lower blood lactate concentration during control (S: 4.4 ± 0.4; ET: 1.4 ± 0.2 mM; p<0.05) and SMTC (S: 5.7 ± 0.5; ET: 2.0 ± 0.3 mM; p<0.05) conditions. Consistent with previous reports, SMTC had no effects on total hindlimb muscle blood flow (control: 104 ± 12; SMTC: 102 ± 13 ml/min/100g; p>0.05) and VC (control: 0.72 ± 0.07; SMTC: 0.72 ± 0.09 ml/min/100g/mmHg; p>0.05) in S rats. Contrary to our hypothesis, no changes in total hindlimb muscle blood flow (control: 98 ± 6; SMTC: 95 ± 6 ml/min/100g; p>0.05) and VC (control: 0.72 ± 0.03; SMTC: 0.66 ± 0.02 ml/min/100g/mmHg; p>0.05) were observed in ET rats. Individual hindlimb muscle blood flow and VC were not significantly different following SMTC in S rats. Similarly, the great majority of the individual hindlimb muscles from ET rats exhibited no significant differences in blood flow (27 out of 28) and VC (25 out of 28) between control and SMTC.

Values are means±SEM. Significance values are reported from between group and between timepoint repeated measures ANOVA and Tukey post hoc analysis. *p<0.05 baseline versus normotensive control values; †p<0.05 versus pretreatment values.

CONCLUSIONS: Young prehypertensives increased peripheral pulse wave velocity when compared to matched normotensives. Additionally, both resistance and endurance exercise training reduced peripheral pulse wave velocity in young prehypertensives.
CONCLUSIONS: Upregulation of nNOS function does not appear to play an obligatory role in muscle hyperemia during submaximal treadmill running in exercise trained rats.

Support: ACSM Doctoral Grant, AHA Midwest Affiliate, NIH HL-108328

2306 Board #352 May 31 8:00 AM - 9:30 AM Effect of Aging and Indomethacin on Forearm Reactive Hyperemia in Healthy Adults.
Jill N. Barnes, Jennifer L. Taylor, Casey N. Hines, Michael J. Joyner, FACSM, Mayo Clinic, Rochester, MN.
(No relationships reported)

Prostaglandins contribute to peripheral vasodilatory responses and this contribution may vary with age. There are conflicting reports on the extent to which post-ischemic hyperemic flow is influenced by the cyclooxygenase inhibitor indomethacin in young adults, with both increased and decreased flow reported. Despite these discrepancies in young adults, the effect of indomethacin on reactive hyperemia in older adults has not been evaluated.

PURPOSE: To evaluate the effect of cyclooxygenase inhibition on forearm reactive hyperemia, in young and old adults. Because aging is associated with a shift from vasodilating to vasoconstricting prostaglandins, we hypothesized that indomethacin would augment forearm vascular conductance during reactive hyperemia in older adults.

METHODS: Forearm blood flow (FFB) responses to 5 minutes of forearm ischemia were measured in 20 healthy subjects, including 10 young (26±5 yr) and 10 older (65±6 yr) adults using venous occlusion plethysmography before (CON) and after cyclooxygenase inhibition with oral indomethacin (INDO).

RESULTS: Baseline FMB, FBF, and forearm vascular conductance (FVC) were not different between young and old adults during either trial. During the INDO trial, MAP increased during reactive hyperemia in the old (+7.7±11 mmHg) but not young adults (-1.3±11 mmHg). Peak FVC was similar between young and old adults during the CON trial (p=0.59), but tended to be lower in older adults during the INDO trial (+7.5±5 AU; p=0.06). The magnitude of change in FVC peak between the CON and INDO trials was significantly different between groups with increased FVC peak in young (+9±4 AU) and decreased FVC peak in old (-5±6 AU). Similarly, the change in FVC area under the curve (AUC) between CON and INDO trials was increased in young (+1±1 AU) and decreased in old (-2±2 AU). CONCLUSIONS: There were no age-related differences in post-ischemic vascular conductance prior to cyclooxygenase inhibition. Contrary to our hypothesis, peak vascular conductance after indomethacin was lower in old adults compared with younger adults. These results suggest that aging alters the effect of cyclooxygenase inhibition on forearm vasodilator responses to reactive hyperemia.

Supported by NIH: R024150 (CTSA); AR056950 (JNB); AG38067 (JNB); AG16574-11P2 (MJJ); HL46943 (MJJ)

2307 Board #353 May 31 8:00 AM - 9:30 AM Independent Relationship Between Flexibility And Arterial Stiffness In Patients With Stroke
Yong-Hee Lee, Soo-Hyun Park, Eun-Sun Yoon, Ki Won Lee, Jae Young Jae, University of Seoul, Seoul, Korea, Republic of.
(No relationships reported)

Increased arterial stiffness is a strong predictor of future cardiovascular events and mortality. Flexibility is associated with arterial stiffness in healthy populations, but it is unclear if this is also the case in patients with stroke.

PURPOSE: We investigate the relationship between flexibility and arterial stiffness in patients with stroke.

METHODS: Ninety-four patients with stroke(male n=68, female n=26, 61±9 years) were recruited in the study. We measured a modified sit and reach test on chair as an index of flexibility. Arterial stiffness was assessed by carotid-femoral pulse wave velocity using applanation tonometry.

RESULTS: There was a significant inverse association between flexibility and pulse wave velocity(r=−0.48, p<0.001). In multivariable linear regression models that adjusted for age, gender, body mass index, duration of stroke, systolic blood pressure, heart rate, medication, an cardiorespiratory fitness, flexibility was an independent associated with pulse wave velocity(b=-0.19, p<0.05). Patients with high flexibility had significantly lower pulse wave velocity than patients with low flexibility (8.9±9 vs. 11.8±9, p<0.001).

CONCLUSIONS: These findings demonstrate that high high flexibility was associated with low arterial stiffness independent risk factors and cardiorespiratory fitness in patients with stroke.

2308 Board #354 May 31 8:00 AM - 9:30 AM Aerobic Exercise Training Improves Arterial Stiffness in Relation to the Reduction of Visceral Adiposity in Middle-Aged Men with Abdominal Obesity
Yoshikazu Takanami,1 Yukari Kawai2, Wataru Aoi1, Yuko Tanimura2, Hiroshi Ichikawa2, Yukari Furukawa1, Toshikazu Yoshikawa1. 1Otsuwa Wemen’s University, Tokyo, Japan; 2Kyoto Prefectural University of Medicine, Kyoto, Japan; 3Kyoto Prefectural University, Kyoto, Japan; 4Doshisha University, Kyoto, Japan.
(No relationships reported)

PURPOSE: To elucidate whether regular aerobic exercise reduces visceral adiposity and arterial stiffness in middle-aged men with abdominal obesity.

METHODS: We assigned forty-six sedentary subjects (51±9 y); mean±SE) to two groups: one that engaged in 30-60 minutes of aerobic exercise/day at least 2 times/week for 16 weeks (Ex, n=36), and one age-matched sedentary control group (C, n=10). Body fat indices and brachial-ankle pulse wave velocity (baPWV) were measured at baseline and after 16 weeks. Visceral fat area (VFA) and subcutaneous fat area (SFA) at the umbilical level was determined by computed tomographic scanning (CT).

RESULTS: According to the baseline CT examination, there were 16 subjects with abdominal obesity (VFA≥100cm², Ob) in Ex (Ex-Ob), and 5 in C (C-Ob). Twenty subjects were not abdominally obese in Ex (Ex-N). Exercise training reduced VFA in Ex-Ob (139±67cm² to 113±47cm²; p<0.001) and also in Ex-N (58±3cm² to 48±3cm²; p<0.001). BaPWV of Ex-Ob decreased from 1340±93cm/sec to 1281±39cm/sec (p<0.05) through exercise training. However, no significant change of baPWV was detected in Ex-N and in C-Ob after 16 weeks period. There was a significant correlation between the changes in VFA and the changes in baPWV in Ex (r=0.338, p<0.05).

CONCLUSIONS: Regular aerobic exercise reduced visceral adiposity and arterial stiffness in abdominal obesity. This reduction of arterial stiffness through aerobic exercise training may be partially caused by the reduction of visceral fat.

2309 Board #355 May 31 8:00 AM - 9:30 AM Measurement Of Peak-flow To Rest-flow Ratio In Children After Aerobic Exercise Using Laser Doppler Fluximetry
Goutham Ganesan, Diana Vigil, Scott Graf, Shlomit Aizik, Dan Cooper, Pietro Galassetti. UC Irvine, Irvine, CA.
(No relationships reported)

PURPOSE: The non-invasive assessment of endothelial function has become a key part of the study of the progression of dysmetabolic states (obesity, diabetes). Reliable measurements have however proven challenging during metabolic perturbations (i.e. physical exercise, invoked in these conditions both as a therapeutic and as a testing tool), and in vulnerable populations such as obese and diabetic children. We sought to optimize the use of an established technique measuring skin microcirculation reactivity, Laser Doppler Fluximetry (LDF), in the post-exercise state in healthy and obese children, and to determine a reproducible method for analyzing and reporting measurements of reactive hyperemia.

METHODS: Ten children (13±1 years, 3; female 5, obese 5, healthy weight) completed standard incremental maximal exercise tests. Post-occlusive Reactive Hyperemia (PORH) testing (1 min occlusion, ≥280 mmHg at wrist, probe placed over middle phalanx of third digit, recumbent position) was conducted 5 min before, and 5 and 15 min post-exercise (Periflux 5000, Perimed, Sweden). Perfusion index (PI) and temperature were continuously measured. Data taken one minute before and two minutes after occlusion was analyzed with PSW software, provided by manufacturer, yielding calculations of time to maximum PI (TM), rest, or baseline pre-occlusion PI (RF), peak post-occlusion PI (PF), and biological zero (BZ).

RESULTS: We observed that the ratio of peak flow to rest flow (PFRF) was very consistent within and across subjects, showing a clear post-exercise vasodilatory effect (pre-exercise: 1.59±1.08; 5 min post, 1.75±1.18; 15 min post 1.85±1.18). As a relative index, PFRF prevented imprecision due to varying baseline values, changes in probe positioning, and inaccuracies in determination of PI absolute values, and could therefore be used as reliable index of maximal hyperemic response in our study group.

CONCLUSIONS: Our data suggests that post-occlusive PFRF ratio may be a reproducible index of both resting vascular function, and of post-exercise vasodilation in children with a wide range of BMI values. Broader application of this variable may help standardize prior non-homogeneous findings of altered post-occlusive hyperemic response in pediatric obese populations, often reported in arbitrary perfusion units.

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Low flow-mediated constriction (LFMC) is a recently introduced technique that has been proposed to provide additional and complementary information to “traditional” flow-mediated dilation (FMD). However, whether LFMC occurs when the test is performed in the brachial artery remains controversial and LFMC has not been well studied in older individuals with increased cardiovascular (CV) risk.

PURPOSE: The purpose of this study was 1) to determine whether LFMC would differ between older individuals with increased CV risk and healthy older individuals, and 2) to examine relationships between LFMC and estimated shear rate (SR).

METHODS: Data from 2 groups [56 individuals with increased CV risk (history of recent stroke or transient ischemic attack, presence of hypertension and/or type 2 diabetes, 67.5±9.2yrs, 12F), and 20 individuals with no clinically manifest CV disease (65.6±4.3yrs, 16F)] were compared. FMD and LFMC were assessed using a 5-min forearm cuff occlusion technique. Diameter and blood velocity data obtained by a Doppler ultrasound machine were used for the calculation of FMD, LFMC, and SR indices using a semi-automated edge detection software. Two indices of SR were calculated: SR during LFMC (SRlow) and the differences in SR between baseline and LFMC (SRdiff).

RESULTS: The prevalence of LFMC was 60.7% in the increased CV risk group and 45.0% in the healthy group. LFMC tended to be greater in the increased CV risk group (0.63±1.64%) than the healthy group (0.2±2.04%; p=0.058). In the healthy group, LFMC was significantly correlated with FMD (r=0.55, p<0.05), whereas no association was observed in the increased CV risk group. Neither SRlow nor SRdiff was correlated with LFMC.

CONCLUSION: These results suggest that LFMC is independent of SR during cuff occlusion in our populations. Whereas greater LFMC may lead to a lower FMD in healthy older individuals, the FMD response may be independent of LFMC in older individuals with increased CV risk. This trend may be independent of FMD in the expression of increased endothelial function.

Supported in part by Peninsula NIHR Clinical Research Facility.
RESULTS: Compared to pre-injury FMD, both IRI (Pre: 7.56 ± 1.04; Post 2.57 ± 1.07 %FMD, p<0.05) and COND (Pre: 7.23 ± 0.94; Post 2.34 ± 1.05 %FMD, p<0.05) resulted in a decrease in vascular response at 120 min. The FMD at 140 min remained blunted (p<0.05) for IRI but returned to pre-injury values by 160 min. The FMD for COND returned to pre-injury values by 140 min with no further change at 160 min. The EXER only intervention did not result in a significant change in %FMD at any time points.

CONCLUSIONS: Ischemic-reperfusion resulted in a significant decrease in endothelial function during the IRI and COND protocols but %FMD returned to pre-injury values by 140 min for COND and not until 160 min for IRI. An acute bout of moderate intensity exercise performed prior to IRI may not attenuate the magnitude of endothelial dysfunction but recovery from IRI may be speeded by exercise.

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**2314 Board #360 MAY 31 8:00 AM - 9:30 AM**

50% VO2max-Arm-Crank Exercise May Not Improve Arterial Stiffness

Yukimi Maki, Hajime Miura, Megumi Sagino. Univ. of Tokushima, Tokushima, Japan.

(No relationships reported)

The endurance exercise such as cycling, walking, or running is useful for improving arterial stiffness. Subjects suffering from partial paralysis or arthritis, however, are not able to conduct these kinds of lower-limb exercise. Previous research suggested that 60-70% VO2max-arm-crank exercise increased arterial stiffness. Therefore, in order to improve arterial stiffness by arm-crank exercise, lower exercise intensity might be needed.

PURPOSE: We tried to identify the acute effect of 50% VO2max-arm-crank exercise on arterial stiffness determined by pulse wave velocity.

METHODS: Six healthy recreationally active adult men were studied under two experimental trials on at 2 separate days. The order of experiments was randomized among 30-min-arm-crank exercises at 50% VO2max (50% Arms) and control (C; seated rest while reading). Before and for 45 min at 15 min intervals after each trial, brachial to ankle pulse wave velocity (baPWV) and brachial systolic and diastolic blood pressure (SBP, DBP) were calculated and recorded. The heart rate (HR) was obtained while in the supine position.

RESULTS: Baseline hemodynamic values were not different among two trials. In 50%-Arm trials, SBP, DBP, and HR returned to baseline at 15-min recovery. Compared with rest value (999.5±26.4 cm•sec⁻¹), baPWV was significantly elevated after 15-min recovery (1083.0±38.6 cm•sec⁻¹), 30-min recovery (1047.7±34.3 cm•sec⁻¹), 45-min recovery (1016.0±64.6 cm•sec⁻¹). In C trial, however, there were no changes in SBP, DBP, HR, and baPWV through the trial.

CONCLUSIONS: These results indicate that acute 50% VO2max-arm-crank exercise increased baPWV, which was the opposite reaction of lower-limb exercise. Therefore, in order to improve arterial stiffness by arm-crank exercise, less than 50% VO2max should be recommended.

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**2315 Board #361 MAY 31 8:00 AM - 9:30 AM**

Systemic Vascular Resistance Response to Exercise in Morbidly Obese College-Aged Mexican-American Females

David Wittenburg, Jared Montoya, Vanessa Martinez, Stephanie Rodriguez, Ildalia Obregon, Alexis Martinez. University of Texas at Brownsville, Brownsville, TX.

(No relationships reported)

Systemic vascular resistance response (SVRR) to exercise provides insight into potential cardiovascular disease. However, one potential risk factor that may contribute to reduction of the SVRR may be the over accumulation of adipose tissue. Research in obesity-related reduction of SVRR in Mexican-American females is lacking.

PURPOSE: The purpose of this study was to examine the SVRR to exercise of morbidly obese Mexican-American college-aged females compared to non-morbidly obese females.

METHODS: Subjects (N=79) were limited to Mexican-American females of college age (mean = 23.59 ± 5.85 yrs) recruited across campus. Body fat percent (BF%) was recorded by air plethysmography. Radial pulse wave contour tonometry was used to determine large artery elasticity index (LAEI) and small artery elasticity index (SAEI). Systemic vascular resistance and arterial stiffness were analyzed using the oscillometric method.

RESULTS: Baseline hemodynamic values were not different among two trials. In 50%-Arm trials, SBP, DBP, and HR returned to baseline at 15-min recovery. Compared with rest value (999.5±26.4 cm•sec⁻¹), baPWV was significantly elevated after 15-min recovery (1083.0±38.6 cm•sec⁻¹), 30-min recovery (1047.7±34.3 cm•sec⁻¹), 45-min recovery (1016.0±64.6 cm•sec⁻¹). In C trial, however, there were no changes in SBP, DBP, HR, and baPWV through the trial.

CONCLUSIONS: These results indicate that acute 50% VO2max-arm-crank exercise increased baPWV, which was the opposite reaction of lower-limb exercise. Therefore, in order to improve arterial stiffness by arm-crank exercise, less than 50% VO2max should be recommended.

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**2316 Board #362 MAY 31 8:00 AM - 9:30 AM**

Acute Effects of Stretching Exercise on Arterial Stiffness

Yuko Gando1, Kent Yamamoto2, Hiroshi Kawano2, Isao Murakata1. 1Waseda University, Saitama, Japan. 2University of North Texas Health Science Center, Fort Worth, TX. (Sponsor: Mitsuru Higuchi, FACSM)

(No relationships reported)

Increased arterial stiffness is a risk factor for cardiovascular diseases. Poor flexibility is associated with arterial stiffening. Currently, it is unknown whether stretching exercise induces favorable changes in the arterial stiffness.

PURPOSE: To determine the acute effects of stretching exercise on arterial stiffness.

METHODS: Seven healthy adults (2 men and 5 women, age 24 ± 1 yrs) were studied separately under parallel experimental trials on two days. The order of experiments was performed randomly between stretching exercise (40 stretching exercises for whole body at maximum range of motion) and sham control (seated rest in the exercise room). Arterial stiffness (baPWV; brachial-ankle pulse wave velocity) was calculated and recorded prior to a multistage submaximal treadmill exercise test and within 5 minutes after completing the submaximal test. Predicted VO2max was calculated from the submaximal test. Subjects were categorized by BF% and VO2max. The SVRR was calculated as the difference between the exercise pretest SVR and posttest SVR.

RESULTS: The non-morbidly obese group had significantly greater predicted VO2max (35.05 ± 5.9 ml/kg/min⁻¹) than the morbidly obese group (28.25 ± 5.9 ml/kg/min⁻¹, p<0.05). The mean SVRR for non-morbidly obese fit subjects (120.72 ± 205.17 dynes/sec/cm²) was significantly greater than for the morbidly obese unfit subjects (37.21 ± 133.83 dynes/sec/cm², p<0.05). To determine if fitness was a factor for SVRR a one-way ANOVA was conducted that excluded the independent variable of obesity. The results of the ANOVA indicated no significant differences for SVRR between the fitness groups. No significant differences between the LAEI and the SAEI were observed between the groups.

CONCLUSIONS: The mediation of morbid obesity attributes to the loss of SVRR in this sample of Mexican-American females; placing them at greater risk for CVD. One possible explanation is that obese individuals typically have less circulating adiponectin. Another research indicates that Mexican-American populations have reduced levels of adiponectin than other population groups.

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**2317 Board #363 MAY 31 8:00 AM - 9:30 AM**

Vitamin C Prevents Attenuation of Flow-mediated Dilation Following Exercise with Augmented Oscillatory and Retrograde Shear

Blair D. Johnson1, Kieren J. Matthe2, Sean C. Newcomer3, Timothy D. Mickleborough1, Janet P. Wallace, FACSM1. 1Indiana University, Indianapolis, IN. 2Purdue University, West Lafayette, IN. (No relationships reported)

Elevated oscillatory and retrograde shear rate (SR) reduces flow-mediated dilation (FMD) possibly due to oxidative stress.

PURPOSE: We tested the hypothesis that the antioxidant vitamin C would prevent the attenuation of FMD following exercise with elevated oscillatory and retrograde SR.

METHODS: Twelve lean healthy men (26.3 ± 0.9 years) ingested 1 g of vitamin C or placebo (1 g sucrose) before undergoing two supine cycle ergometer exercise trials (20 min at 90 W). A forearm blood pressure cuff was inflated to 60 mm Hg during exercise to increase oscillatory and retrograde SR in one arm. The contralateral arm served as the control. Brachial arterial FMD was measured in both arms before and immediately after exercise. SR profiles were assessed at baseline and during exercise. The oscillatory shear index (OSI) was determined as: [retrograde/(retrograde+aneutgrade)].
RESULTS: Baseline FMD was not different between arms or trials ($P > 0.52$ for both) (placebo: cuffed $4.9 \pm 2.4\%$, control $4.4 \pm 1.5\%$; vitamin C: cuffed $4.9 \pm 3.0\%$, control $4.5 \pm 2.4\%$). Antegrade SR increased during exercise ($P < 0.01$), but was not different between trials ($P = 0.37$) but was greater in the cuffed arm ($P = 0.01$) (placebo: cuffed $52.8 \pm 13.0 s^{-1}$, control $49.6 \pm 12.5 s^{-1}$; vitamin C: cuffed $53.2 \pm 13.0 s^{-1}$, control $45.4 \pm 9.0 s^{-1}$). Retrograde SR increased in both arms during exercise ($P < 0.01$) and was greater in the cuffed arm in both trials ($P < 0.01$) (placebo: cuffed $36.7 \pm 10.8 s^{-1}$, control $27.9 \pm 9.7 s^{-1}$; vitamin C: cuffed $35.6 \pm 10.3 s^{-1}$, control $26.1 \pm 6.7 s^{-1}$). Mean SR was not different between arms or trials ($P > 0.10$ for both) (placebo: cuffed $16.1 \pm 14.7 s^{-1}$, control $21.7 \pm 15.9 s^{-1}$; vitamin C: cuffed $17.6 \pm 11.9 s^{-1}$, control $19.2 \pm 9.5 s^{-1}$). OSI was greater in the cuffed arm vs. control ($P = 0.02$) and was not different between trials ($P = 0.88$) (placebo: cuffed $0.40 \pm 0.1$, control $0.36 \pm 0.1$; vitamin C: cuffed $0.40 \pm 0.1$, control $0.37 \pm 0.1$). Postexercise FMD in the control arms increased ($P < 0.01$) but were not different between trials ($P > 0.05$) (placebo $7.7 \pm 2.8\%$ vs. vitamin C $7.1 \pm 3.5\%$). FMD in the cuffed arm was unchanged in the placebo trial ($5.4 \pm 2.4\%$, $P = 0.52$). FMD increased in the vitamin C trial ($6.6 \pm 3.3\%$, $P = 0.03$).

CONCLUSIONS: Vitamin C prevents the attenuation of FMD after exercise with elevated oscillatory and retrograde SR through an apparent reduction of oxidative stress.
**Board #367**  MAY 31  8:00 AM - 9:30 AM

**Effect of Maximal Exercise on Carotid Artery Stiffness in African-American and Caucasian Men and Women**

Bo Ferrahll, FACSM, Sushant Randinve, Huimin Yan*, Abbi Lane*, Rebecca Kappus, Marc Cook*, Peng Sun*, Shevon Harvey*, Kenneth Wilund, Jeffrey Woods, FACSM, University of Illinois at Chicago, Chicago, IL. University of Illinois at Urbana-Champaign, Urbana, IL.

(*No relationships reported*)

**PURPOSE:** Arterial stiffness is higher in young African-Americans (AA) vs Caucasians (CA). It has also been suggested that peripheral, but not central arterial stiffness changes differentially after maximal exercise in AA, but only in a select small sample of AA men. The purpose of this study was to compare the arterial response to maximal exercise in AA and CA men and women.

**METHODS:** 36 AA (17 men and 19 women) and 34 CA (18 men and 16 women) between the ages of 18-35 volunteered for the study. Women were tested during menses. Carotid, brachial and femoral artery stiffness were assessed using high-resolution ultrasound imaging. Subjects completed a maximal exercise test with maximal oxygen uptake (VO2max) measurements. All arterial measures were conducted in a supine position, at rest and then at 15 and 30 minutes after the maximal exercise.

**RESULTS:** AA exhibited lower VO2max (31.8±5.2 vs 24.6±3.6 ml/kg/min) but slightly higher body mass index (27.1±5.2 vs 24.6±3.6) than CA (p<.05). Consequently, all arterial and blood pressure exercise responses were adjusted for VO2max and BMI, and the adjusted responses were presented. CA increased carotid beta stiffness more following exercise than AA (5.6±2.0 vs 13.3±2.0 from 5.9±0.3 to 5.9±0.3 to 5.9±0.2 vs 5.9±0.2; p<.01 for interaction). There was no significant change in brachial or femoral artery stiffness following maximal exercise for either group (data not shown; p>.05). However, aortic SBP significantly decreased in CA but did not change in AA following exercise (105 to 102 to 100 mmHg vs 103 to 105 to 105 mmHg; p<.001 for interaction) and carotid SBP showed a unexplained increase, and approached significance (117±17 to 113±13 vs 112 to 116 vs 116 for CA vs AA respectively; p=0.07 for interaction).

**CONCLUSION:** These data show that AA exhibited lower changes in carotid artery stiffness following maximal exercise compared to CA despite maintaining higher BP, suggesting an uncoupling of changes in stiffness and blood pressure following exercise. Future work is needed to determine if the differential responses between AA and CA translates to differences in CVD risk.

**Board #368**  MAY 31  8:00 AM - 9:30 AM

**The Associations Between Aerobic Capacity and Arterial Stiffness in People with Chronic Spinal Cord Injury**

Masae Miyatani, Cameron Moore*, Rei Masani, Paul L. Oh*, Miles R. Popovic*, B Cathy Craven. Toronto Rehabilitation Institute, Toronto, ON, Canada.

(*)No relationships reported*)

**PURPOSE:** People living with spinal cord injury (SCI) are a vulnerable population prone to coronary artery disease (CAD) resulting in high morbidity and mortality. Arterial stiffness assessed by pulse wave velocity measured between the common carotid and femoral arteries (cPWV) is an established independent predictor of CAD morbidity and mortality in the able-bodied population. The European Society of Hypertension and the European Society of Cardiology have defined cPWV values ≥1200 cm/s as a diagnostic threshold for subclinical vascular end-organ damage. We have previously reported that average cPWV values among people with chronic SCI above this diagnostic threshold. Prior studies have demonstrated that aerobic capacity is inversely associated with arterial stiffness in able-bodied people. However, the relationship between arterial stiffness, particularly elevated cPWV values (≥1200 cm/s), and aerobic capacity in people with SCI has not been described.

**METHODS:** To explore the associations between aerobic capacity (VO2peak) and elevated cPWV values (≥1200 cm/s) among adults with chronic SCI.

**RESULTS:** Thirty-six SCI participants with chronic SCI (C2-T2; AIS A-D; 11 paraplegics and 19 tetraplegics; time post injury: 14.3±11.7 yrs; Age: 50.6±11.8 yrs; Height: 175.9±9.4 cm; and Weight: 85.7±19.1 kg) participated in the study. cPWV was measured using two Doppler flowmeters and VO2peak was measured by arm ergometry. Subjects were stratified into two groups according to cPWV values (<1200 cm/sec: low cPWV, ≥1200 cm/sec: high cPWV). Logistic regression analysis was used to determine the contribution of aerobic capacity after adjustment for confounders (age, level of injury, and gender) to high cPWV.

**RESULTS:** Aerobic capacity was significantly and negatively associated with cPWV (r=-0.459, p<0.045). After correction for other confounding parameters, low aerobic capacity was an independent predictor for high cPWV (odds ratio = 2.04, 95% CI=1.07-3.87, p<0.029).

**CONCLUSIONS:** Aerobic capacity is an independent predictor of high cPWV values (≥1200 cm/sec) among people with chronic SCI. Further research is needed to explore whether improvements in aerobic capacity will reduce arterial stiffness and adverse cardiac outcomes among people with chronic SCI.

**Board #369**  MAY 31  8:00 AM - 9:30 AM

**Six Weeks of Sprint Interval Training Speeds Flow-Mediated Dilation in Women**

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(*No relationships reported*)

The effects of sprint interval training (SIT) on blood flow-mediated dilation (FMD) have previously been reported; p>.05). However, aortic SBP significantly decreased in CA but did not change in AA following exercise (105 to 102 to 100 mmHg vs 103 to 105 to 105 mmHg; p<.001 for interaction) and carotid SBP showed a unexplained increase, and approached significance (117±17 to 113±13 vs 112 to 116 vs 116 for CA vs AA respectively; p=0.07 for interaction).

**CONCLUSION:** Six weeks of SIT reduces SFA response time to peak dilation despite a similar shear stimulus suggesting an alteration in shear-induced vasodilation. Supported by NSERC

**Board #370**  MAY 31  8:00 AM - 9:30 AM

**Effects of Diet and/or Low-intensity Resistance Training on Arterial Stiffness and Body Composition in Women**

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(*No relationships reported*)

Arterial stiffness (pulse wave velocity, PWV) is inversely related to muscle strength and mass. High-intensity resistance exercise training (RET) preserves lean soft tissue mass (LSTM) during weight loss, but it may increase PWV. Although low-intensity RET with slow movement (LIRET) may improve LSTM and PWV, its effects on PWV and LSTM during weight loss are unknown.

**PURPOSE:** To determine the effect of diet-induced weight loss and/or LIRET on arterial function and body composition in obese women.

**METHODS:** Forty-five postmenopausal obese women (54.3±0.9 years; 33.7±0.9 kg/m2) were randomized to LIRET (n=12), diet (n=14) or diet+LIRET (n=14) for 12 weeks. The data of 40
RESULTS: A high carbohydrate diet improved arterial stiffness, blood pressure, and FM but resulted in leg LSTM loss. LI+R Improved trunk FM, muscle strength, and blood pressure independently of baPWV; however, LI+R did not affect body weight and body FM. Our findings suggest that addition of LI+R to a weight loss program would be recommended to improve aerobic blood pressure and body composition since prevents the loss of leg LSTM induced by hypocaloric diet.
Pre-exercise Ingestion of Amylomaize Decreases Hypoglycemia Risk During High Intensity Cycling

Rachel Bell, Douglas S. King, Mike E. Spurlock, Rick L. Sharp, FACSM. Iowa State University, Ames, IA.

(no relationships reported)

Modified amylomaize-7 was previously shown to be 92% digestible but is digested slowly enough that hyperinsulinemia is avoided (Zhou et al. J Nutr, 127:997).

PURPOSE: To assess the effect of a carbohydrate pre-load on performance of a brief high-intensity cycling trial, and to compare the metabolic response when amylomaize-7 versus dextrose was consumed in the hour before exercise.

METHODS: Ten trained cyclists (VO2max 64.6 ± 1.8 ml.kg-1.min-1) were given 1 g.kg-1 body mass of either dextrose (DEX) or amylomaize-7 (AMY-7) or a flavored water placebo (PL) 45 min prior to exercise on a cycle ergometer. A 15 min ride at 60% Wmax was immediately followed by a self-paced time trial (TT) equivalent to 15 min at 80% Wmax (264 ± 12 KJ). Blood samples were taken at baseline, pre-exercise, pre- TT, post- TT and 30 min post-exercise.

RESULTS: When cyclists consumed the DEX preload, mean serum glucose concentration increased by 3.3 mM ± 2.1 before exercise, compared to AMY-7 or PL (0.2 ± 0.5, 0.1 ± 0.8, respectively, p<0.001). Glucose concentrations returned to baseline by pre- TT in all treatments. However, the mean post-TT glucose concentration of 5.5 ± 0.4 mM in the DEX group was significantly lower than baseline, AMY-7 or PL (5.8 ± 0.4, 6.8 ± 0.8, 6.8 ± 1.5, respectively, p<0.05). Serum insulin concentration increased nine-fold from baseline to pre-exercise in the DEX trial (1.3 ± 0.1 to 11.7 ± 1.0), whereas PL or AMY-7 remained unchanged (p>0.05). Time (s) required to complete the performance trial was not significantly different between DEX, AMY-7 or PL (1091 ± 71, 1054 ± 66, 1078 ± 59, respectively, p=0.209).

CONCLUSIONS: Pre-exercise ingestion of amylomaize-7 compared to dextrose resulted in a more stable glucose concentration, but did not offer an additional performance advantage in a high-intensity cycling time trial.

Insulin, Glucose, and Blood Lipid Responses with a High Glycemic Index Diet Following Downhill Running in Normal and Overweight Women

Katherine A.M. McNulty, Colleen P. Miller, Gregory N. Ruegssegger, Peter Stordahl, Mary P. Miles, FACSM. Montana State University, Bozeman, MT.

(no relationships reported)

A chronic, low-grade level of inflammation occurs with increases in adiposity. This inflammation is implicated in development of insulin resistance (IR) and cardiovascular disease (CVD). Hyperglycemia intensifies both IR and inflammation.

PURPOSE: To determine if insulin, glucose, homoeostatic model assessments (HOMA) of IR (HOMA-IR), β-cell function (HOMA-B), insulin sensitivity (HOMA-S), cholesterol, triglycerides (TG), HDL, and LDL responses differ in normal vs. overweight women consuming a high glycemic index (GI) diet following downhill running.

METHODS: Normal weight (BMI ≤ 25 kg/m², n = 7) and overweight (BMI > 25 kg/m², n = 7) women (20-37 y) performed 30 minutes of downhill running with their heart rate (HR) at 65% of predicted maximal oxygen consumption (VO2max). Participants ate a high GI diet consisting of a carbohydrate/protein/fat ratio of 71%/11%/18%, with kilocalories relative to participant’s body mass (31 kcal/kg) for 24 hours post-exercise. Blood was drawn from participants in fasting conditions immediately prior to downhill running, and at 0 h, 24 h, and 48 h following exercise.

RESULTS: There were no significant differences between groups at baseline. HOMA-S was higher in normal compared to overweight women and increased from 109.7 ± 51.4 pre-exercise to 127.0 ± 57.6 24 h post-exercise in both groups. HOMA-B and IR responses did not differ between groups. Cholesterol decreased from 183.0 ± 27.5 at pre-exercise to 177.8 ± 25.1 mg/dl 24 h post-exercise. There was a trend (P = 0.06) towards higher TG in the overweight group vs. normal weight group (110 ± 69 vs. 55 ± 28 mg/dl), and TG increased from pre-exercise (82.2 ± 58.1 mg/dl) to 0 h (91.3 ± 55.8 mg/dl), while there was a trend (P = 0.08) to decrease 24 h post-exercise (63.2 ± 36.7 mg/dl). HDL decreased (P < 0.05) from pre-exercise (61.4 ± 12.3) to 24 h post-exercise (58.4 ± 10.7 mg/dl). Magnitude of change (Δ) associated with BMI for A in insulin at 24 h, ∆HOMA-B at 24 h (r = 0.55), and ∆HOMA-B at 24 h (r = 0.625).

CONCLUSION: The combination of inflammation and high GI diet elicited changes in insulin (+), HOMA-B (+), and TG (-) that associated with BMI. While both groups had decreased cholesterol at 24 h, the overweight group had greater decreases in TG after consuming a high GI diet for 24 h after 30 minutes of downhill running.

Effects of Impaired Glucose Metabolism-Induced Inflammation on the Joint Function in Current and Retired Athletes

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(no relationships reported)

This study aims to investigate the differences of metabolic fitness, inflammatory response and joint condition between current and retired female athletes, as well as the correlation between inflammation and joint function.

METHODS: The subjects of this study are all female basketball players. They are divided into two groups based on their status: (1) current group (n = 12, 18.2±6.9 yr, height 166±0 cm, weight 59.6±2.7 kg) and (2) retired group (n = 19, 56.1±1.0 yr, height 171±0 cm and weight 73.1 ± 2.7 kg). Analysis of a representative sample of all subjects for whom data on body mass index (BMI), waist circumference (WR), Western Ontario and McMaster Universities (WOMAC) index of osteoarthritis, and fasting glucose (FG), hemoglobin A1c (HbA1c), C-reactive protein (CRP), and 2-hour plasma glucose during an OGTT and blood glucose area under the curve (GAUC) were determined after an 12-hour period of fasting.

RESULTS: The current group had significantly lower BMI, WR, GAUC, HbA1c and WOMAC scores than the retired group (P<0.05). The score of functional evaluation in WOMAC for current group was significantly lower than retired group (6.9±2.8 vs 19.4±3.2, P<0.05). There was a significantly positive correlation between CRP and FG (r = 0.55) and CRP and HbA1c (r = 0.498), respectively (P<0.05). However, there was no difference in the CRP levels between the two groups and no significant correlation existed between age and CRP.

CONCLUSION: The main finding of this study is that the metabolic fitness, the function of knee and HbA1c were impaired in the retired female athletes. Although impaired metabolic fitness-induced inflammatory status in the retired athletes, the deterioration of joint function in the retired subject group was not induced by inflammation.
The presence of carbohydrate in the mouth has been associated with immediate improvements in human performance and the facilitation of neural drive to muscle. Oral energy receptors may alter alterations include hepatic impairment of glycogen storage and hypertriglyceridemia, a risk factor of cardiovascular diseases. By the other hand, physical activity is prescribed to improve the metabolic control in diabetic subjects.

**PURPOSE:** To evaluate the effects of aerobic training on serum triglycerides and hepatic glycogen content in diabetic rats.

**METHODS:** Forty-five Wistar male rats were randomly allocated into four different groups: sedentary control (SC), trained control (TC), sedentary diabetic (SD) and trained diabetic (TD).

Experimental diabetes was induced by an intravenous single dose injection of alloxan monohydrate (32 mg/kg bw dissolved in citrate buffer 0.01M, pH 4.5). For diabetic status checking, a 2332

RESULTS: The main finding of this study was an increase in the motor cortex activation network with CHO compared to PLA during the handgrip task. Additional areas of activation with CHO were seen in left insular cortex and left central operculum (primary taste areas), and regions of the frontal cortex associated with rewarding sensory stimuli.

**CONCLUSION:** This is the first demonstration of oral CHO exposure enhancing the extent of a neural activation network during a motor task. The increased activity within motor cortex and regions involved in reward processing provides a neural basis for enhancements in force production and motor output observed with oral exposure to carbohydrate.
CONCLUSIONS: This study presents a potential metabolic risk for the politicians, despite more weekly walking distance was performed during their voter visit. The insulin resistance state of this group appears to be associated with substantially greater baseline inflammation level.

2336  
MAY 31  2:00 PM - 3:30 PM  
The Characteristic Of Metabolism In Young Boxing Athletes  
Ta-Cheng Hung,1 Ming-Chia Lin,2 Kun-Fu Liao,2 Chien-Wen Hou,2 Chung-Yu Chen.3 Shih-Chien University; Taipei Physical Education College, Taipei, Taiwan.2 Taipei Physical Education College, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Previous study has shown that the former elite power sports (boxing, wrestling, weight lifting) athletes exhibited higher relative risk in insulin resistance and hypertension than elite endurance (long-distance running) athletes in older age.

PURPOSE: To investigate that whether this metabolic deterioration already occurred in the young boxing athletes.

METHODS: A total of 563 college students were divided into two groups: physical active control (n=538, aged 21.58±4.07) and boxing athletes (n=25, aged 20.96±2.5). The boxing athlete regularly participated in boxing training program and competition. Physical active control attended to routine physical education (PE) courses and work out more than 160 min/wk. The resting blood pressure included the systolic blood pressure (SBP) and diastolic blood pressure (DBP) was determined. All plasma samples were collected for measuring the glucose, insulin and cholesterol after an overnight fasting.

RESULTS: The BMI value of boxing athlete was significantly higher than those of control group. Boxing athlete presented significantly greater systolic blood pressure (SBP) and diastolic blood pressure (DBP) than in control group. No significant difference was observed in the levels of fasting glucose, insulin and cholesterol between in control and boxing athlete.

CONCLUSIONS: Our study showed significantly greater value of BMI, SBP and DBP in boxing athlete than in control group. The higher SBP and DBP in boxing athlete were appeared to relate to greater BMI value rather than increased the insulin and glucose level; suggest that well weight management needs to be more concerned in these young power sports athletes.

2337  
MAY 31  2:00 PM - 3:30 PM  
Interactive Effect Of Igf-1 And Exercise Training On Muscle Glut4 Protein Expression  
Chung-Yu Chen, Yu-Chiang Lai, Chien-Wen Hou, Maiilikarjuna Korivi. Taipei Physical Education College, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Exercise transiently elevates the IGF-1 (insulin-like growth factor 1) level, but whether exogenous IGF-1 administration can reproduce exercise training benefit in glycemic control is currently unknown.

METHODS: This study compared the effect of IGF-1 administration and exercise training on glycogen storage, glucose tolerance, and muscle GLUT4 protein expression in normal rats.

RESULTS: Forty rats were weight matched and evenly assigned to the following 4 groups: control (C), exercise trained (E), IGF-1 treated (I), and exercise-trained + IGF-1 (EI). Same volume of saline or IGF-1 (2 µg/kg BW) was injected daily to rats. Exercise training consisted of 90 min swimming for the first week and gradually increased to 180 min twice for the third week. Oral glucose tolerance test (OGTT) was performed in all rats under fasting condition. Muscle tissues were removed at the end of the 3-week treatments (3 days after OGTT). The levels of GLUT4 protein and mRNA were determined in red and white portions of the quadriceps muscle (RQ and WQ).

METHODS: Both exercise training and chronic IGF-1 administration increased GLUT4 expression and improved glucose tolerance without an observed additive effect. Exercise training increased glycogen level in RQ and WQ above control level. Despite chronic IGF-1 administration increased muscle GLUT4 expression above control level, glycogen increase was not observed.

CONCLUSIONS: Our data suggests that IGF-1 can partially reproduce exercise training effect on improving glycemic control.

2338  
MAY 31  2:00 PM - 3:30 PM  
Effect of Glycemic Index of Snack Bars on Substrate Utilization during Subsequent Moderate Intensity Exercise  
Wendy Y. Huang, Stephen H. Wong, FACSM, Feng Hua Sun, Ka Fai Tsang. The Chinese University of Hong Kong, Hong Kong, China.  
(No relationships reported)

PURPOSE: To investigate whether the glycemic index (GI) of pre-exercise snack bars will affect substrate utilization during subsequent moderate intensity exercise.

METHODS: Seven young physically active male subjects (age: 21.0 ± 0.7 yr, BMI: 22.7 ± 2.1 kg·m⁻², VO₂max: 51.2 ± 4.6 mL·kg⁻¹·min⁻¹) volunteered to participate in the study. All subjects completed two main trials in a counterbalanced crossover design with seven days interval. In the main trials, all subjects reported to the lab after an overnight fast. Then they ate one of two snack bars: a low-GI snack bar (LGI) and a moderate-GI snack bar (MGI). The estimated GI values for the two snack bars were 28 and 68, respectively. All snack bars provided similar energy and carbohydrate (CHO) content (1 g CHO/kg body mass). However, the energy percentages of fat and protein were different (LGI vs. MGI: fat, 30% vs. 24%; protein, 9% vs. 16%). After 90-min resting, all subjects completed 45-min cycling at 60% VO₂max. Substrate utilization was measured using indirect respiratory calorimetry every 30 minutes during the postprandial and every 15 minutes during exercise. Blood glucose and lactate concentrations were measured every 15 minutes.

RESULTS: Blood glucose concentrations peaked at 30 min and returned to baseline level at the end of postprandial period in both trials. During exercise, glucose concentrations were suppressed in the MGI trial than those at the onset of exercise, but not in the LGI trial. During the postprandial period, blood glucose was higher at 60 min in the MGI trial compared with that in the LGI trial (5.74 ± 0.83 vs. 4.67 ± 0.46 mmol·L⁻¹, P < 0.05). The incremental area under the blood response curve of glucose (IAUC) value was also higher in the MGI trial than in the LGI trial (MGI vs. LGI: 206 ± 39 vs 136 ± 28 mmol·min⁻¹·L⁻¹, P < 0.05). No differences were observed in blood lactate concentrations, fat and CHO oxidation amounts between the two trials both during the postprandial and exercise periods.

CONCLUSIONS: The results suggest that substrate utilization during the 45-min moderate intensity exercise was not affected by the pre-exercise LGI or MGI snack bars consumption.

2339  
MAY 31  2:00 PM - 3:30 PM  
Subcellular Localization-dependent Skeletal Muscle Glycogen Content in the Recovery Period After a High-level Soccer Match  
Joachim Nielsen1, Peter Krustrup1, Lars Nybo2, Thomas P. Gunnarsson2, Klas Madsen3, Henrikk Daa Schnrøer1, Jens Bangsbo2, Niels Ørtenblad1. 1University of Southern Denmark, Odense M, Denmark. 2University of Copenhagen, Copenhagen, Denmark. 3Aarhus University, Aarhus, Denmark.  
(No relationships reported)

PURPOSE: Whole muscle glycogen levels are deteriorated for a prolonged period following a soccer match. The present study was conducted to investigate how this relates to glycogen content in distinct subcellular localizations. Thus, subcellular localizations of glycogen may be regulated differently and be of distinct importance for muscle performance and recovery.

METHODS: Seven high-level male soccer players had a vastus lateralis muscle biopsy collected immediately after and 24, 48, 72 and 120 h after a competitive soccer match. Transmission electron microscopy was used to estimate the glycogen volume in subsarcolemmal (SS), intermyofibrillar (IMF) and intramyofibrillar (Intra) localizations. Two-way interactions or main effects were tested using linear mixed-effect model with subject, time and fibre as random effects and with time and localization as fixed effects. Values were log-transformed before analysis and presented as geometric means and 95% confidence intervals.

RESULTS: During the first day of recovery, glycogen content increased by ~60% in all defined subcellular localizations (SS, 0.029 (0.024-0.035) vs 0.046 (0.038-0.057) µmol·µm⁻²; IMF, 0.014 (0.012-0.017) vs 0.022 (0.020-0.025) µmol·µm⁻²; Intra, 0.0016 (0.0012-0.0020) vs 0.0026 (0.0022-0.0032) µmol·µm⁻²), but during the subsequent second day of recovery Intra glycogen content did not increase further (48 h, 0.0025 (0.0020-0.0030) µmol·µm⁻²) compared with an increase of 25% in subsarcolemmal glycogen (48 h, 0.058 (0.048-0.069) µmol·µm⁻²) (P = 0.047). Conversely, from the second to the fifth day of recovery, Intra glycogen content exclusively increased (53%) (120 h, 0.0037 (0.0029-0.0048) µmol·µm⁻²) compared to no change in subsarcolemmal (120 h, 0.0048 (0.0037-0.0063) µmol·µm⁻²) or intermyofibrillar glycogen (120 h, 0.027 (0.023-0.031) µmol·µm⁻²) (P < 0.005).

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CONCLUSION: In the recovery period after a soccer match, the increase in glycogen content is dependent on its subcellular localization. These results indicate that spatial distinct depositions of glycogen may have differential regulatory mechanisms, which might be influenced by the type of prior exercise.

2340 Board #15 MAY 31 2:00 PM - 3:30 PM
Intake of Dammarane Oligo-Saponins Improves Glycogen Resynthesis in Human Skeletal Muscle after Exercise
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(Purpose: Glycogen is the major energy source in the skeletal muscle for physical activities. Ginseng extracts shown to enhance the exercise performance, but no study demonstrated the effect of purified ginseng extracts and their dose response on glycogen metabolism in human skeletal muscle after exercise. The present study aimed to investigate the impact of different doses of Dammarane Oligo-Saponins (DS), a purified ginseng extract on glycogen re-synthesis in exercised human skeletal muscle.

Methods: Twelve physically active male college students were considered as placebo and DS trials. DS trials received three different doses of DS substance (low-240, medium-480, high-960 mg/day) for one-month, and all subjects performed an acute bout of cycling exercise for 1 hr at 75% VO2max. Muscle samples from vastus lateralis were collected by needle biopsy immediately before (0) and 3-h after exercise. Blood glucose, insulin and lactate levels were estimated before exercise, immediately and 3-h after exercise. Crossover trials were performed once after every dose with 4-week washout interval.

Results: We found glycogen resynthesis rate was significantly higher in DS-240 trial (2.15±0.66µmoles/mg tissue/h) than in placebo trial. The protein levels of glycogen synthase (GS) were significantly (P<0.05) elevated immediately after exercise, and continued until 3-h after exercise in all DS trials. Phospho-GS levels were also increased immediately after exercise in low to high dose of DS. However, lower pGS/GS ratio was found in DS240 trial 3-h after exercise compared to placebo trial. Estimated Akt protein levels in muscle samples were not significantly altered. Nevertheless, phospho-Akt was significantly increased immediately after exercise in all 3 trials, while, DS-240 trial showed 3-h after exercise. Blood lactate levels with high dose was higher 3-h after exercise, while blood glucose levels were lower with low dose (DS-240) 3-h after exercise. No significant change in insulin levels were noticed among groups after exercise.

Conclusions: Our findings clearly demonstrating that one-month Dammarane oligosapoinns supplementation improved the glycogen resynthesis in skeletal muscle, and this was more prominent with moderate dose of DS.

2341 Board #16 MAY 31 2:00 PM - 3:30 PM
Exercise Training Improves Glucose Tolerance In Type 2 Diabetic Rats Regardless Elevation Of Body Temperature
Takamasa Tsuzuki1, Hiroyuki Kobayashi2, Toshinori Yoshihara1, Ryo Kakigi1, Noriko Ichinoseki-Sekine1, Hisashi Naito1, Shizuo Katamoto1, 1Juntendo University, Itabu, Japan. 2Tsukuba University Hospital, Mito, Japan.

(Purpose) Exercise has been shown to improve impaired glucose tolerance and type 2 diabetes. Exercise elevates body temperature, resulting in increased heat shock protein (HSP) expressions in skeletal muscle. This increase of HSP expression has been suggested to contribute to the improvement of glucose tolerance. However, it is unclear whether exercise alone without raising body temperature can improve glucose tolerance.

Methods: To examine the effects of exercise training with and without elevation of body temperature on glucose tolerance in type 2 diabetic rats without elevation of body temperature.

Results: Body temperature significantly increased in OTr-OLETF (40.65 ± 0.41°C), whereas body temperature in CTr-OLETF (38.01 ± 0.35°C) remained similar after exercise. No significant differences in HSP72 expressions were observed among the three OLETF groups in soleus muscle. In plantaris however both CTr- and OTr-OLETF induced higher HSP72 expressions than Sed-OLETF, with the increase in HSP72 expression being greater for OTr-OLETF. The area under the curve of IPGT was smaller for CTr- and OTr-OLETF than Sed-OLETF, indicating improved glucose tolerance after training. The values were however similar between CTr- and OTr-OLETF.

Conclusions: Preventing the rise in body temperature during exercise did not preclude the increase of HSP expression. Regardless of different expression levels of HSP72 induced by exercise training, exercise training with and without elevation of body temperature improved glucose tolerance in type 2 diabetic rats by similar degrees.

2342 Board #17 MAY 31 2:00 PM - 3:30 PM
High Physical Activity Attenuates The Hyperlipidemic Effect Of A Fructose-rich Meal
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(Purpose: The hyperlipidemic effect of a chronic high fructose diet has been well documented, however, whether increased physical activity (PA) may confer protection against these effects is yet to be determined.

Methods: Twenty-two normal weight men and women (age: 21.18 ± .61, BMI = 22.54 ± .60 kg/m2) consumed an ad libitum diet while ingestiong an additional 75g of fructose for 14 days on 2 occasions. During the 14 days, subjects maintained either low PA (4500steps/day) or high PA (12,500 steps/day). Prior to and at the conclusion of the intervention, subjects underwent a study day in which they were given a fructose-rich meal (600 calorie mixed meal (45% carbohydrate [7.3% fructose], 40% fat, and 15% protein)) in the morning after a 12 h overnight fast. Blood was sampled at baseline and for 6 h after the meal and analyzed for triglycerides (TG), very-low-density lipoproteins (VLDL), and total cholesterol (TC). An intraperitoneal glucose tolerance test (IPGT) was performed for each group before and after the training period. Soleus and plantaris muscles were sampled under anesthesia 48 hours after the last exercise session. HSP72 expressions were measured using western blot analysis.

Results: We found glycogen resynthesis rate was significantly higher in DS-240 trial (2.15±0.66µmoles/mg tissue/h) than that in placebo trial. The protein levels of glycogen synthase (GS) were significantly (P<0.05) elevated immediately after exercise, and continued until 3-h after exercise in all DS trials. Phospho-GS levels were also increased immediately after exercise in low to high dose of DS. However, lower pGS/GS ratio was found in DS240 trial 3-h after exercise compared to placebo trial. Estimated Akt protein levels in muscle samples were not significantly altered. Nevertheless, phospho-Akt was significantly increased immediately after exercise in all 3 trials, while, DS-240 trial showed 3-h after exercise. Blood lactate levels with medium and high dose was higher 3-h after exercise, while blood glucose levels were lower with low dose (DS-240) 3-h after exercise. No significant change in insulin levels were noticed among groups after exercise.

Conclusions: Our findings clearly demonstrating that one-month Dammarane oligosapoinns supplementation improved the glycogen resynthesis in skeletal muscle, and this was more prominent with moderate dose of DS.

2343 Board #18 MAY 31 2:00 PM - 3:30 PM
Effects of Moderate Swim Exercise on Adiposity and Metabolic Function in Mice
Robert A. Pohlemann1, Ana Cameiro1, Vera Farah2, Lynn Hartzler1, Mariana Morris1, 1Wright State University, Dayton, OH. 2Universidade Presbiteriana Mackenzie, São Paulo, Brazil. (Sponsor: Lynn Darby, FACSM)

(Purpose: Chronic exercise has been recommended for diabetics as a way to attenuate metabolic changes and prevent obesity.

593
PURPOSE: This study was undertaken to determine the effects of swim training on the metabolic and anthropomorphic response to a high fat (60%) and fructose (10% liquid) diet in C57BL/6J male mice.

METHODS: Mice were randomly assigned to one of three groups: Control (CON, Standard Chow & Water, n=10); Sedentary (SED, High Fat Chow & Fructose Water, n=9); and Exercise (EX, High Fat Chow & Fructose Water, n=9). EX mice swam 1 hr/day, 3 days/week, for 8 weeks. SED and CON did not participate in the exercise program. Caloric consumption and body composition were measured weekly (Echo-MRI). A glucose tolerance test (GTT) was conducted at week 7. Plasma glucose, insulin, leptin, and corticosterone were measured at week 8.

RESULTS: Exercise did not improve body fat or fat cell size. Body fat was as high as ~40% in the SED and EX groups as compared to 18% in CON. The increased levels of corticosterone, insulin, and glucose in the fat/fructose groups were reduced by exercise. Corticosterone: CON, 214±1.6 ng/mL; SED, 571±0.9 ng/mL; EX, 257±1.6 ng/mL (SED=EX, p<0.01). Insulin: CON, 1.2±0.2 ng/mL; SED, 8.3±2.3 ng/mL; EX, 3.4±0.5 ng/mL (SED=EX, p<0.05). Glucose: CON, 136.2±4.7 mg/dL; SED, 153.9±5.5 mg/dL; EX, 120.2±6.2 mg/dL (SED=EX p<0.01). GTT was impaired by the fat/fructose diet with levels corrected by exercise (p<0.05).

CONCLUSION: These results document the beneficial effects of even moderate exercise on key metabolic parameters in dietary-induced diabetes.

This study was supported by NIH R01 HL093567

2344 Board #19  MAY 31  2:00 PM - 3:30 PM
Time Trial Performance 4 h following Glycogen-Depleting Exercise is Enhanced Similarly with Recovery Non-dairy Chocolate Beverages vs Chocolate Milk
Adam N. Upshaw, Tiffany Larn, Arash Bandegian, Peter W.R. Lemon, FACSM. University of Western Ontario, London, ON, Canada.

(No relationships reported)

PURPOSE: To assess whether non-dairy chocolate beverage ingestion post-glycogen depletion exercise can enhance 20km time trial performance 4 hours later.

METHODS: Ten healthy trained male cyclists (21 ± 2 y, VO2max = 60.5 ± 2.6 ml•kg•min^-1; mean±SD) completed a series of intense cycling intervals designed to lower muscle glycogen (Jentjens & Jeukendrup, 2003) followed by 4h of recovery and a subsequent 20km cycling time trial. During the first 2h of recovery, participants ingested chocolate dairy (DAIRYCHOC), chocolate soy milk (SOYCHOC), chocolate hemp milk (HEMPCHOC), low fat dairy milk (MILK), or a 0 kcal artifically sweetened, flavored beverage (PLACEBO) at 30min intervals in a double blind, counterbalanced repeated measure design. All drinks, except the PLACEBO were isotonenic (1010 ± 148 kcal) and provided 1g CHO•kg body mass. CHO:PRO ratio was 4:1, 1.5:1, 4:1, and 5:1, for DAIRYCHOC, MILK, SOYCHOC, and HEMPCHOC, respectively.

RESULTS: Time trial performance (DAIRYCHOC 34.58 ± 2.5 min, SOYCHOC 34.83 ± 2.2 min, HEMPCHOC 34.88 ± 1.1 min, MILK 34.47 ± 1.7 min) was enhanced similarly vs PLACEBO (37.85 ± 2.1) for all treatments (P=0.019).

CONCLUSION: These data suggest that post exercise macronutrient and total energy intake are more important for 20 km time trial performance following glycogen-depleting exercise than protein type or protein: carbohydrate ratio.

2345 Board #20  MAY 31  2:00 PM - 3:30 PM
The Effect Sweet Cassava Polysaccharide (SCP) on Exhaustive Running Performance
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(No relationships reported)

PURPOSE: This study was to examine the effect of sweet cassava polysaccharide (SCP) on endurance performance.

METHODS: Thirty male SD rats (7-week old) were divided into three groups: control (C), exercise (E) and exercise with SCP administration (ESCP) at the dosage of 500mg/kg body weight by gastric-intubation for 6 days in addition to standard rat food and plain water. Exercise training was performed in the E and ESCP groups for 5 days (no exercise in the 6th day), and then all rats were sacrificed for determining the levels of gastrocnemius and soleus glycogen content and blood metabolites such as blood glucose, free fatty acid and insulin after the ESCP and E treatment.

RESULTS: The running time to exhaustion was significantly longer in ESCP group than in E group- (63 vs. 45 minutes, p<0.05). Both gastrocnemius (C, ESCP, and E for 2.10 ± 0.51, 1.70 ± 0.25, and 2.30 ± 0.31) and soleus (C, ESCP, and E for 3.15 ± 0.92, 2.23 ± 0.44, and 1.09 ± 0.59 mg/g, respectively, p<0.05) glycogen content of ESCP and C groups were significantly greater than those of E group, but, only significantly higher in the C group than in the ESCP group for soleus was found. In addition, free fatty acid (C, ESCP, and E for 1.21 ± 0.13, 1.25 ± 0.12, and 0.84 ± 0.14 mM/L, respectively, p<0.05) and blood glucose (C, ESCP, and E for 111.4 ± 5.6, 109.1 ± 4.68, and 100.1 ± 1.91 mg/dL, respectively, p<0.05) concentrations were significantly higher in the ESCP and C groups than in the E group. CONCLUSIONS: A 5-day supplementation of SCP can extend the running time to exhaustion, which might be attributed to elevated muscle glycogen content and free fatty acid levels in blood.

2346 Board #21  MAY 31  2:00 PM - 3:30 PM
Carbohydrate Attenuates Central Fatigue in Cyclists
Beth W. Glace, Ian J. Kremencik, Malachy P. McHugh, FACSM. Lenox Hill Hospital, New York, NY.

(No relationships reported)

PURPOSE: Carbohydrate ingestion delays fatigue after exhaustive cycling.

METHODS: 4 men [35.4±5.3 yrs; VO2peak 4064±64 ml•kg•min^-1] were assigned, in a double-blind crossover design, to an artificially sweetened, non-caloric, electrolyte beverage (“Placebo”, 4C Totally Light 2 Go!) and to a commercially available sports drink (“Carbohydrate”, Gatorade) at a rate of 1% of body weight each hour. Subjects cycled for 2 hours at their ventilatory threshold, approximately 66% of VO2peak, with 5, 1-minute sprints interspersed, followed by a 3-Km time trial. Intensity was then increased to the workload at their respiratory compensation threshold [approx. 85% VO2peak] and subjects were encouraged to pedal for as long as possible. Ratings of perceived exertion [RPE] were measured throughout using the Borg scale. Blood glucose, lactate and quadriceps strength were measured pre-exercise, post-3K time trial and post-exhaustion. Isometric strength testing was performed in a semi-reclined position: 1) MVC, 2) MVC with superimposed femoral nerve magnetic stimulation to measure central activation ratio [CAR]; 3) femoral nerve stimulation [PMS] in a 4-second pulse train on a relaxed muscle. Changes in MVC and strength measurements were analyzed with repeated measures ANOVA.

RESULTS: Post-exercise strength was 92% of baseline in the Carbohydrate trial vs. 75% in the Placebo trial [p=0.002]. Preservation of strength with Carbohydrate was due to better maintenance of central activation [Carbohydrate CAR after fatigue was 91% of baseline vs. Placebo CAR 80% of baseline, p=0.036], since there was no evidence of peripheral fatigue based on maintenance of PMS-elicited force [effect of time, p=0.869; time x drink, p=0.938]. Carbohydrate intake tended to improve time trial and ride to exhaustion performance. There was no effect of drink on blood glucose or lactate.

CONCLUSION: Carbohydrate ingestion preserves performance via a central mechanism during exhaustive cycling.
Effects of Carbohydrate Supplementation on Human Growth Hormone and Cytokine Responses during Resistance Exercise
Pan Soo Kim, Ying Chang, Hyun Lyung Jung, Jun Gu Jung, Ho Youl Kang. Kyungpook National University, Daegu, Korea, Republic of.
(No relationships reported)

PURPOSE: This study was to investigate the effects of carbohydrate consumption on human growth hormone (hGH) and cytokine responses during resistance exercise.

METHODS: Ten male students (Age: 23.2 ± 0.4 yr, Height: 174.1 ± 2.0 cm, Body Weight: 68.4 ± 1.7 kg) were randomly received to the exercise treatment (8RM 3sets/CHO). The 8RM 3sets/CHO ingested the carbohydrate (1.2 g/kg bw) during and after resistance exercise which consisted of leg press exercise with three sets using eight repetition maximum (8 RM) load. Blood samples were drawn immediately before (pre) and at 15, 30, 45, 60, 75, 90, 105, and 120 min after exercise. Plasma hGH, total testosterone, cortisol, insulin and glucose levels were determined and Interleukin 1, Interleukin 1β and Interleukin 10 levels were also measured.

RESULTS: Plasma hGH level in 8RM 3sets/CHO was significantly decreased at 30, 45, 60, 75, 90 min during exercise compared with the 8RM 3sets (p<0.05). Plasma glucose in 8RM 3sets/CHO was significantly increased at 15, 30, 45, 60, 90 min during exercise compared with the 8RM 3sets and plasma insulin responses in 8RM 3sets/CHO was significantly increased at all times (15~120 min) compared to those of 8RM 3sets (p<0.05). The cortisol level was significantly increased in 8RM 3sets/CHO at 120min after (0) exercise than 8RM 3sets (p<0.05). Testosterone level was significantly reduced at 45, 60, 75, 90, 105, 120 min compared to those of CON (p<0.05). Plasma CK activity and cytokines (IL-6, IL-1β, IL-10) were no significantly different between two treatments.

CONCLUSIONS: The data of this study indicate that carbohydrate supplementation during resistance exercise could suppress the elevation of plasma growth hormone, but did not affect the concentrations of plasma cortisol and testosterone.

In addition, carbohydrate consumption during resistance exercise did not cause the changes of plasma IL-6, IL-1β, and IL-10 levels.

Consumption Of A Novel, Carbohydrate-Free Recovery Beverage Reduces Muscle Damage And Improves Recovery Post-exercise
Paul A. Borsa, FACSM, 1 Kelly A. Larkin, 2 Jeffrey S. Martin. 2 University of Florida, Gainesville, FL. 1 University of Missouri-Columbia, Columbia, MO.
( P.A. Borsa: Contracted Research - Including Principle Investigator; Revaleso Corporation.)

PURPOSE: To assess the effects of consuming a novel carbohydrate-free recovery beverage on muscle damage, inflammation and functional recovery following a single bout of isokinetic resistance exercise for the biceps brachii muscle.

METHODS: Subjects were blinded and randomly assigned to a beverage (BEV; n=20) or placebo control (PLA; n=20) group. Subjects consumed 2.6 500ml bottles of the BEV or PLA daily, as determined by weight categories, for 23 days. On day 19 subjects completed a fatigue protocol for the biceps in order to induce muscle damage. The fatigue protocol consisted of 3 sets of 20 repetitions using concentric and eccentric contractions of the elbow flexors. Blood draw and clinical measurements were performed pre-exercise and 24, 48, and 96-hrs post-exercise. Clinical measures included maximal isometric arm strength, pain with elbow extension, resting arm angle (RANG) and self-report arm disability. Pain was quantified using a visual analog scale and RANG was measured in degrees. Disability was measured using the QuickDASH self-report questionnaire. Plasma samples were analyzed to determine concentrations of creatine kinase (CK), myoglobin (Mb) and C-reactive protein (CRP).

RESULTS: There was no significant difference in maximal isometric arm strength between BEV PLA pre-exercise and at 48-hr and 96-hr post-exercise. Pain with elbow extension and self-report arm disability were significantly higher in the PLA compared to the BEV group at 48-hr [39.2±16 v. 25.4±13, p<0.01; 25.9±9 v. 19.8±3, p<0.01] and 96-hr [17.8±13 v. 7.7±8, p<0.01; 11.9±3 v. 16.8±5, p<0.01] after exercise, while RANG was significantly higher in the BEV group compared to PLA at 48-hr [159.2±7 v. 150±11; p<0.01] and 96-hr [163.4±5 v. 158.9±4, p<0.01] after exercise. Similarly, plasma concentrations for CK (IU/L) and CRP (mg/L) were significantly lower in the BEV group compared to PLA at 48-hr [235.6±280 v. 770.6±934, p<0.05; 3.1±2 v. 5.4±4, p<0.05] and 96-hr [364±247 v. 948±1098, p<0.05; 2.6±4 v. 5.8±5, p<0.01] after exercise.

CONCLUSIONS: Consuming a novel, carbohydrate-free recovery beverage significantly reduced exercise-induced muscle damage and inflammation, and improved biochemical and functional recovery.

Effects Of Carbohydrate And Electrolyte Supplementation On Processing Speed, Selective Attention And V02max
Ali Boolani, 1, Kumar Tammaraddi, 2 Bert Jacobson, FACSM, 1 Will Roszel. 1 Oklahoma City University, Oklahoma City, OK. 3 Alvin C. York VA Hospital, Nashville, TN. 2 Oklahoma State University, Stillwater, OK.
(No relationships reported)

PURPOSE: The purpose of this study was to evaluate performance on cognitive post sub-maximal VO2Max testing using the Bruce protocol after consumption of water or a carbohydrate-electrolyte solution (CE).

METHODS: Volunteers (N=12, age=21.42 ± 2.43, weight= 82.34 ± 33.44; height= 175cm ± 12.8) from a Historically Black College and University (HBCU) were issued a Stroops task (ST) and Random Numbers (RN) test at baseline. The ST congruent (STC) and incongruent (STI) words were timed and number incorrect was identified. The RN was a one minute timed test with numbers 0-99 randomized in a 10x10 grid. Subjects circled numbers as they were identified. Subjects were given water at the start of their warm-up on a Bruce Protocol (BP) VO2Max test and were asked consume it prior to the end of the first level of the BP. Subjects were administered the test until they reached a perceived exertion of 20 on a Borg rating of perceived exertion (RPE) scale. When a subject reached a RPE of 20 the test was stopped and without rest subjects were re-administered a ST and RN. Subjects were asked to complete the same protocol one week later however, they were administered 400ml of Gatorade G2 fruit punch. Data was analyzed using paired t-tests and test scores were analyzed for pre- and post-test data for both days. Changes in test scores were evaluated using paired t-tests.

Consumption Of A Novel, Carbohydrate-Free Recovery Beverage Attenuates Strength Loss After High Intensity Resistance Exercise
Kelly A. Larkin, Paul A. Borsa, FACSM. University of Florida, Gainesville, FL
( K.A. Larkin: Contracted Research - Including Principle Investigator; Revaleso Corporation.)

PURPOSE: To assess the effects of consuming a novel carbohydrate-free recovery beverage on strength loss and ratings of perceived exertion (RPE) following isokinetic exercise.

METHODS: Subjects were blinded and randomly assigned to either a beverage (BEV; n=20) or placebo control (PLA; n=20) group. Subjects consumed 2 to 6 500ml bottles of the BEV or PLA daily, as determined by weight categories, for 23 days. On day 19 subjects completed a fatigue protocol for the biceps in order to induce muscle damage. The fatigue protocol consisted of 3 sets of 20 repetitions using concentric and eccentric contractions of the elbow flexors. Blood draw and clinical measurements were performed pre-exercise and 24, 48, and 96-hrs post-exercise. Clinical measures included maximal isometric arm strength, pain with elbow extension, resting arm angle (RANG) and self-report arm disability. Pain was quantified using a visual analog scale and RANG was measured in degrees. Disability was measured using the QuickDASH self-report questionnaire. Plasma samples were analyzed to determine concentrations of creatine kinase (CK), myoglobin (Mb) and C-reactive protein (CRP).

RESULTS: There was a smaller decrease in MVC post-exercise then the PLA control group [BEV: pre-ex = 38.4±19, post-ex = 19.1±10; PLA: pre-ex = 46.5±26, post-ex = 22.4±14]. The strength loss index was also significantly lower for the BEV group compared to PLA control [BEV: 0.505; PLA: 0.527; p<0.01]. In addition, the exercise protocol was perceived as less strenuous by the BEV group [BEV: 16.5, PLA: 17.8; p<0.05].

CONCLUSIONS: Consuming a novel, carbohydrate-free recovery beverage for 18 days prior to high intensity resistance exercise can significantly reduce muscular fatigue and ratings of perceived exertion.

Effects Of Carbohydrate And Electrolyte Supplementation On Processing Speed, Selective Attention And Vo2max
Ali Boolani, 1, Kumar Tammaraddi, 2 Bert Jacobson, FACSM, 1 Will Roszel. 1 Oklahoma City University, Oklahoma City, OK. 3 Alvin C. York VA Hospital, Nashville, TN. 2 Oklahoma State University, Stillwater, OK.
(No relationships reported)
RESULTS: Analysis yielded significant difference in pre and post-test STI (p<0.01) and RN (p<0.006) for water. There was no significant difference in STC (p=0.613) for water. There was a significant difference in pre and post-test STI (p<0.001), STC (p<0.002), but no significant difference in RN (p=0.587) for CE. No significant differences in changes in STC (p=0.975), STI (p=0.181), RN (p=0.690) for both protocol were identified. A significant difference in VO2Max was also noted (p=0.002)

CONCLUSIONS: Significant decreases in STI and an increase score on RN may be attributed to increased cognitive function post-exercise. However no significant difference was found between the changes in of STC, STI and RN may lead us to assume that CE supplementation during exercise does not improve cognitive function more than water. The increase in VO2Max during may be attributed to increased blood glucose post supplementation giving the subject more time before they reached their lactic threshold.

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**2351 Board #26 MAY 31 2:00 PM - 3:30 PM**

**CHO Mouth-rinse Improves 16 Km Time Trial Cycling Performance In A Glycogen Depleted State**

Alexis R. Mauger1, Harry McGonagle2, Lee Taylor2, Paul C. Castle2, 1University of Kent, Chatham, United Kingdom. 2University of Bedfordshire, Bedford, United Kingdom.

(No relationships reported)

Rinsing of carbohydrate (CHO) solutions during exercise can improve performance in fixed work-amount cycle time trials (TT) and automated treadmill running of ~45-60 min duration. Mechanisms responsible for this improved performance have been attributed to a reduced perceived exertion, activation of reward centres in the brain and/or increased cortical excitability. However, this phenomena has never been demonstrated in distance-based TT cycling, or when exercise is performed in a glycogen depleted state.

PURPOSE: To determine whether the central effect of CHO mouth-rinse during a 16 km cycling TT improves performance when muscle glycogen has been previously depleted.

METHODS: Eight recreationally active subjects completed a VO2max test, a 16 km familiarisation TT and four performance 16 km TT. The evening before each performance TT, subjects completed a previously described muscle glycogen depletion protocol (Van Den Bergh et al, 1996) and then ate a low-CHO evening meal before the subsequent performance TT. During the performance TT, in a double-blind, randomised, fashion, subjects either ingested (GlI) or rinsed (GluR) 150 mL of 6.4% glucose solution every 2 km, or ingested (PlaI) or rinsed (PlaR) 150 mL of commercially available non-caloric concentrate sweetened with aspartame and saccharin. Subjects received no feedback during the TT other than distance completed. Measures of blood lactate B[Lac], heart rate (HR), RPE and power output (PO) were recorded during each TT.

RESULTS:Time to complete the TT was significantly reduced (F2,5.17 = 4.3, p = 0.02) in the GluR (29:53 ± 2.56 min) vs. PlaR (31:16 ± 3.15) (p = 0.05). The 5% performance improvement in the GluR (compared with PlaR) was accompanied by a mean 21 W higher PO in the first 12 km (F3,21 = 3.4, p = 0.03) and a mean 8 bpm higher HR (F3,21 = 3.1, p = 0.04) throughout the TT. No changes in B[Lac], B[Glu] or RPE across the TT (p > 0.05) were observed. No significant differences were observed between the GluI, PlaR and PlaI conditions.

CONCLUSIONS: The proposed central changes and subsequent exercise performance improvement accompanying CHO mouth-rinsing during exercise are apparent even when muscle glycogen levels have been previously depleted.

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**2352 Board #27 MAY 31 2:00 PM - 3:30 PM**

**Effect Of Carbohydrate Mouth Rinse And/or Ingestion On High-intensity Exercise Performance**

Ajmol Ali, Catherine Moss, Ji Y. Yoo, Bernhard Breier. Massey University, Auckland, New Zealand.

(No relationships reported)

There is equivocal data regarding mouth rinsing with carbohydrate (CHO) and exercise performance. It has been suggested that in a fed state, where muscle and liver glycogen stores are not compromised, glucose levels are maintained and hence mouth rinsing will not affect performance.

PURPOSE: To examine effects of fluid intake, CHO mouth rinse, and CHO ingestion on cycling performance under glycogen-compromised conditions.

METHODS: Nine recreationally trained cyclists volunteered for this randomised, counterbalanced, double-blind study. Four main trials were performed on an electronically braked cycle ergometer; each trial, separated by 7 days, took place over 2 days. On Day 1 the participants underwent a 90 min glycogen-reducing exercise protocol, immediately followed by a low-carbohydrate meal and then a subsequent overnight fast. The following morning a 1-h time trial performance test was conducted. Subjects performed a certain amount of work as fast as possible for the performance test. For the main trials subjects either a) mouth rinsed with a 15% CHO solution (CHOR), b) ingested 7.5% CHO solution (CHOI), c) mouth rinsed with a taste-matched placebo (PLAR), or d) ingested taste-matched placebo (PLAI); solutions were administered every 12.5% of exercise completed. Blood samples were taken every 25% of exercise.

RESULTS: There were no significant differences in performance time between treatments (CHOI 3927 ± 288 s; CHOR 4101 ± 236 s; PLAI 4125 ± 316; 4097 ± 310 s; mean ± SD; P=0.22). However, mean power output was higher in CHOR (231 ± 33 W) relative to other trials (221-223 W; P=0.05). There was a main effect of treatment (P<0.001) and interaction of treatment x time for plasma glucose (P<0.001); values were similar at the start of exercise (4.2-4.9 mM) but were higher in CHOR at 75% (5.4 ± 0.7 mM) and 100% (5.9 ± 1.2 mM) of exercise relative to other trials (3.9-4.7 mM; P<0.05). There were treatment (P<0.001) and interaction (P=0.015) effects for insulin; levels were higher in CHOR between 50-100% of exercise (2.6-2.0 mM/L) relative to other trials (1.5-0.4 mM/L; P<0.05).

CONCLUSIONS: Mouth rinsing with a CHO solution in a glycogen-compromised condition did not affect exercise performance. CHO ingestion increased glucose concentrations and improved performance relative to fluid ingestion and CHO mouth rinse trials.

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**2353 Board #28 MAY 31 2:00 PM - 3:30 PM**

**Pre-exercise Carbohydrate Supplementation Does Not Suppress Rate Of Fatigue During Resistance Exercise In Trained Females.**

Bill I. Campbell1, Kelly A. Raposo1, Ashley Bullion1, Amber Petchenka1, Nina Pannoni1, Brad Cloer1, Shawn Deignan1, Tina Vyas2, Richard Kreider, FACSM2.

1University of South Florida, Tampa, FL. 2Texas A&M University, College Station, TX.

(No relationships reported)

PURPOSE: To investigate the effects of ingesting pre-exercise waxy maize carbohydrate on the rate fatigue (as measured by total repetitions performed) during an acute bout of resistance exercise.

METHODS: 13 resistance-trained females (21.9 ± 4.8 yrs; 163.8 ± 7.6 cm; 62.1 ± 6.7 kg) participated in 2 separate resistance exercise sessions separated by seven days. During a familiarization trial, each participant’s 1RM for the bench press and leg press was determined. Next, the participants were randomly assigned to either the carbohydrate or placebo treatment session using a double blind, counterbalanced, cross-over design with each participant consuming 1.0g carbohydrate/kg of body mass or a non-caloric placebo beverage 60 minutes before exercise. The source of carbohydrate was waxy maize carbohydrate. The resistance exercise workout required each participant to perform 5 sets of bench press at 75% 1RM followed by 5 sets of leg press at 85% of 1RM performed to muscular failure, with 5 minutes of rest between each set and 5 minutes of rest between the two exercises. The rate of fatigue was calculated as the percentage decline (in repetitions completed) from the first set to the fifth (and final) set in both the bench press and leg press. Data were analyzed by a paired samples t-test (p < 0.05).

RESULTS: There was no statistically significant difference between treatments in the rate of fatigue in relation to bench press and leg press. Rate of fatigue for bench press in the carbohydrate group was 54 ± 14% and was 57 ± 8% in the placebo group. There were no significant differences (p=0.420) between these two groups in relation to rate of fatigue in the bench press. Rate of fatigue for leg press in the carbohydrate group was 29 ± 22% and was 22 ± 24% in the placebo group. There were no significant differences (p = 0.144) between these two groups in relation to rate of fatigue in the leg press.

CONCLUSIONS: Pre-exercise carbohydrate supplementation (in the form of waxy maize carbohydrate) does not impact the rate of fatigue during an acute bout of resistance exercise in resistance-trained females.
Effects Of A Whey-carbohydrate Supplement On Markers Of Muscle Damage After Concurrent Exercise In Men

Catherine Saenz, Jenna M. Apicella, Brooke L. Bailey, William J. Kraemer, FACSM, Carl M. Maresh, FACSM, Jeff S. Volek. University of Connecticut, Storrs, CT. (No relationships reported)

Effects of a whey-carbohydrate supplement on markers of muscle damage after concurrent exercise in men

Catherine Saenz, Jenna M. Apicella, Brooke L. Bailey, William J. Kraemer, FACSM, Carl M. Maresh, FACSM, Jeff S. Volek. University of Connecticut, Storrs, CT

Ingestion of whey protein and carbohydrate after varying types of resistance exercise rapidly increase plasma levels of essential amino acids and insulin which has been shown to positively affect muscle protein balance, but its effect on markers of muscle damage remains unclear.

PURPOSE: To examine the effects of a whey-carbohydrate supplement ingested mid-workout on exercise-induced muscle damage (EIMD) as determined by blood levels of creatine kinase (CK), myoglobin and fast-twitch skeletal muscle troponin-I (cTnI).

MAY 31  2:00 PM - 3:30 PM

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MAY 31  2:00 PM - 3:30 PM

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MAY 31  2:00 PM - 3:30 PM

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Ingestion of whey protein and carbohydrate after varying types of resistance exercise rapidly increase plasma levels of essential amino acids and insulin which has been shown to positively affect muscle protein balance, but its effect on markers of muscle damage remains unclear.

PURPOSE: To examine the effects of a whey-carbohydrate supplement ingested mid-workout on exercise-induced muscle damage (EIMD) as determined by blood levels of creatine kinase (CK), myoglobin and fast-twitch skeletal muscle troponin-I (cTnI).
RESULTS: CK and myoglobin significantly increased over time indicating that the protocol induced muscle damage. CK levels peaked IP AET (mean ± SE, percent change from pre AET, Water: 42 ± 4; Supplement: 44 ± 5, p<0.001). Myoglobin levels peaked 60min post AET (mean ± SE, percent change from pre AET, Water: 293±36; Supplement: 303 ± 37, p<0.05). tTest analysis positively correlated with CK (r= 0.434; p<0.001). There was no significant difference in CK, myoglobin, or sTnI between supplementation conditions.

CONCLUSION: A high-carbohydrate breakfast cereal to a high-carbohydrate meal would blunt postprandial glycemic and insulin excursions. We hypothesized that addition of a high-fiber breakfast cereal to a high-carbohydrate meal would blunt postprandial glycemic and insulin excursions.

METHODS: To assess the effect of dietary fiber on postprandial glucose and insulin responses in children and young and older adults. Supported by NIH R010847 and a grant from the Wheat Foods Council.

CONCLUSION: The addition of dietary fiber (primarily insoluble) to a high-carbohydrate meal failed to attenuate the postprandial glucose and insulin responses in children and young and older adults. Supported by NIH R010847 and a grant from the Wheat Foods Council.

2530 Board #33
MAY 31  2:00 PM - 3:30 PM
Post-Exercise Chocolate Milk and Cycling Performance Following 30 Hours of Recovery
Ruhan-Yu Wan, Jonathan L. Stickford, Emily J. Dawkins, Alice K. Linderman, Timothy D. Mickleborough, Joel M. Stager, FACSMD. Indiana University, Bloomington, IN.

PURPOSE: To assess the effects of aerobic exercise training combined with either a low- or high-glycemic index (GI) diet on insulin sensitivity and free circulating MG-H1 and G-H1 (measured by liquid chromatography tandem mass spectrometry), insulin sensitivity (measured by 40 mU/mhour insulin stimulated glucose clamp), fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), body composition and VO2max were measured.

RESULTS: Both groups lost equal amounts of body weight (-7.9 ± 1.6 kg) and adiposity (-4.4 ± 0.5% body fat) and showed similar improvements in peripheral tissue insulin sensitivity (+87.8 ± 13.3%) and VO2max (+ 5.9 ± 0.7 ml/kg/min; all P < 0.05). FPG was reduced following the lifestyle intervention (p=0.003) and a significant group effect was observed in the LoGIX group (p<0.001). HbA1c was also reduced (-0.07 ± 0.08%, p<0.05) by the lifestyle intervention but did not reach significance. MG-H1 was reduced in both groups (LoGIX: -9.9 ± 7.5; HiGIX: -13.0 ± 11.6); however the HiGIX group demonstrated greater reductions in G-H1 compared to LoGIX (9.1±1.1.6; HiGIX: -0.4±0.8 ng/mL, p=0.04).

CONCLUSION: The combined aerobic exercise and glycemic index diet lifestyle intervention was successful in improving body composition, aerobic fitness, glycemic control and reactive precursors to AGES in obese adults with IGT. These data suggest that regular aerobic exercise and a controlled diet can reverse the formation of AGES which may lead to reduced risk of future diabetes and diabetic complications.

Supported by ACSM Research Endowment Grant (JMH)
CONCLUSIONS: Ingestion of CM immediately following exhaustive exercise did not represent an advantage to cyclists performing ~ 1 h of exercise following a day of free-living recovery. The athletes’ dietary choices during the free-living period appeared sufficient to replenish muscle glycogen such that it washed out the expected macronutrient benefits of CM.

2361 Board #36 MAY 31 2:00 PM - 3:30 PM
Effect Of A Natural Versus Commercial Product On Running Performance And Gastrointestinal Tolerance
Brandon W. Too, Sarah Cicai, Kali R. Hockett, Elizabeth Applegate, FACSM, Brian A. Davis, FACSM, Gretchen A. Casazza. University of California at Davis, Davis, CA.
(No relationships reported)
PURPOSE: To examine the effects of raisins and chews on running performance and gastrointestinal (GI) tolerance. METHOD: Eleven male (29.3 ± 2.4 yrs) runners completed three randomized trials (raisins, chews and water only) separated by 7 days apart. Each trial consisted of 80-min submaximal (75%VO2max) running followed by a 5-km time trial (TT). Heart rate (HR), respiratory exchange ratio (RER), glucose, lactate, free fatty acids, glycerol, insulin, electrolytes, creatine kinase, GI symptoms and rating of perceived exertion (RPE) were recorded every 20-min during the submaximal trial and at the end of the TT. Whole body muscle soreness and fatigue were also measured.
RESULTS: R02, HR, muscle soreness and fatigue, electrolytes, lactate and RPE did not differ due to treatment. RER was significantly higher during the carbohydrate treatments, as was blood glucose (104.9 ± 3.6, 107.0 ± 2.5, 98.6 ± 2.9 mg·dl-1 for raisin, chews and water respectively). Plasma creatine kinase was higher with raisins (466.6 ± 101.7, 308.2 ± 58.5, 321.5 ± 48.3 U·L-1 for raisin, chews and water respectively). Time to complete the TT was shorter for both carbohydrate treatments (20.6 ± 0.8, 20.7 ± 0.8, 21.6 ± 0.8 min for raisin, chews and water respectively). GI disturbance was mild for all treatments.
CONCLUSION: Both the raisins and chews maintained high blood glucose levels and improved running performance compared to water only. Running performance between the raisins and chews were similar with no significant GI differences. Key words: blood glucose, time trial, respiratory exchange ratio, creatine kinase, carbohydrate, fiber

2362 Board #37 MAY 31 2:00 PM - 3:30 PM
Efficacy of Chocolate Lactaid Milk as a Recovery Supplement on Cycling and Strength Performance in Young, Active Women
(No relationships reported)
Recovery after intense exercise is vital for optimizing subsequent performance. Nutritional supplements containing carbohydrate (CHO) and protein (PRO) are the primary constituents in recovery drinks. Recently, chocolate milk (CM) has been identified as a potent recovery beverage, although results are equivocal regarding its efficacy.
PURPOSE: The aim of the study was to evaluate the effects of CM on subsequent cycling and strength performance in active women. METHOD: Eight active women (age: 22.3 ± 3.8 yr, physical activity: 9.5 ± 1.5 h/wk, % BF: 23.6 ± 4.3 %) completed familiarization trials including a VO2max test , 5 interval training bouts, a 12.9 km cycling time trial (TT), and 10 repetitions of knee extension/flexion (K/F) at 60’s on an isokinetic dynamometer (IKD) over 2. At the same time 3 d later, subjects cycled for 30 min at 50 %VO2max followed by eight 60 s bouts at 100%VO2max to deplete muscle glycogen. Immediately post exercise and 2 h later (50% K/F), subjects ingested an isocaloric, randomly assigned meal, CHO (Bagel + Gatorade = 370 Kcal, 77 g CHO) or CM (370 Kcal, 53 g CHO, 6 g fat, and 18 g PRO). The next day, subjects completed a 16.6 km TT followed by 3 bouts of 10 maximal repetitions on the IKD. Three days later, subjects repeated the 2-day exercise protocol and ingested the other recovery beverage after day 1. Subjects standardized dietary intake and refrained from intense exercise for 48 h pre-trial, and all testing was conducted during the follicular phase. Paired t-test and repeated measures ANOVA were used to examine differences in TT performance and peak/average K/F torque across time and/or treatment.
RESULTS: In response to the TT, mean power (157.9 ± 24.4 W vs. 157.3 ± 29.4 W), average speed (18.8 ± 1.2 m/h vs. 18.7 ± 1.4 m/h), and overall time (32.4 ± 2.8 min vs. 32.0 ± 2.6 min) were similar between CM and CHO. There was no change (P>0.05) in muscle force between CM and CHO across bouts (P>0.05). Peak K/F torque was similar (P>0.05) with CM (88.6 ± 19.6 ft/lb, 89.3 ± 21.8 ft/lb) and 90.4 ± 18.4 ft/lb) compared to CHO (92.2 ± 20.6 ft/lb, 89.0 ± 20.3 ft/lb, and 91.0 ± 18.5 ft/lb) in bouts 1 - 3.
CONCLUSION: In active women, there was no difference in subsequent exercise performance after ingesting CM or CHO post glycogen-depleting exercise. Thirty min of cycling may have been inadequate to fully exhaust glycogen stores.

2363 Board #38 MAY 31 2:00 PM - 3:30 PM
Understanding The Role Of Lactate And Its Transporters In Cancer
Rajaa Hassien, George A. Brooks. University of California, Berkeley, Berkeley, CA.
(No relationships reported)
The role of lactate and its transporters in healthy muscle tissue is well known, while their role in cancer is still debated. The MDA-MB-231 is a mesenchymal breast-cancer cell line that has high MCT4 expression, glycolytic rate, and invasive cancer growth in vivo. Previously, we have shown that the oxygen consumption and expression of MCT1 protein in MDA-MB-231 cell line is very low compared to normal breast cell lines. MCT1 was reported by others to be deleted in MDA-MB-231 cells by promoter hypermethylation. The role of MCT1 deletion in this cell line is not clear.
PURPOSE: To determine the role of MCT1 deletion on the proliferation rate of MDA-MB-231 cells,
METHODS: MDA-MB-231 cells were transfected with MCT1-CMV7S plasmid or a control CMV7S plasmid. The CMV7S plasmid contains the G148 resistant (neo) gene, which allowed us to generate stable cancer cell lines expressing either a high level of MCT1 or empty vector. Cells were fixed and stained with antibodies to the lactate transporter (MCT1), the mitochondrial marker (Cytochrome, Cyt C), and the proliferation marker (Ki-67), and then visualized using confocal microscopy.
RESULTS: Transfected MDA-MB-231 cells expressed MCT1 protein in the plasma membrane and also in concentrated vesicles throughout the cells.
CONCLUSION: By various combinations of knocking in MCT1, and/or deleting MCT4 we hope to be able to affect the proliferation rate of MDA-MB-231 cancer cells. This work is supported by a gift from CytoSport, Inc. RH is supported by the National Science Foundation Graduate Research Fellowship (NSFGRF).

2364 Board #39 MAY 31 2:00 PM - 3:30 PM
The Influence Of Nutritional Interventions On The Measurement Of Gross Efficiency During Cycling
Matthew Cole, Damian A. Coleman, Jonathan D. Wiles. Canterbury Chirst Church University, Canterbury, United Kingdom.
(No relationships reported)
Many research studies report and monitor cycling efficiency over a sustained period of time. None of these studies report that the nutritional intake was controlled or recorded across the period of assessment.
PURPOSE: To determine whether manipulation of nutritional intake before, during and after cycling exercise could influence subsequent gross efficiency measurement.
METHODS: Thirty six cyclists were split into three groups and undertook one of three studies. All studies involved repeated 2-hour cycling tests at submaximal exercise intensity (60% of Power at VO2max) in a randomised, crossover design. During study A, carbohydrate (CHO) intake was manipulated in the 3-days preceding cycling trials. Participants consumed isocaloric diets (~4000kcal) that contained a high (70%), moderate (45%) or low (20%) proportion of CHO, with the remaining proportions derived from fat and protein (10%) intake. For study B, cyclists consumed a standard 3-day pre-exercise diet and conducted four exercise tests where they consumed either water (600ml.h-1), CHO (36g.h-1), caffeine (5mg.kg-1) or both CHO and caffeine in combination during the test. During study C, cyclists undertook four exercise trials. Following a standard 3-day pre-exercise diet, participants completed the first two tests on consecutive days and consumed either a high or a low CHO diet (identical to study A) in the 24-h period between tests. A week later, this was repeated with the alternate diet ingested in the recovery period between trials. During all tests, expired air was measured at 30 min intervals in order to calculate gross efficiency (GE).

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Pulmonary hypertension (PH) is known to restrict functional capacity, exercise tolerance, and the ability to carry out routine physical activities. However, PH has been understudied and the severity of associated physical limitations is not fully understood.

PURPOSE: To elucidate the effects of eccentric endurance training on muscle structure, composition and function in COPD patients.

METHODS: 3 of 10 male (65±1.2 yrs) severe COPD patients (PEF1=37.7±2 %predicted) completed 10 weeks of eccentric cycle training. Pre and post testing included assessment of quadriceps muscle: 1) structure determined through a needle biopsy to quantify fiber cross sectional area and type using immunofluorescent labeling of myosin-heavy chain Type 1 and 2 isoforms; 2) composition using DEXA reflected as lean and fat tissue mass; 3) function determined by peak strength and endurance using the isokinetic Biodex dynamometer. The muscle biopsy analyses were performed with the investigator blinded to training status (pre vs. post).

RESULTS: Cross-sectional area increased in Type 1 fibers by 76% (4570±1733 to 9048±3241 µm²; p=0.06), with little (7.6%) change in Type 2 fibers (5916±594 to 6221±979 µm²) after training. The proportion of Type 1 fibers increased by 7% (28.6±6.6 to 36.1±2.1%) and Type 2 fibers decreased proportionally (71.4±6.6 to 63.9±21.5%). Thigh lean tissue mass increased (6.4±0.88 to 6.54±0.89 kg, p<0.05) and fat mass decreased (2.82±0.65 vs. 2.68±0.59, p<0.05) after training. Muscle endurance power increased by 35% in two patients and there were no changes in peak isokinetic torque.

CONCLUSIONS: This randomized clinical exercise training examining eccentric cycling as a novel training modality for COPD is ongoing. Preliminary findings suggest eccentric cycling induces marked fiber hypertrophy and fiber shift specific to Type 1 fibers in COPD muscle. These cellular changes are associated with improved lean and fat tissue mass of the thigh and improved muscle endurance. Eccentric cycling appears effective in inducing structural and functional adaptations within COPD muscle.

Preliminary pulmonary hypertension (PH) is known to restrict functional capacity, exercise tolerance, and the ability to carry out routine physical activities. However, PH has been understood and the severity of associated physical limitations is not fully understood.

PURPOSE: To examine cardiopulmonary capacity and exercise tolerance in patients with PH.

METHODS: Twenty-three patients with PH (Age: 52 ± 11 yrs; BMI: 31 ± 7 kg/m²; mean ± SD) and nine sedentary healthy controls (CON; 48 ± 9 yrs; 30 ± 9 kg/m²) completed symptom-limited treadmill cardiopulmonary exercise tests (CPET) and 6-minute walk tests (6MWT). As part of the NIH Exercise Therapy for Advanced Lung Disease Trial, functional aerobic impairment (FAI) was calculated as a percent deviation in peak VO₂ from an algorithmically predicted peak VO₂ based on age and gender for persons with a sedentary lifestyle (Bruce et al., 1973).

RESULTS: Compared to CON, patients with PH had significantly lower peak VO₂ (14.0 ± 4.7 vs. 23.9 ± 6.5 ml/kg/min; P = 0.002), time to peak exercise (630 ± 192 vs. 1144 ± 393 s; P = 0.002), peak work rate (93 ± 48 vs. 228 ± 61 W; P < 0.001) and VO₂ at anaerobic threshold (9.3 ± 5.0 vs. 13.2 ± 3.7 ml/kg/min; P = 0.015). 6MWT distance was also shorter (P = 0.006) in PH (409 ± 81 m) than in CON (553 ± 130 m). Moderate FAI was observed in patients with PH (41 ± 22 %), while as expected, FAI was not observed in CON.

CONCLUSIONS: Overall exercise tolerance was substantially diminished in patients with PH compared to sedentary controls. Observation of FAI in this group reflects the effect of pathomechanisms on cardiopulmonary function. Instrumental activities of daily living (IADL) fall within a range of VO₂ demands between 10.5 and 17.5 ml/kg/min. In patients with PH, cardiopulmonary reserve is reduced to levels impairing performance and insufficient for sustaining even low intensity IADL. As such, these patients may greatly benefit from a medically supervised exercise rehabilitation program.

Supported by NIH Clinical Center 1 Z01 CL060068-02 CC.
Women on body fat and weight status may be part of an effective weight management and obesity prevention strategy.

Women who self-classified their body weight as "Normal" (n=84), 75 (89%) were in fact normal BMI, while 6 (7%) women were overweight and 1 (1%) was considered obese by BMI. As "Normal", results of the DXA scan showed 61(73%) were in fact normal fat, while 16 (19%) women were over-fat and 6 (7%) were obese. When examining BMI results of those same participants, statistical analysis of perceived weight status and measured percent body fat (%BF) (No relationships reported).

Intersitial lung disease (ILD) is a debilitating condition that limits functional capacity and cardiopulmonary reserve. Patients with ILD often experience severe exercise intolerance which can limit participation in daily activities. Little is known about the effects of aerobic exercise on cardiopulmonary function and exercise capacity in populations with ILD.

PURPOSE: To examine the effects of a 10-week aerobic exercise program on measures of functional capacity and cardiopulmonary reserve in patients with ILD.

METHODS: Six patients with ILD (3 males, 3 females; Age: 61 ± 7 yrs; BMI: 30 ± 5 kg/m2; mean ± SD) completed treadmill cardiopulmonary exercise tests (CPET) and 6-minute walk tests (6MWT) before and after a 10-week aerobic exercise training program (AET). The AET was comprised of treadmill walking at an intensity of 70-80% of heart rate reserve determined from the initial CPET, for 30-45 minutes, 3 times per week on non-consecutive days.

RESULTS: The AET resulted in significant increases in peak VO2 (from 17.93 ± 6.29 to 19.93 ± 5.31 ml/kg/min; p = 0.029), anaerobic threshold (from 10.2 ± 2.0 to 13.4 ± 2.4 ml/kg/min; p = 0.002), 6MWT (from 456 ± 67 to 494 ± 48 m; p = 0.022), and CPET duration (from 711 ± 93 to 837 ± 110 s; p = 0.002).

CONCLUSIONS: These are results from the NIH Exercise Therapy for Advanced Lung Disease Trial. Following an intensive 10-week aerobic exercise training regimen, significant improvements in cardiopulmonary reserve and exercise tolerance were observed. These results suggest that patients with ILD may respond well to an intensive aerobic exercise training program and could possibly benefit from participation in an exercise-based pulmonary rehabilitation program. Supported by NIH Clinical Center 1Z01 CL006068-02 CC.

D-18 Free Communication/Poster - College/Young Adult

May 31, 2012 1:00 PM - 6:00 PM
Room: Exhibit Hall

2368 Board #43 MAY 31 2:00 PM - 3:30 PM
Effects of a 10-week Aerobic Exercise Program on Cardiorespiratory Function in Patients with Intersitial Lung Disease
Joshua G. Woolstehulme1, Randall E. Keyser, FACSM2, Bart E. Drinkard1, Lisa Chin1, Michelle Kennedy3, Steven D. Nathan4, Gerilyn Connors1, Leighton Chan5.
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(No relationships reported)

Intersitial lung disease (ILD) is a debilitating condition that limits functional capacity and cardiopulmonary reserve. Patients with ILD often experience severe exercise intolerance which can limit participation in daily activities. Little is known about the effects of aerobic exercise on cardiopulmonary function and exercise capacity in populations with ILD.

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RESULTS: The AET resulted in significant increases in peak VO2 (from 17.93 ± 6.29 to 19.93 ± 5.31 ml/kg/min; p = 0.029), anaerobic threshold (from 10.2 ± 2.0 to 13.4 ± 2.4 ml/kg/min; p = 0.002), 6MWT (from 456 ± 67 to 494 ± 48 m; p = 0.022), and CPET duration (from 711 ± 93 to 837 ± 110 s; p = 0.002).

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D-18 Free Communication/Poster - College/Young Adult

May 31, 2012 1:00 PM - 6:00 PM
Room: Exhibit Hall

2369 Board #44 MAY 31 3:30 PM - 5:00 PM
Many College Women Are Not Aware That They Are Over-fat Or Obese
(No relationships reported)

Because awareness of one’s own body weight is a key motivator in weight reduction efforts, lack of knowledge of being over-fat or obese poses a challenge for interventions aimed at reducing obesity rates. Previous studies have examined women’s ability to self-classify their weight status in comparison with their actual body mass index (BMI). However, little is known about the alignment of perceived weight status and measured percent body fat (%BF).

PURPOSE: The purpose of this study was to examine the alignment among perceived weight status, weight status based on BMI, and measured fat status.

METHODS: A total of 120 college-aged women (19.5 ± 1.2 yrs; 23.4 ± 3.4 kg/m2, 31.9 ± 6.8 %BF) completed this cross-sectional investigation. Participants self-classified their body weight status on a scale from 1 (very underweight) to 5 (very overweight). BMI was calculated from measured height and weight, and %BF was assessed using dual-energy x-ray absorptiometry (DXA): 21.32% was considered normal fat, 33.39% was considered over-fat, and >39% was obese. Kappa statistics were conducted to examine the alignment among these variables.

RESULTS: The alignment between self-classified weight status and measured fat status was poor (kappa = 0.343), while the alignment between perceived weight status and weight status based on BMI was slightly better (kappa = 0.515). The agreement between women’s %BF and BMI classifications was poor (kappa = 0.299). Of the 84 women who self-classified their weight as “Normal”, results of the DXA scan showed 61(73%) were in fact normal fat, while 16 (19%) women were over-fat and 6 (7%) were obese. When examining BMI results of those same women who self-classified their body weight as “Normal” (n=84), 75 (89%) were in fact normal BMI, while 6 (7%) women were overweight and 1 (1%) was considered obese by BMI.

CONCLUSION: Results from this analysis provide evidence that many college women are not aware that they are over-fat or obese. Previous studies demonstrate that women struggle to accurately estimate weight status, and results from this investigation demonstrate that this accuracy may be worse when comparing estimations to measured fat status. Efforts to educate college women on body fat and weight status may be part of an effective weight management and obesity prevention strategy.

2370 Board #45 MAY 31 3:30 PM - 5:00 PM
Effects Of Six-month Trunk Stability Exercises On Low Back Pain Prevalence In Young Athletes
(No relationships reported)

The six-month prevalence of low back pain in young athletes is reported to be about 20%. In prevention and rehabilitation exercise is supposed to be evident. However, it is not clear if a regular 15-minute-exercise is efficient in highly trained athletes.

PURPOSE: To examine the effects of trunk stability exercises on low back pain prevalence in young athletes.

METHODS: 140 athletes from four elite schools of sport (85 male/ 55 female; 13±0.5 yrs; 50±9 kg; 14±5 h training per week; 13±4 competitions last season) were included in a six-month controlled intervention trial. Subjects were assigned to an intervention (IG; n=43) and control (CG; n=97) group. The intervention included a progressive trunk exercise program (minimum of thrice a week in the warm-up-phase of normal training). The program was structured into three levels and consisted of four exercises (side-stabilization, pelvis lift, side-jumps, two-legged jump). At baseline and after six month subjective low back pain was assessed (LBP; six-month-prevalence; numeric rating scale). Furthermore, jumping performance (counter movement jump (CMJ): force plate; maximum peak force [Nm], peak jump). At baseline and after six month subjective low back pain was assessed (LBP; six-month-prevalence; numeric rating scale). Furthermore, jumping performance (counter movement jump (CMJ): force plate; maximum peak force [Nm], peak jump height [m], JH) was analyzed to control if athletic capability was effected due to intervention. Descriptive analysis was followed by two-way ANOVA (dependent samples) to calculate effects of interaction (p<0.05).

RESULTS: Athletic capability, controlled by jumping performance, increased in both groups (pre-PFmax/post-PFmax: IG: 1132±237 Nm/1193±220 Nm, CG:1079±240 Nm/1155±238 Nm; HJ/absmax: IG: 0.24±0.04 m/0.26±0.04 m, CG: 0.24±0.04 m/0.26±0.04 m). Coaches gave a gapless training documentation for 86% of athletes (IG); IG implemented the program 2.1±0.5 times during the six-month period. Reduction of LBP and improvement of jumping performance could not be assigned to the effect of the trunk stability program applied. Efficacy of the additional trunk stability exercises as conducted have therefore to be considered critically, mainly due to low compliance of IG. Further studies need to focus on improvement of compliance.
Conclusions: The obesity crisis is striking at younger ages with alarming rates in Latino youth. Over 50% of students in grades 1-8 in our charter school are overweight/obese (> 85 percentile). An intervention: Youth Empowered to Succeed (YES) targets 50 middle school students and provides daily fitness & college peer mentoring. Despite almost daily exercise for 1 year, several Latino children. The meals (27 lunches) were served to small groups in a separate dining hall during which nutritional information was provided including lessons on calorie balance, general nutrition, and tips on healthy eating. No changes to family meals or other programing occurred. RESULTS: Significant weight loss over 1 month (paired t-test pc 0.05). On average BW decreased by 3 pounds with a maximum loss of 7. Previously all 10 students had gained BW each quarter and this was the first time any of them lost weight. All students reported more energy, better concentration and attitude post intervention. CONCLUSION: Substitution of a healthy lunch successfully changed a habitual pattern of weight gain in Latino youth engaged in a prescribed fitness program. 9 of 10 lost a significant amount of weight and self-reported feeling better about themselves and their bodies. This study supports the important and long-term implications of providing a healthy lunch in terms of stemming the obesity epidemic in Latino middle school students. Supported by DHHS/OMH grant 1 YEPMP096044-02

Methods: Twenty college students with a mean age of 20 years included 12 males and 8 females who participated in a 14 week APE/CPE course at a University in New England. Body mass index (BMI), body composition, hand grip dynamometry, vertical jump and health behaviors were examined pre and post. Physical fitness and activity associated behaviors were assessed via the International Physical Activity Questionnaire (IPAQ) and included frequency of days and time spent in the last seven days participating in vigorous and moderate physical activity, walking, and sitting. RESULTS: Physical activity behavior associated variables; specifically the number of days and the duration of time spent performing vigorous physical activity increased significantly (from 3.5 to 4.4 days per week, p = .005 and from .7 to 1.4 hours per session, p = .02) with no other behavioral or physical variables achieving statistically significant changes during this time period. CONCLUSION: Higher education health and fitness courses for young adults have the potential to impact physical and behavioral health and fitness variables and may provide effective strategies for the reduction of overweight and obesity in young adults. These findings suggest that longitudinal studies and studies comparing APE/CPE courses to other health promotion programs are indicated.

Methods: Participants were recruited from a mid-Western University via face-to-face contact, email, and fliers. FIT was assessed with three measures: PACER multi stage 20-meter shuttle run (PACER), modified pull-up (MPU), and one-minute sit-up (SU). Anthropometric assessment included height, WT, and average of 3 WC measurements. Body fat (BF) was assessed using bioelectrical impedance. Self-reported PA was assessed with the International Physical Activity Questionnaire (IPAQ) to determine minutes of walking and PA per week. Descriptive statistics, independent t-test (by sex), ANOVA (by class), and Pearson’s Correlation were utilized to determine differences and relationships for PA, FIT, and WC. RESULTS: The sample included 149 male (mean age 20.2, SD 1.5) and 203 females (mean age 19.9, SD 1.4), with 46.8 % residing in dorms/residence halls. There was a significant difference between weight (WT) and WC by class (p<0.001). However, when examined by sex, only men had a significant difference by class for WT, BF, and WC (p<0.005). A non-significant but decreasing trend in moderate, vigorous, and walking (TPA) by class was found. Furthermore, there was a non-significant but decreasing trend for men’s walking and TPA by class, whereas vigorous and moderate PA appeared to remain more constant. WC was correlated with moderate PA for freshman only (p<0.005). For men, WC was significantly correlated with PACER
The transition to college often invokes changes in physical activity (PA) behaviors that may alter weight status in young adults. Contemporary studies indicate that in addition to moderate to vigorous physical activity (MVPA), sedentary (SED) time may also have implications for health.

**METHODS:** Female freshmen (n=162; 18.0±0.3 y) were assessed for height and weight to determine body mass index (BMI) and waist circumference (WC). Physical activity was assessed via accelerometer in minutes of SED, light (LPA), moderate (MMPA), vigorous (VPA), and moderate + vigorous (MVPA) at the beginning and end of the academic year.

**RESULTS:** At baseline, females had normal weight status (62.7 ± 8.7 kg, BMI 22.9 ± 3.1 kg/m², WC 82.6 ± 8.7 cm). Over the academic year weight, WC, and SED increased (1.6 ± 2.6 kg, 0.8 ± 4.2 cm, 29.9 ± 103.9 min); while LPA and MVPA decreased (26.9 ± 71.0 min, 9.1 ± 34.1 min, respectively, all p <0.05). Subjects were further classified as Gainers (>3% weight gain), Maintainers (<3% weight change), and Losers (weight loss >3%). No changes in SED, LPA, or MVPA were observed among Losers, although few freshman lost weight (n = 13). In Maintainers (n = 77), LPA and MVPA decreased (28.7 ± 62.6 min and 7.9 ± 33.8 min respectively). However, Gainers (n = 72) experienced a reduction in LPA and MVPA (29.2 ± 78.4 min and 11.0 ± 33.9 min respectively), while SED increased (47.7 ± 111.5 min) (all p <0.05).

**CONCLUSION:** Unfavorable changes in weight status among female freshman may be related to decreased physical activity and increased sedentary time during their first year on a college campus. On-going analysis is exploring the implications for changes in weight due to changes in PA, dietary intake, stress, sleep and medications (i.e. oral contraceptives).

*Grant Support: USDA 2008-55215-11825*

**2375 Board #50 MAY 31 3:30 PM - 5:00 PM**

**Still Active In College ? The Contribution Of College Physical Education On Exercise And Physical Active Behaviors.**

Jean Lemoyne1, Pierre Valois1, Université du Québec à Trois-Rivières, Trois-Rivières, Québec, Canada. 2Université Laval, Quebec city, Quebec, Canada. (Sponsor: François Trudeau, FACSM)

*No relationships reported*

Most epidemiological studies demonstrated an important decline in physical activity between teenage years and the young adulthood. However, few longitudinal data is available regarding the influences of physical education during transition through high school and college.

**METHODS:** Data was drawn from an initial sample of 417 college students (275 females, 142 males) participating in mandatory physical education classes. Mean age of the participants was 17.8 ± 2.4 years. A longitudinal design was conducted over a 2-year period, involving 6 waves of assessment, measuring self-reported physical activity. Latent growth analysis was conducted, first to analyze the rate of change for physical activity and then to observe the potential influences of physical education on the maintenance of physical activity. RESULTS: Results revealed excellent fit indices for each models (CFI > 0.97, RMSEA < 0.03). During the college years, there is a slight but significant increase in physical activity, suggesting a direct influence of physical education (p < 0.05). The best fit for the rate of change trajectory was following a cubic function, suggesting substantial influences of the physical education program on active behaviors. Further analysis revealed a significant decrease (p < 0.05) of physical activity between each trimester, suggesting little influence of the program. The most important influences of physical education were observed among the less active groups.

**CONCLUSIONS:** Physical education permits and encourages the maintenance of a minimal level of physical activity. Over a 2 year physical education program, less predisposed groups at the initial level seemed to be more influenced towards the adoption of physical activity. However, influences of physical education seemed to disappear between each trimesters, suggesting a minimal influence from the program. Further research is needed to better understand the influences of the physical education program. Funded by the Ministère de l’Éducation du Loisir et du Sport, Quebec.

**2376 Board #51 MAY 31 3:30 PM - 5:00 PM**

**Faster Rate of Weight-loss Associated with Female Athlete Triad Components in Youth**

Sheng-An Lo1, Chieh-Ling Wang2, Shu-Chich Chen1, Kuei-Hui Chan1, National Taiwan Sport University, Taoyuan, Taiwan. 2Shih Hsin University, Taipei, Taiwan. (Sponsor: François Trudeau, FACSM)

*No relationships reported*

The female triad (triad) is an interrelated condition of low energy availability, amenorrhea, and osteoporosis. A large body of evidence suggests that the populations who suffer from the triad components are mainly athletic and physically active women. Inappropriate weight-loss behaviors are one of the main factors causing the triad. However, weight-loss attempts are common in young women. They may be susceptible to the triad components regardless of physical activity levels.

**PURPOSE:** To determine the prevalence of the triad in athletes and non-athletes with weight-loss attempts.

**METHODS:** One hundred thirty-four female competitive athletes (20.1±1.5 yrs) and 144 healthy female non-athletes (20.1±1.1 yrs) were recruited from 2 colleges. Each subject completed screening questionnaires assessing eating disorders (EDs), menstrual status, weight-loss experience, and physical activity levels. The EDs were assessed by 26-item eating attitudes test (EAT-26). The physical activity levels were assessed by the short version of International Physical Activity Questionnaire. The body fat percentage (%BF) and bone strength (bone mineral density) were also measured by eight-polar tactile-electrode impedance meter and ultrasound meter, respectively. Two groups.

**RESULTS:** The %BF of non-athletes were significantly higher than athletes (28.3±5.6% vs. 25.3±5.8%, p<0.05). Subjects with EDs, menstrual dysfunction (MD), or both reported they lost 1.9±0.5, 1.6±0.7, or 1.7±0.8 kg per wk during the past year. Therefore, the definition of faster rate was weight-loss >1.5 kg/wk in this study. Between subjects with faster and slower rate of weight-loss, significant differences were found in the rate of weight-loss (2.1±0.7 vs. 0.9±0.6 kg/wk, p<0.05), EAT-26 score (18.8±6.2 vs. 12.2±9.3, p<0.05), and the prevalence of MD (52 vs. 0%, p<0.05). No significant differences were found in Z-scores [bone mineral density (0.7±0.8 vs. 1.0±0.4, p>0.05)] and stiffness index [bone quality (108.2±14.4 vs. 111.5±15.3, p>0.05)] between 2 groups.

**CONCLUSIONS:** Our study suggests weight-loss >1.5 kg/wk is associated with the developments of EDs and MD in youth.
PURPOSE: To determine if young adults know their risk for CHD, specifically values for fasting blood glucose (gluc) and cholesterol (chole), and examination of prevalence of CHD risk factors among young adults attending a medium-sized university in the Southeast U.S. was carried out.

METHODS: 60 female college students (21.7 ± 2.4 years) and 40 male students (21.4 ± 1.7) completed a survey to assess health habits and CHD risk factors prior to completing a fitness testing battery. The exam included measured blood pressure, maximal aerobic fitness, strength measures, body composition, flexibility and balance.

RESULTS: None of the women or men reported knowing their fasting chole or gluc concentrations. The proportion of the other risk factors included the following: 1.7% of women and 0% of men reported a family history of heart disease; 3.4% of women and 15% of men reported being inactive; 3.4% of women and 10% of men were regular smokers; 60% of women and 55% of men had a body mass index (BMI) 25 but less than 30; with 3.4% of women and 15% of men having a BMI ≥ 30; there were no reports of hypertension among the women or men; 17.5% of women had one CHD risk factor and 37.5% of men had at least one risk factor for CHD.

CONCLUSIONS: Risk factor levels are low in this group of exercise science students (for whom the survey and fitness tests were compulsory) and students who chose to undergo a fitness battery. Neither healthy individuals with no risk factors nor individuals with one or more risk factors knew their fasting chole and gluc levels. Therefore, they did not know their personal risk for CHD.

D-19 Free Communication/Poster - Creatine
MAY 31, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2379 Board #54 MAY 31 2:00 PM - 3:30 PM Oxidative Stress In The Serum Of Exercised Rats Supplemented With Creatine
Michel B. Araújo1, Leandro P. Moura1, Marcelo C. Junior1, Rodrigo A. Dalila2, Fabricio A. Voltarelli2, Amanda C. Spontoni1, Maria Alice R. Mello1. 1São Paulo State University, Rio Claro, Brazil. 2Mato Grosso Federal University, Rio Claro, Brazil. (No relationships reported)

PURPOSE: There is evidence that creatine may exert antioxidant activities. This study analyzes the effects of aerobic training and creatine supplementation on biomarkers of oxidative stress in the serum of rats.

METHODS: Adult male wistar (90 day old) rats were submitted to a Maximal Lactate Steady State (MLSS) test in order to identify the aerobic/anaerobic metabolic transition during treadmill running. Soon afterwards, the rats were divided into 6 groups: Trained Creatine (TCr), Trained (T), Trained Maltodextrin (TM), Control Creatine (CCr), Control Maltodextrin (CM) and Control (C). Trained rats ran on a treadmill for 40 minutes per day, 5 days per week for 8 weeks, at a speed equivalent to per individual MLSS. Creatine supplemented rats received creatine monohydrate per 5 days per week (0.107g/kg body weight (b.w)) and maltodextrin (0.160g/kg b.w) by gavage. At the end of the experiment, all the rats were sacrificed and the amount of the substances that reacted with thiobarbituric acid (TBArs) and catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GSH-GPx) activities in the serum were analyzed.

RESULTS: The amount of TBArs did not differ among the groups. There also were no significant differences between the groups in relationship to CAT and SOD activities. On the other hand, GSH-GPx activity was lower in the TM group (2.24 ± 1.75) group than other groups (TCr 3.87 ± 1.47; T 2.85 ± 1.63; CCr 5.60 ± 1.73; CM 4.28 ± 2.32 and C 2.85 ± 1.06).

CONCLUSION: These results suggest that neither exercise or supplementation did not affect the redox state of the animals.

2380 Board #55 MAY 31 2:00 PM - 3:30 PM Thermoregulatory And Cardiovascular Responses To Creatine, Glycerol And Alpha Lipoic Acid In Trained Cyclists
Thelma P. Polyviou, Takas Pantazis, Wu Chean Lee, Dalia Malkova, Yannis P. Pitsiladis, FACSM. University of Glasgow, Glasgow, United Kingdom. (No relationships reported)

It has been shown that supplementation with creatine (Cr) and glycerol (Gly), when combined with glucose (Gluc) necessary for the enhancement of Cr uptake by the muscle, induces significant improvements in thermoregulatory and cardiovascular responses during exercise in the heat.

PURPOSE: To determine whether Cr/Gly-induced thermoregulatory and cardiovascular responses are maintained or even enhanced when the majority (~75%) of the Glu in the Cr/Gly supplement is replaced with the insulotropic agent alpha lipoic acid (Ala).

METHODS: 22 healthy endurance trained cyclists were randomly assigned to receive either 11.4 g of Cr-H2O, 1 g of Gly/kg body mass (BM) and 150 g of Gluc (Cr/Gly/Glu) or 11.4 g of Cr-H2O, 1 g of Gly/kg BM, 100 g of Gluc and 100 mg Al (Cr/Gly/Glu/Ala) for 7 days. Exercise trials were conducted pre- and post-supplementation and involved 40 min of constant-load cycling exercise at 70% VO2 max followed by a self-paced 16.1 km time trial at 30°C and 70% relative humidity.

RESULTS: BM increase, although not statistically significant (p=0.056), was noted in most individuals: 1.75% (1.3-3.0) kg and 0.9% (0.0-2.1) kg (median (range) in the Cr/Gly/Glu and in the Cr/Gly/Glu/Ala, respectively. Heart rate (HR) and core temperature (Tcore) were significantly lower post-supplementation: HR was reduced on average by 3.0 ± 1.2 beats/min and by 1.8 ± 1.4 beats/min (mean ± SD) in the Cr/Gly/Glu and Cr/Gly/Glu/Ala trials, respectively while Tcore was reduced by 0.2 ± 0.1 on both trials; the reduction in HR and Tcore was not different among the two supplementation groups.

CONCLUSION: Cr/Gly-induced improvements in thermoregulatory and cardiovascular responses during exercise in heat were not affected with part replacement of Gluc with Ala.

2381 Board #56 MAY 31 2:00 PM - 3:30 PM The Effects of Creatine Supplementation and Plyometric Training on Vertical Jump and Sprint Performance
Solomon H. Young, David L. Gee, Kelly L. Pritchett, Robert C. Pritchett. Central Washington University, Ellensburg, WA. (No relationships reported)

Creatine (Cr) supplementation is associated with improving measurements of maximal strength. However, since Cr supplementation is also associated with weight gain, this may impair weight impacted exercises like jumping and sprinting.

PURPOSE: The purpose of this study was to determine the effects of Cr supplementation on vertical jump and sprint performance during 4 weeks of plyometric training.

METHODS: Using a randomized, double-blind design, subjects were assigned to receive either Cr or placebo (Pl) for 4-weeks. A total of 13 subjects completed the study (6 = Pl, 7 = Cr). Data was collected at baseline (T0), post-loading (T1), and post-maintenance (T2). Measures included body weight, height, biochemical impedance analysis (BIA), single and multiple vertical jump performance, (x 10m) shuttle sprint time, and anaerobic power using a 30-s Wingate trial. BIA was used to determine total body water (TBW). Subjects were instructed to maintain a normal diet and to follow a training program designed for this study. Data was analyzed using repeated measures two-way ANOVA for differences (time x treatment) and t-tests to assess the absolute change in values for all measures.

RESULTS: The interaction over time between treatment groups revealed significantly greater increases in body weight, body mass index (BMI), and average Wingate power (p < 0.05) for the Cr group. Using the absolute change in values, t-tests revealed significant increases in body weight (mean gain = 1.0 kg, p = 0.003) and TBW (mean gain = 0.4 kg, p = 0.03) in the Cr group compared to Pl after T1. No significant changes in single jump height or shuttle sprint time were seen were seen with either Cr or Pl groups. Average Wingate power tended to increase from T0 to T2 in the Cr group (mean % change = +5.9%) with no change in the Pl group (p = 0.06). Average repeated vertical jump height from T0 to T2 tended to decline in the Pl group (mean change = -7.5%) compared to Cr (mean change = -0.2%, p = 0.07).

604
CONCLUSION: Although weight increased with Cr supplementation, it did not impede sprint and jump performance. Cr supplementation did tend to increase power as measured using the non-weight impacted Wingate test. Cr supplementation can be recommended to athletes wishing to increase power and weight without negatively affecting sprint and vertical jump performance.

2382 Board #57 MAY 31 2:00 PM - 3:30 PM
MAGNIFICENT CREATION CREATINE AND WHEY PROTEIN SUPPLEMENTATION EFFECTS COMBINED WITH PERIODIZED TRAINING ON BODY WATER
Lorrie R. Brilla, FACSM, David N. Suprak, Rory Callahan. Western Washington University, Bellingham, WA. (L.R. Brilla: Contracted Research - Including Principle Investigator: Albion Laboratories.)

Creatine is often “stacked” with protein supplementation to enhance performance. Magnesium augments creatine absorption. The efficacy of these supplements in combination with a superimposed training program has not been well established.

PURPOSE: To compare the effects of supplementation with magnesium-creatine creatine (C), Creatine with whey protein stack (W), and a placebo (P), combined with periodized resistance training (RT), on total and compartmentalized body water.

METHODS: Healthy, recreationally active subjects (n=23) completed the study. Subjects were randomly assigned, in a double-blind format, to C (400 mg magnesium with 5 g creatine per day), W (35 g of whey protein, in addition to C supplement), and P (dextran). The 8-week RT progressively increased strength and power in a linearly periodized fashion. Testing was conducted pre and post RT and supplementation program. Strength testing was 1-repetition maximum (1RM) bench press (BP) and back squat (BS). Total body water (TBW) and both intracellular (ICF) and extracellular (ECF) fluid compartments were determined with bioimpedance. The effects of time and group were assessed with a two-way repeated measures ANOVA.

RESULTS: There were no group by time interactions or group effects for any of the performance variables (P > 0.05 for each). Significant increases in strength were observed for both 1RM BP and BS (P < 0.01 for each) over time for all groups (BP Akg: P = 4.83, C 6.82, W 5.81; BS Akg: P = 12.78, C 7.42, W 13.13). There were no significant changes in TBW (P > 0.05). ICF had a significant time by group interaction (P < 0.05), and subsequent simple effects analysis showed C (+1.5%) and W (+1.26%) increased and P (-0.34%) decreased. ECF had a significant time by group interaction (P < 0.05), and subsequent simple effects analysis reflected the shifts from the ICF.

CONCLUSIONS: In healthy, recreationally active individuals, participation in periodized RT has a greater effect on improving strength than superimposed supplementation with either C or W. No significant changes in TBW were noted. However, ICF and ECF were significantly affected by supplementation showing a shift to increased ICF, with magnesium-creatine creatine increasing to a greater extent than the whey stack group.

2383 Board #58 MAY 31 2:00 PM - 3:30 PM
NO ADVERSE EFFECTS ASSOCIATED WITH LOW-DOSE LONGER-DURATION CREATINE SUPPLEMENTATION IN OLDER ADULTS
Eric S. Rawson, FACSM, Andrew C. Venezia, Christopher D. Still, Bloomsburg University, Bloomsburg, PA. (No relationships reported)

The effects of low-dose, longer-term creatine supplementation on kidney function and reported adverse events in older men and women have not been described.

PURPOSE: The purpose of this study was to assess the effects of low-dose, longer-duration creatine supplementation on makers of health in older adults.

METHODS: Thirty-five older men and women (mean age 71 yr) ingested 2.3 g of creatine (n=18) or placebo (n=17) per day for six weeks. A renal function test consisting of blood levels of Potassium, Chloride, CO2, Anion Gap, Glucose, Blood Urea Nitrogen, Creatinine, Calcium, Phosphorous, and Albumin were assessed pre- and post-supplementation. Reported frequency of adverse events related to muscle, gastrointestinal, and kidney function was collected at baseline, and at 3 and 6 weeks post-supplementation. Renal function between groups was assessed with an ANOVA, and frequency of adverse events was assessed with a Chi square analysis.

RESULTS: Creatine supplementation had no effect on any measured marker of renal function from pre- to post-supplementation (mean change score creatinine vs. placebo) Sodium (-0.2 vs. -0.3 mmol/L), Potassium (0.1 vs. -0.1 mmol/L), Chloride (-0.7 vs. 0.1 mmol/L), Anion Gap (-1.0 vs. -0.6 mEq/L), Glucose (-6.1 vs. 7.1 mg/dL), Blood Urea Nitrogen (-0.2 vs. 1.0 mg/dL), Creatinine (-0.1 vs. 0.01 mg/dL), Calcium (0.1 vs. -0.05 mg/dL), Phosphorous (0.2 vs. 0.02 mg/dL), and Albumin (0.02 vs. 0.00 g/dL) (all p>0.05). Additionally, there were no differences in the frequency of reported adverse events between creatine and placebo supplemented groups pre-supplementation, or at 3 or 6 weeks post-supplementation (all p>0.05).

CONCLUSIONS: Low dose, longer-duration creatine supplementation is not associated with increased risk of adverse events in older adults. It may be unnecessary for older adults who have normal kidney function to have a renal panel prior to low-dose creatine supplementation. Also, these data support the findings of previous studies that showed no adverse effects associated with creatine supplementation. FUNDING: National Institutes of Health National Center for Complementary and Alternative Medicine (1R15 AT003938-01).

2384 Board #59 MAY 31 2:00 PM - 3:30 PM
COMBINED ERGOGENIC EFFECTS OF CREATINE ADDED TO DIFFERENT TYPES OF CARBOHYDRATES, MALTODEXTRIN AND RIBOSE
Carlos Eduardo Costa, Helena Angélica P. Batatinha, Érico C. Capetero, Mackenzie Presbiterian University, São Paulo, Brazil. (No relationships reported)

Creatine supplementation is a resource that assists in training to increase lean mass and strength by promoting ATP resynthesis and consequently protein synthesis. Ribose is a pentose that is involved in the resynthesis of adenosine nucleotides, providing more ATP and prolonging anaerobic activity. Maltoextrin is a complex carbohydrate that helps spare glucose for muscle and central nervous system delaying the state of fatigue.

PURPOSE: We investigated the effects of creatine supplementation alone and combined with 2 types of carbohydrates (ribose and maltodextrina).

METHODS: We had 20 subjects divided into 4 groups: CrG (Creatine Group), CrMG (Creatine and Maltoextrin Group), CrRG (Creatine and Ribose Group), CrRMG (Creatine, Ribose and Maltoexntine Group), all groups did 1MR test at bench press exercise and 3 sets of maximum repetitions with 3 minutes interval between each set. All groups did one week load of 10g of creatine, 10g of Ribose and 20g of Maltoextrin every day according to each group. 7 days later they repeated the same tests. Data were analyzed using one way ANOVA test, p<0.05 was adopted.

RESULTS: On the 1MR test significant difference was observed between Crg (3.4 ± 2.5) e o CrRMG (11.6 ± 4.9), the CrG e CrMG wasn’t show significant differences compared to the others, suggesting that combined supplementation promotes strength gains. Maximum repetitions test showed no statistical differences. CrRG showed a trend to sustain the number of maximum repetitions throughout the 3 sets.

CONCLUSIONS: We can conclude that the use of 1 type of carbohydrate combined with creatine wasn’t able to improve 1MR test. However when we combined ribose and maltodextrine with creatine significant increases were detected.

2385 Board #60 MAY 31 2:00 PM - 3:30 PM
CREATINE SUPPLEMENTATION INCREASES EFFECTIVENESS OF LOWER-LIMIT LEAN MASS IN OSTEOARTHRITIS: A ROLE FOR MYOSTATIN?
MARINA Y. SOLIS, Manoel Neves Jr, Guilherme Giannelli Artioli, Hamilton Rochel, Hamilton Rochel, Ricardo Fuller, Fabiana Braga Benatti, Ana Lucia De Sá Pinto, Fernanda Rodrigues Lima, Antonio Herbert Lancha Jr, Eloisa Bonfá, Bruno Gualano. School of Medicine - University Of São Paulo, São Paulo, Brazil. (No relationships reported)

Creatine monohydrate (CrM) supplementation has been suggested as a therapeutic intervention in some chronic disabilities, including knee osteoarthritis (OA). However, little is known about the molecular mechanism underlying the beneficial response to CrM. In this respect, a few studies have suggested that chronic CrM supplementation could increase lean mass partially by

605

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modulating myostatin (MSTN) pathway

**PURPOSE:** To assess the effects of CM supplementation combined with resistance training on muscle function, lower-limb lean mass, and MSTN pathway in women with knee OA.

**METHODS:** A 12-week randomized, double-blind, placebo-controlled clinical trial was performed. Twenty-three postmenopausal women with knee OA were submitted to lower-limb resistance training (3 times a week) and randomly assigned to either CM supplementation (20 g/d for 1 week and 5 g/d thereafter) or placebo (PL). Physical function (as assessed by timed-stands test) and lower-limb lean mass (as assessed by DXA) were assessed at baseline (PRE) and after 12 wk (POST). Additionally, muscle samples were taken at PRE and POST and CM pathway was assessed by quantitative real-time (qPCR).

**RESULTS:** Physical function and lower-limb lean mass were significantly improved only in the CrM group (PRE: 15.7 ± 1.4; POST: 18.1 ± 1.8, p = 0.006; PRE: 13.3 ± 2.3; POST: 13.8 ± 2.0, p = 0.04; respectively). qPCR revealed no alteration in MSTN expression and MSTN binding proteins, i.e., SMAD-7, follistatin, follistatin-like 3 (FSTL3), activin receptor IIb (ACTV-Ilb) and growth and differentiation factor-associated serum protein (GASP-1) (p>0.05) as a consequence of CMr combined with exercise.

**CONCLUSION:** CM supplementation improves physical function and lower-limb lean mass in postmenopausal women with knee OA who underwent resistance training. However, CM pathway seems not to be implicated in these beneficial adaptations. Further studies should investigate other molecular mechanisms behind CM-induced lean mass accretion. Supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) - Grant 2010/15450-3.
CONCLUSION: 12 weeks of creatine supplementation associated or not with resistance training was unable to improve cognitive function and depression in mentally healthy elderly women. The longer-term follow-up of this study with a larger sample will confirm the veracity of this conclusion.

D-20  Free Communication/Poster - Energy Balance and Metabolic Responses
MAY 31, 2012  1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2389  Board #64  MAY 31  3:30 PM - 5:00 PM
Differential Responses of Metabolic Syndrome Components to Tumor Necrosis Factor-a Levels over 16-Weeks
Mary P. Miles, FACSM, Colleen P. Miller, Amy C. Hartz, Gregory N. Ruegsegger, Katherine A.M. McNulty, John C. Christopher. Montana State University, Bozeman, MT.

(TNF) is an inflammatory cytokine that interferes with insulin signaling and associates with risk for development of insulin resistance and related metabolic problems. It is important to know whether elevations in TNF are an early indication of accelerated progression of the metabolic syndrome components.

PURPOSE: To determine whether, overweight adults with lower versus higher basal levels of TNF have measurable changes in variables related to metabolic syndrome over a 16-week time period.

METHODS: Adults (n=40) were measured pre- (INITIAL) and post-16 weeks (FINAL) for BMI, waist circumference, blood pressure, and fasting insulin, triglycerides (TG), HDL, TNF, interleukin (IL)-6, C-reactive protein (CRP), and homeostatic model assessment of insulin resistance (HOMA-IR). Participants were ranked by INITIAL TNF concentrations, and the lowest 15 and highest 15 were placed in LOW and HIGH TNF groups. There were 11/4 and 13/2 women/men in the LOW and HIGH groups, respectively.

RESULTS: INITIAL values were similar between groups with the exceptions of a trend (P=0.09) for higher CRP (1.53 ± 0.53 vs 2.29 ± 0.83 mg/l) and a trend (P=0.07) for greater waist circumference (88.5 ± 6.5 vs 93.6 ± 8.1 cm) in the HIGH compared to LOW TNF group. HDL increased (P=0.05) over time with no difference between groups. There was a trend for decreased systolic and diastolic blood pressure (P=0.08 for both), an increase in insulin (P=0.08) and HOMA-IR (P=0.09). Group by time interactions (P=0.05) were measured for IL-6 and TG. Post-hoc analysis identified trends for IL-6 to decrease (P=0.10) and for TG to increase (P=0.06, from 95.7 ± 36.4 to 114.7 ± 48.5 mg/dl) in the HIGH TNF group. Thus, the effect of higher plasma TNF levels in overweight individuals may vary by tissue.

CONCLUSION: These findings provide preliminary evidence that insulin levels and HOMA-IR increase over time in overweight individuals, independent of TNF levels. Fasting insulin and HOMA-IR primarily reflect insulin sensitivity of liver and beta-cell activity. However, an increase in TG, an occurrence linked to insulin resistance in adipose tissue, was more pronounced in the HIGH TNF group. Thus, the effect of higher plasma TNF levels in overweight individuals may vary by tissue.

This study was funded by a grant from the American Heart Association Western States Affiliate.

2390  Board #65  MAY 31  3:30 PM - 5:00 PM
Energy Expenditure During and After Standard Exercise While on a Carbohydrate or Fat Restriction Diet
Rachel M. Perron, Robert J. Brychta, Kong Y. Chen, Carla M.M. Prado, Mario Siervo, Laura Musse, Kevin D. Hall. National Institutes of Diabetes Digestive and Kidney Disease, Bethesda, MD.

PURPOSE: As different dietary interventions may lead to variable energy expenditure and weight loss, we aimed to measure exercise and post-exercise energy expenditure during calorically equal dietary restrictions of carbohydrate versus fat.

METHODS: Eight obese subjects (4 male, 4 female; BMI ≥ 30 kg/m²) were fed a low carbohydrate (LC) or a low fat (LF) diet in a randomized, crossover design. Subjects spent 5 days on a baseline (weight-maintenance) diet and 6 days on either an LC or LF diet (30% caloric reduction) with a 2-10 week washout period between diets. During both baseline and diet conditions, subjects spent 60 minutes daily walking at a consistent, self-selected pace on a treadmill. Oxygen consumption (VO₂), carbon dioxide production (VCO₂), and energy expenditure (EE) were measured in a metabolic chamber.

RESULTS: A comparable negative energy balance was achieved during the LC (-634±213 kcal/day) and LF (-592±148 kcal/day) caloric restricted periods, which induced at the end of each period a weight loss of -1.5±0.3kg (P<0.05) and -1.2±0.3 kg (P<0.05), respectively. Exercise EE and post-exercise EE did not change during the two dietary interventions. However, exercise EE significantly decreased during the LC diet whereas EE values did not change during the LF diet.

CONCLUSION: Exercise and post-exercise respiratory quotient, but not energy expenditure, responded to a significant restriction of dietary carbohydrate, but not dietary fat.

2391  Board #66  MAY 31  3:30 PM - 5:00 PM
Post-exercise Growth Hormone Kinetics Differ Between Assay Methods During Energy Balance
Dennis E. Scofield, David W. DeGroot, FACSM. Matthew R. Ely, J Philip Karl, Andrew J. Young, FACSM, Bradley C. Nindl, FACSM. U.S. Army Research Institute of Environmental Medicine, Natick, MA.

The secretion of growth hormone (GH)–characterized by molecular heterogeneity that includes molecular weight variants and aggregates--is modulated in part by changes in nutritional status and exercise. Treating serum samples with glutathione prior to assay is a method used to break disulfide-linked GH aggregates and potentially increase GH assay signal. The effect of this treatment on GH secretion was compared under conditions of energy balance.

PURPOSE: To determine the effect of glutathione (GSH) treatment on serum GH samples obtained during energy balance (EB), underfeeding (UF) and overfeeding (OF).

METHODS: 10 men (22 ± 2 yrs) were assigned to 3 interventions over 12 days: 4 days each of EB, UF (60% of EB), and OF (150% of EB). Subjects exercised on a cycle ergometer at 50% VO₂peak for 20 min on the 4th day of each intervention period. Blood samples were obtained pre-, post- and 30 min post-exercise. Serum GH concentrations were determined in reduced (+GSH) and non-reduced (-GSH) states using a commercially available IRMA assay. Data were analyzed using RM ANOVA (P ≤ 0.05) with Tukey HSD post-hoc test when appropriate.

RESULTS: During all feeding conditions the mean GH signal was significantly increased in the +GSH samples (EB: +GSH: 2.2 ± 0.07 vs. -GSH: 1.8 ± 0.7 ng/mL, P < 0.01; UF: +GSH: 1.3 ± 0.3 vs. 1.0 ± 0.3 ng/mL, P = 0.04; OF: +GSH: 0.8 ± 0.2 vs. -GSH: 0.6 ± 0.2 ng/mL, P < 0.01). During EB, post-hoc testing indicated a greater GH assay signal in +GSH (3.0 ± 0.8 ng/mL) vs. -GSH (2.4 ± 0.6 ng/mL) at post-exercise (P < 0.01).

CONCLUSION: These data demonstrate that compared to untreated serum samples, the addition of GSH to serum prior to assay allows for the detection of significant alterations in post-exercise GH concentrations due to the detection of disulfide-linked GH aggregates. The mechanism by which nutritional status affects the differential response of GH aggregates to aerobic exercise and their influence on post-exercise homeostasis remains to be determined.
While high intensity intermittent exercise (HIIE) training programs show greater decreases in indirect measures of adiposity (skinfold and dual x-ray absorptiometry) than continuous exercise training programs, there is limited information about potential mechanisms.

PURPOSE: The aim of this study was to elucidate reasons behind this finding and to examine the influence of exercise intensity during HIIE on potential fat loss.

METHODS: Healthy, untrained males completed a VO2max test and 2 HIIE protocols a) 20s cycling at 150% VO2peak, with 40s rest (20:40 HIIE), and b) 10s cycling at 300% VO2peak, with 50s rest (10:50 HIIE); both were followed by a 90-min recovery. Blood and respiratory gases were collected and heart rate and rating of perceived exertion (RPE) monitored. Student T test, 2 way repeated measures ANOVA and Tukey’s post hoc analysis were used to identify significant differences (p<0.05). All procedures were approved by the Victoria University Human Research Ethics Committee.

RESULTS: On completion of the two HIIE no differences were observed in heart rate, oxygen consumption (VO2), carbon dioxide production (VCO2) and RPE. While plasma lactate increased during both HIIE protocols, the decline in the recovery period was significantly higher following the 10:50 HIIE (p<0.05). No group differences were seen in plasma glucose, however at the end of HIIE plasma insulin was significantly elevated from rest 15 min post the HIIE (p<0.05). During HIIE and recovery, plasma glycerol increased significantly more with 20:40 HIIE compared to the 10:50 HIIE bout. Excess post exercise oxygen consumption (EPOC) was significantly greater in the 10:50 HIIE compared to the 20:40 HIIE bout (P<0.05).

CONCLUSIONS: During HIIE, physiological responses to the 2 protocols were not different demonstrating the effectiveness of the workload matched design. Plasma markers of fat metabolism indicate 20:40 HIIE utilises relatively greater fat than 10:50 HIIE (p<0.05), while the greater plasma lactate during HIIE and the recovery period are indicative of an increased glycolysis during the 10:50 bout (p<0.05). The elevated EPOC following both bouts of HIIE provides a potential mechanism for enhanced energy utilisation with bouts of higher workloads.

INTRODUCTION:

The ability to alter postprandial metabolism in favor of increased energy expenditure and fatty acid (FA) oxidation could help attenuate the retention of body fat.

PURPOSE: To compare acute effects of resistance exercise (RE) and endurance exercise (EE) to a resting control (C) for effects upon subsequent postprandial energy substrate partitioning in obese women.

METHODS: Sedentary, obese women (n=10; Body weight = 101.0 ± 8.0 kg; BMI = 37.1 ± 2.3) participated in a crossover designed study. Each subject was studied on 3 occasions: RE, EE, and C. Subjects completed a body composition, 10-repetition maximum (10RM), and aerobic capacity test (VO2peak). A standardized meal of 20 kcal/kg FFM (CHO-48%, Fat-36%, Protein-16%) was administered 30 min after exercise. Pulmonary gas exchange was assessed immediately before the meal and at 40, 80, 160, 240, 320, and 400 min afterwards in order to assess changes in metabolic rate, fat oxidation, and carbohydrate oxidation. RM ANOVAs were used for statistical analysis. Values were calculated as averages over the 400 min assessment period.

RESULTS: In comparison to C, both RE and EE led to an increased rate of fat oxidation (RE, 0.58 ± 0.07 kcal/min; EE, 0.54 ± 0.06 kcal/min; C, 0.41 ± 0.03 kcal/min, P<0.05) with no significant difference between RE and EE. There was no significant difference in carbohydrate oxidation between any conditions (RE, 0.85 ± 0.05 kcal/min; EE, 0.88 ± 0.06 kcal/min; C, 0.94 ± 0.06 kcal/min). Postexercise increase in % energy from fat was significant in RE (P<0.05) and approached significance in EE (P=0.05) (RE, 41.4 ± 3.6 %; EE, 39.1 ± 3.3 %; C, 22.3 ± 1.9 %). Postexercise increase in % energy from carbohydrate was significant in RE (P<0.05) and approached significance in EE (P=0.05) (RE, 58.6 ± 3.6 %; EE, 60.9 ± 3.3 %; C, 77.7 ± 1.9 %).

CONCLUSION: Acute, moderate intensity EE and high intensity RE both enhance the rate of fat oxidation in the postprandial period in obese women when compared to a sedentary control. The results indicate that RE and EE may be equally effective in altering postprandial energy substrate partitioning, and the findings may have implications for designing weight loss programs.

INTRODUCTION:

Physical exercise is responsible for altering various physiological parameters. Although several studies report a phenomenon known as “anorexia induced by exercise” in response to endurance exercise, little is known about the effects of resistance physiological exercise on food intake.

PURPOSE: To verify the patterns of food intake of young rats (~4 months) in response to a 12-week resistance training protocol.

METHODS: The rats were kept in individual cages in inverted light/dark cycle and had free access to food and water. They were divided in two groups: a sedentary control group (CON) and a trained group (TR). The training consisted of 35 sessions, one session a day, 3 days a week. In each session rats performed a total of 30 repetitions at 80% of the previously established maximum force. This protocol has been successfully used in our lab to induce muscle hypertrophy. Food intake was measured in a daily basis every morning. To compare the difference between treatments at each time point, we used analysis of variance (ANOVA) for repeated measures.

RESULTS: No significant differences between groups were found for body weight at both PRE (CON=403.1 ± 1.06g; TR=402.13 ± 1.46g) and POST intervention (CON=500.38 ± 48.64g; TR=507.63 ± 24.12g). Likewise, there was no significant difference between groups for food intake, at any time of the study (PRE: CON=30.00 ± 0.00g; TR=29.00 ± 1.07g; POST: CON=29.00 ± 3.21g; TR=29.00 ± 3.21g).

CONCLUSIONS: According to the data obtained, we can conclude that 35 sessions of strength training with 80% of maximum load does not affect the voluntary food intake and weight in an animal model for resistance exercise training. Supported by FAPESP: 2010/08329-3 and 2010/10852-6.

INTRODUCTION:

It is known that an acute bout of high-intensity exercise induces appetite suppression. Recent research suggests that the appetite stimulating hormone secreted from the gut, acylated ghrelin, mediates exercise-induced appetite changes. However, it remains unclear whether there are differences in appetite and acylated ghrelin responses to different modes of exercise (i.e. weight bearing exercise versus non-weight bearing exercise). Rope skipping exercise is traditional exercise modality that everyone who had experienced during elementary school years in Japan, and it has characteristic exercise modality that it has a great up-and-down motions of the center of mass.

PURPOSE: This study was to examine the effects of exercise mode on appetite and plasma acylated ghrelin.

METHODS: Sixteen healthy young men (age 24.6 ± 0.5 yrs, body mass 65.7 ± 1.6 kg, maximal oxygen uptake 46.6 ± 1.6 ml/kg/min) participated in this study. After 12-h fasting, all subjects undertook three, 160 min trials, 1) rope skipping exercise (291 ± 9 kcal, 3 sets x 10 min with 5 min interval, then rested for 120 min), 2) bicycle ergometer exercise (298 ± 10 kcal, 3 sets x 10 min with 5 min interval, then rested for 120 min), 3) control (rested for 160 min). Plasma concentration of acylated ghrelin and hunger evaluated by visual-analog scale (0 mm Not Hungry - 100 mm Very Hungry) were measured throughout.

RESULTS: Two-way ANOVA revealed significant (P<0.05) interaction effects for hunger and acylated ghrelin, indicating suppressed hunger and acylated ghrelin during rope skipping and endurance exercise modes.
bicycle ergometer exercises. There were no significant trial effects for hunger and acetylated ghrelin. The amount of change in appetite from baseline during exercise was greater in the rope skipping trial (-30 ± 7 mm) than both bicycle ergometer (-9 ± 5 mm) and control trials (3 ± 3 mm) by one-way ANOVA (P<0.05). However, there was no difference of change in plasma concentration of acetylated ghrelin from baseline between in rope skipping and bicycle ergometer exercise trials.

CONCLUSION: These results suggest that rope skipping exercise with dramatic ups and downs in center of mass may have greater effect of exercise-induced suppression of appetite but not of acetylated ghrelin compared with bicycle exercise without ups and downs.

2396 Board #71 MAY 31 3:30 PM - 5:00 PM
Effects Of Exercise On Appetite And Ad Libitum Energy Intake In Men And Women

(No relationships reported)

Short-term aerobic exercise suppresses appetite and subsequent energy intake in men, however it remains unclear whether this occurs in women.

PURPOSE: To determine whether exercise alters subjective appetite ratings, appetite hormones and ad libitum energy intake differently in men and women.

METHODS: 11 healthy men (22 ± 2 yrs; 16 ± 6 %BF; 42.9 ± 6.5 ml/kg-min) and 10 healthy women (21 ± 2 yrs; 23 ± 3 %BF; 39.9 ± 5.5 ml/kg-min) completed a no-exercise and exercise condition in a counterbalanced, cross-over fashion. Subjects either rested for 60 minutes (no-exercise) or exercised on a cycle ergometer at ~70% VO2 max until 30% of their total daily energy expenditure was expended (Men; exercise expenditure = 975 ±195 kcal; Women; exercise expenditure = 713 ±86 kcal). Hunger and satiety ratings and insulin concentrations were assessed before and up to 30 minutes post each condition using a repeated measure ANOVA. Forty minutes after completion of both conditions, subjects were given an ad libitum buffet meal and relative energy intake was calculated as energy intake minus exercise expenditure.

RESULTS: There was no significant sex or condition effect in appetite ratings (i.e., hunger and satiety) and insulin concentrations. Absolute energy intake was significantly higher (P<0.05 in the exercise and no-exercise conditions in men (1648 ±95, 1216 ±33 kcal, respectively) compared to women (591 ±183, 590 ±231 kcal, respectively). Relative energy intake was significantly lower (P<0.05) after exercise compared to no-exercise in men (558 ±813, 1133 ±19 kcal, respectively) and women (-205 ±248, 530 ±23 kcal, respectively). However, relative energy intake was highly variable as 12 out of 21 subjects had lower energy intake after exercise, whereas 9 subjects had higher relative energy intake.

CONCLUSIONS: We observed no change in appetite ratings or insulin concentrations in either sex. However, ad libitum relative energy intake was lower after exercise in both men and women. Other key hormones (e.g. peptide YY, acetylated ghrelin) may have a more profound role in appetite regulation and may explain the lower relative energy intake.

2397 Board #72 MAY 31 3:30 PM - 5:00 PM
Fetuin-A Responses to Incremental Weight Loss
Peter W. Grandjean, FACSM1, Guang Ren2, Xiaoming He3, Teayoun Kim4, Laurel A. Littlefield5, Robert L. Bowery6, Felipe Araya-Ramirez7, A Jack Mahurin, FACSM8, Suresh T. Mathews9, 1Bayelor University, Waco, TX. 2Auburn University, Auburn, AL. 3Baptist Hospital, Montgomery, AL.

(No relationships reported)

Fetuin-A is a hepatokine known to attenuate insulin action by suppressing insulin receptor tyrosine kinase activity. Fetuin-A concentrations are elevated in obesity, insulin resistance and type 2 diabetes and can be reduced with weight loss. Dose-response relationships between changes in fetuin-A concentrations and incremental weight loss and changes in body composition have not been characterized.

PURPOSE: The objectives of this investigation were to characterize the effects of incremental weight loss on circulating concentrations of fetuin-A and to determine relationships between fetuin-A and changes in body composition in obese men.

METHODS: Sixteen obese men (age = 43.3 ± 9.0; weight = 106.5 ± 17.8 kg; BMI = 33.4 ± 4.4 kg/m2; body fat = 36 ± 4%) were assigned to regularly-practiced exercise and dietary restriction in order to reach a targeted weight loss of 8 to 10% of initial body weight over a 6 to 10-month period. Fasting blood samples were analyzed for fetuin-A concentrations and clinical markers of insulin sensitivity and changes in body fat. Changes in body fat distribution were measured at regular weight loss intervals (2-4%, 4-6%, 6-8% and target weight loss).

RESULTS: Fetuin-A was significantly reduced with 2-4% weight loss (83 mg/mL ± 18.7%) and decreased by 126 mg/mL or 28.5% with target weight loss (P = 0.0002). Body fat decreased by 4% (p < 0.0001) and lean mass decreased by 3% (p < 0.0001) with the targeted weight loss. Markers of insulin sensitivity [HOMA and glucose/insulin ratio, reported previously; MSSE Vol. 43 (5) No. 2462, 2011] were improved with as little as 4-6% weight loss (p = 0.05). Reductions in fetuin-A were correlated with the decrease in total fat mass measured after reaching target weight (0.67, p = 0.0045).

CONCLUSIONS: As little as 2-4% weight loss resulted a decrease in fetuin-A concentrations. Continued weight and body fat loss resulted in further decrements in fetuin-A and improved insulin sensitivity. The decrease in fetuin-A was associated with a reduction in fat mass that occurred with 6-8% weight loss in obese men.

Funded by an Alabama Agriculture Experiment Station Foundation Grant

2398 Board #73 MAY 31 3:30 PM - 5:00 PM
Effects Of Visfatin Rs4730153 Snps On Exercise-induced Weight Loss Of Chinese Obese Children And Adolescents
ai ping lai1, wenhe chen2, Kelly Helm3, 1Zhejiang College of Sports, Hangzhou, China. 2Shanghai University of Sport, Shanghai, China. 3Valparaiso University, Valparaiso, IN.

(No relationships reported)

PURPOSE: To investigate the effects of Visfatin gene polymorphism RS4730153 on exercise-induced weight loss.

METHODS: 88 obese children and adolescents of Han Chinese were subjected to 4 weeks of aerobic exercise to lose weight. By using ligase detection-polymearase chain reaction(LDR-PCR) sequence typing techniques,Rs4730153 polymorphism of Visfatin gene of individual subject was determined, physical shape, functions, quality and metabolic indicators of glucose and lipid metabolism before and after exercise intervention were measured.

RESULTS: AG genotype frequency was 15.9% among subjects. Significant changes were found when indicators of all genotypes were compared before and after aerobic exercise. Compared indicators of all genotypes before and after aerobic exercise, there were significant changes. Pre-exercise triglyceride (TG) levels were significantly different between two genotypes (GG:1.40 ±0.74 mmol/L, AG:1.86 ± 1.11 mmol/L, P=0.05). Exercise-induced changes of HOMA-B level between two genotypes were significantly different (GG: 0.220 ± 0.178, AG: 0.33 ± 0.207, P=0.05). Gender also influenced changes of various metabolic indicators by exercise.

CONCLUSIONS: Visfatin single nucleotide variants RS4730153 exist in obese Han Chinese children and adolescents. Weight loss via exercise may be improved by reducing TG levels or by increasing insulin sensitivity of obese children with homozygous Visfatin RS4730153.

2399 Board #74 MAY 31 3:30 PM - 5:00 PM
Is there Longitudinal Agreement between Methods to Estimate Total Body Water on Adolescents?
José Ramón Alvero Cruz1, Elvis Camero2, Jesús Barrera Expósito1, José Carlos Fernández García3, Luis B Sardinha3, 1Faculty of Medicine, University of Málaga, Málaga, Spain. 2Faculty of Education Sciences. University of Málaga, Málaga, Spain. 3Technical University of Lisbon, Lisbon, Portugal.

(No relationships reported)

Accurate estimation of total body water (TBW) is a cornerstone of the body composition assessment, since it is used to estimate fat-free mass and fat mass. Also, TBW changes have several implications on performance and health. However, there is a lack of knowledge about the agreement between gold standard and field methods to assess longitudinal changes of TBW in mainly on adolescents.

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PURPOSE: The aim of this study was to explore the agreement between deuterium dilution method and whole-body bioelectrical impedance analysis (BIA) before and after 2 years of follow-up on adolescents.

METHODS: 73 adolescents (36 girls and 35 boys) were assessed (age = 13.6 ± 1.2 yr, BMI = 22.0 ± 3.2 kg/m²) during a 2-years follow-up period (2YFU) which was between October 2006 and 2008. TBW was determined by the isotope (deuterium oxide (D²O)) dilution technique using an isotope-ratio mass-spectrometer and a BIA by the traditional protocol. Paired sample T-test was performed to compare differences between TBW estimated by BIA and deuterium before (DifB-D²O_1) and after (DifB-D²O_2) 2YFU. Bland and Altman plot (B&A) and Kendall’s Tau were carried out in order to analyze the agreement and bias between methods. Differences between TBW by ‘D²O and BIA were calculated (DifB-D²O). Independent sample T-test between DifB-D²O_1 and DifB-D²O_2 was used in order to analyze if the magnitude of differences was statistically significant between conditions.

RESULTS: Paired sample T-test did not show significant differences between methods either before (31.9 ± 4.3 vs. 32.1 ± 4.8 kg, BIA and D²O respectively; p > 0.05) or after 2YFU (33.6 ± 4.3 vs. 35.1 ± 5.4 kg, BIA and D²O respectively; p > 0.05). The B&A showed that DifB-D²O_2 had large confidence intervals (CI= -8.70 to 5.62 kg) and a significant proportional bias (Kendall’s Tau = 0.31, p < 0.001). Independent sample T-test between DifB-D²O before and after was statistically significant (-1.36 kg, p < 0.001).

CONCLUSION: The main finding of this study was that after a 2YFU, BIA underestimated the TBW larger than before the follow up period. Also, DifB-D²O_2 had more variability and a great negative tendency than DifB-D²O_1. So, our data indicate that higher TBW values greater underestimated by BIA. These results may be considered when TBW changes are assessed by BIA, mainly during maturation periods.

2400 Board #75 MAY 31 3:30 PM - 5:00 PM Adult-Child Differences in Substrate Utilization Following Moderate and Vigorous Intensity Cycle Ergometer Exercise

Justin R. Bland1, Karin A. Pfeiffer, FACSM2, Joey C. Eisenmann2, Lorraine Weatherspoon1, Kimberly S. Maier1, Michigan State University, East Lansing, MI. Helden DeVos Children’s Hospital, Grand Rapids, MI.

(no relationships reported)

INTRODUCTION: Previous research has shown fat oxidation, measured by respiratory exchange ratio (RER), to be greater in children than in adults at rest and during exercise. Few studies have investigated substrate utilization post-exercise in children.

PURPOSE: To examine adult-child differences in substrate utilization following moderate and vigorous intensity exercise performed on the cycle ergometer.

METHODS: 20 children and 23 adults visited the laboratory on three separate occasions and completed an exercise trial each day: VO2max test, moderate exercise (MOD), and vigorous exercise (VIG). Maximum power output (MaxPO) during the VO2max test was used to determine workload for MOD (55% MaxPO) and VIG (75% MaxPO) exercise. MOD and VIG trials were randomized and counterbalanced. Participants rested for 30 minutes (min) prior to exercise; the last 20 min were used for baseline VO2 measures. In order to mimic child physical activity patterns, tests were 2-min square-wave intervals lasting 1 hour for the MOD trial and 30 min for the VIG trial. Expired gas measurements began 10 min prior to the cessation of exercise and continued for 30 min. Substrate utilization was examined using multivariate analysis of variance (ANOVA) for RER at minutes 1, 5, 10, 15, and 20 post-exercise. Another ANOVA model statistically controlling for caloric intake and gender was also performed.

RESULTS: After MOD, children’s RER was significantly lower than adults at 1, 5, and 10 min (0.84 ± 0.05 vs. 0.90 ± 0.05, 0.93 ± 0.05 vs. 1.00 ± 0.08; 0.86 ± 0.03 vs. 0.91 ± 0.05, respectively; all p < 0.01; effect sizes of 0.61, 0.26, and 0.29, respectively). After VIG, RER was similar in children and adults at min 1 and 10; however, children’s RER in min 5 was significantly lower than adults (1.02 ± 0.06 vs. 1.15 ± 0.11, p = 0.001; effect size of 0.60). Children’s RER in min 15 and 20 was significantly higher than adults’ (0.83 ± 0.05 vs. 0.77 ± 0.06, 0.83 ± 0.05 vs. 0.75 ± 0.06, respectively; p > 0.05; effect sizes of 1.66 and 2.12, respectively).

CONCLUSIONS: Children had lower RER than adults after MOD, but higher RER 15 and 20 min after VIG. Children rely more on fat oxidation at rest and during exercise than adults. This study observed children to utilize a greater proportion of carbohydrates than adults after VIG.

Funded by Michigan State University College of Education

2401 Board #76 MAY 31 3:30 PM - 5:00 PM Using the Bite Counter Device to Measure Energy Intake in Overweight African Americans

Phillip W. Jasper, Jenna L. Scisco, Veronica G. Parker, Adam W. Hoover, Eric R. Muth, Clemson University, Clemson, SC.

(no relationships reported)

Energy intake can be measured using tools such as paper-and-pencil and electronic food diaries, dietary recalls, food frequency questionnaires, and food history questionnaires (Thompson & Subar, 2008). Energy intake estimation with these tools can be challenging, and none of these methods allow the individual to measure their energy intake automatically and in real time. The Bite Counter is a watch-like device that can measure bites of food taken during a meal. This study was the first observational study using the Bite Counter in free-living humans.

PURPOSE: To determine the relationship between the numbers of bites taken during meals and three variables: kilocalories, meal duration, and meal location.

METHODS: Bite Counter devices were worn by 13 African-American participants (7 females, mean age = 55.5 (SD = 9.1), mean BMI = 36.8 (SD = 7.4)). Participants wore the Bite Counter on their dominant wrist for one week. Participants recorded bites of food by turning the device on when they began eating a meal and off when they finished eating a meal. Participants also completed daily dietary recalls using the Internet-based Automated Self-Administered 24-Hour Recall (ASA24 Beta version, National Cancer Institute, Bethesda, MD, 2009). Kilocalories for each meal and meal location were obtained from the ASA24. Bites for each meal and meal duration were obtained from the Bite Counters.

RESULTS: 147 meals were included in the analysis. Participants took an average of 42 bites (SD = 26) per meal, ate an average of 549 kilocalories (SD = 379) per meal, and ate for an average of 15 minutes (SD = 10) at each meal. 101 meals were eaten at home, and 46 meals were eaten outside of the home (e.g., work, restaurants). Correlational analyses indicated positive relationships between kilocalories and bites, r(145) = .31, p < .01, and meal duration and bites, r(145) = .87, p < .01. Significantly more bites were taken during meals eaten outside of the home (M = 51, SD = 35) compared to those eaten at home (M = 38, SD = 20, t(145) = 2.80, p < .05).

CONCLUSIONS: This small-scale study in African-American, overweight adults indicated that bites may serve as a measure of energy intake and meal duration. Additionally, bite count could be used to help individuals identify locations where their energy intake may increase.

2402 Board #77 MAY 31 3:30 PM - 5:00 PM The Effects of Massage Therapy on Weight Management

Mark Blegen, FACSM1, Hannan Hassan2, Megan Gosselin1, Alisse Indrellie1, Heidi Sande1, Tracey Matthews1, St. Catherine University, St. Paul, MN. Springfield College, Springfield, MA.

(no relationships reported)

Cortisol is an adrenal cortex hormone and is released in response to stress. Massage has been shown to lower cortisol levels in individuals. High levels of cortisol in the body are associated with increases in fat mass and distribution.

PURPOSE: To examine if receiving weekly massages would influence salivary cortisol, bodyweight, blood pressure, and heart rate.

METHODS: Blood pressure, heart rate and salivary cortisol were measured post-massage, 15 min post-massage and 30 min post-massage. In the control setting, variables were measured at the same time point. For body weight a 2 X 2 repeated measures factorial ANOVA was computed to examine body weight. Measures were taken pre- and post-massage and pre- and post-control. In addition, 2 X 4 Repeated Measures ANOVAs were conducted for HR, SBP, DBP and salivary cortisol with an alpha level of 0.05.

RESULTS: A significant difference (p < 0.05) between the control and massage conditions was found for body weight. No significant difference (p > 0.05) between the two groups existed for body weight at pre-test (massage: 189.75 ± 24.15 lbs, control: 190.81 ± 24.60 lbs). Subjects weighed significantly less (p < 0.05) after massage than during the control session (massage: 186.94 ± 24.50 lbs, control 190.94 ± 23.71 lbs). For SBP, a significant interaction between time and condition existed. At baseline and the end of the condition, the massage group had significantly lower mean SBP (118.00 ± 11.39, 118.25 ± 6.50) than the control condition (128.5 ± 16.50, 122.63 ± 10.30). For heart rate, significant differences (p < 0.05) were found for the condition. Subjects had a significantly lower heart rate during the massage condition (67.38 ± 3.59) than the control condition (75.56 ± 3.39). For DBP, the massage condition had a...
significant lower mean DBP (78.13 ± 3.28) than the control condition (86.13 ± 2.45). For salivary cortisol the massage condition exhibited a significantly lower value (1.15 ± 0.08, 1.42 ± 0.07).

CONCLUSION: Receiving weekly massages may be an adjunct to a weight management plan by reducing cortisol and thereby influencing body weight.

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**D-21**  
**Free Communication/Poster - Fitness and Performance Testing III**  
**MAY 31, 2012 1:00 PM - 6:00 PM**  
**ROOM: Exhibit Hall**

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<th>2403</th>
<th>Board #78</th>
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<tr>
<td><strong>Gender Differences in Isokinetic Strength and Endurance among Division II Athletes</strong></td>
<td>Elizabeth Mathews, Kara Feller, Robert S. Van Zant, The University of Findlay, Findlay, OH.</td>
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<td><strong>PURPOSE:</strong> Gender disparity is noted in ACL injury. Muscles acting on the knee provide dynamic stabilization to the joint. The purpose of this study was to identify the gender differences in isokinetic muscular strength and endurance among Division II athletes in sports (soccer, basketball, volleyball) most susceptible to ACL injury.</td>
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<td><strong>METHODS:</strong> 33 Division II athletes (15 female, 18 male) provided informed consent for participation. Prior to their competitive season, athletes were tested for knee flexion and extension muscular strength and endurance in both dominant (D) and non-dominant (ND) legs using a Biodex 3 isokinetic dynamometer. Once seated and stabilized, subjects first performed 6 maximal repetitions at 1.04 and 4.19 radians per second (rad/sec). To test muscular endurance, subjects then performed 60 maximal repetitions at 3.14 rad/sec. Peak torque (PT), time to PT, PT to body weight ratio (PT/BW), and agonist/antagonist ratio (AGON/ANTAG) were determined at all 3 test speeds. In the endurance set, percent total work performed in the first third and final third of the set, as well as 30 and 60 sec recovery percentage of PT were assessed. All tests were conducted by the same investigator, providing standardized verbal feedback. All parameters were analyzed for group (gender) differences via independent t-test using SPSS statistical software.</td>
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<td><strong>RESULTS:</strong> Gender differences were noted regarding muscular endurance in knee extension and flexion. Female Division II athletes may lack comparable dynamic knee joint stability relative to their male counterparts. Even when corrected for body weight differences, Division II male athletes generate significantly greater knee extension torque and, in the ND leg, knee flexion torque. No gender differences were noted regarding muscular endurance in knee extension and flexion. Female Division II athletes may lack comparable dynamic knee joint stability relative to their male peers due to their reduced ability to generate maximal muscular strength.</td>
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<td><strong>CONCLUSIONS:</strong></td>
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<th>2404</th>
<th>Board #79</th>
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<td><strong>Heart Rate Variability and Maximal Oxygen Consumption in Healthy College Students</strong></td>
<td>Andrew G. Thompson1, Carmine Gricio1, David Swain, FACSM2, James Onate3, Nelson Cortes3, Old Dominion University, Norfolk, VA. Old Dominion University, Norfolk, VA. Old Dominion University, Norfolk, VA.</td>
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<td><strong>PURPOSE:</strong> The purpose of this study was to determine the effects of altering the perception of effort, for the duration of a maximal oxygen uptake (VO2max) trial, through bio-feedback on the incidence of plateau at VO2max.</td>
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| **METHOD:** Following Local University Institutional ethical approval, 7 active male participants volunteered to participate (age 23.9 yrs ± 5.0; mass 82.8 kg ± 9.4; stature 180.9 cm ± 9.4; VO2max 49.19 ml·kg-1·min-1 ± 5.41). All participants completed four gradient-based VO2max trials on a treadmill using a ramp of 0.5% 30 s-1 at a constant speed of 10 km·h-1. The initial trial served as a familiarisation. During the remaining three trials, which were completed in a randomised order, heart rate was displayed to the participants as the actual value (HR-A) and with a variation of -10 b·min-1 (HR-L) and +10 b·min-1 (HR-H). Throughout all four trials VO2 was recorded on a breath by breath basis using a pre-calibrated metabolic cart. The chosen criterion for attainment of a plateau response was a ΔVO2 ≤ 50 ml·min-1 between the final two consecutive 30s sampling periods. At least one secondary criterion for the attainment of VO2max was employed: RER > 1.15;  
| **RESULTS:** Across all three conditions there was no significant difference in VO2max and end workload (p>0.05). The ΔVO2 values (ml·kg-1·min-1) between the final two consecutive 30s samples were HR-L 68.95 ± 46.42; HR-A 23.78 ± 24.15; HR-H 55.27 ± 61.29. ΔVO2 was significantly lower in HR-A than HR-L (p<0.04) but there was no significant difference between HR-L and HR-H or HR-H and HR-A (p>0.05). The incidence of plateau varied across trials, HR-L 43%, HR-A 86%, HR-H 57%. RPE remained statistically unchanged (p>0.05) HR-L 18.5 ± 1.6; HR-A 18.7 ± 1.8; HR-H 19.1 ± 1.2. |  
| **CONCLUSIONS:** These data are implicit of a detrimental effect on the attainment of a plateau in VO2max, with manipulation of biofeedback. Given the disassociation between RPE and the behaviour of ΔVO2 at exhaustion, it is conceivable that differences in plateau attainment are instead related to a deviation from the mental map set during the familiarisation trial. Such a divergence may detract from the efficacy of a teleoanticipatory pacing strategy and, in turn, influence the central regulatory command at the end of a VO2max trial. |  

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2406  Board #81  MAY 31  2:00 PM - 3:30 PM
Impact Of K4b2 Calibration Drift On Respiratory Measurements During Walking And Running
Chris Easton1, Chris C.F. Howes1, Richard O. Matzko1, Fabio Piaser2, Yannis P. Pispasilis, FACSM2, 1Kingston University, Kingston upon Thames, United Kingdom. 2University of Glasgow, Glasgow, United Kingdom.
(No relationships reported)
The K4b2 (COSMED s.r.l, Rome, Italy) is a portable metabolic analyser designed to measure breath-by-breath respiratory variables in the field. While the majority of published evidence suggests that the K4b2 is valid and reliable during rest and exercise, it has been previously demonstrated that the accuracy of the %O2 and %CO2 measurements can drift over time (McLaughlin et al. 2001. Int J Sports Med 22(4): 280-284). However, the effect of K4b2 calibration drift on respiratory variables during prolonged exercise tests is presently unclear.

PURPOSE: To examine the accuracy of K4b2 measurements of VO2, VCO2 and VE following a one hour delay between calibration and measurement.

METHODS: Ten male participants (age: 31 ± 11 years, height: 181 ± 3 cm and body mass: 84.1 ± 10.0 kg) completed three maximal discontinuous incremental exercise tests on a motorized treadmill at speeds corresponding to 4, 5, 6, 8, 10, 12, 14 and 16 km·hr-1, or until volitional exhaustion. Participants completed 3 min of exercise at each speed, followed by 3 min active recovery for all speeds above 10 km·hr-1. Respiratory variables were measured continuously using either a laboratory based metabolic cart (Oxycon Pro, Carefusion, Germany) (OP), a K4b2 calibrated immediately before use (K4b2) or a K4b2 calibrated one hour prior to the test (K4b2-D). Values were averaged over 20 sec, and limits of agreement were calculated as a function of measured value (Mean Difference) ± 1.96 (SD between subjects). Differences were considered significant at the p<0.05 level. (N=3 for each condition at each speed)

RESULTS: Values between OP and K4b2 (P=0.19) but K4b2-D compared to the OP at faster running speeds (P=0.05). Bland and Altman analysis indicated good agreement in the measurement of VO2 between OP and K4b2 with a mean difference of 38 ml·min-1 and limits of agreement between -285 and 208 ml·min-1. The mean difference between K4b2-D and OP was 84 ml·min-1 with limits of agreement between -469 and 302 ml·min-1.

CONCLUSIONS: The K4b2 overestimated VO2 during faster running speeds following a one hour delay between calibration and measurement. Whilst care should be taken when using this device for longer duration exercise tests, the extent of the differences were small and newer models of the K4b2 are fitted with a periodical recalibration mechanism which may eliminate this issue.

2407  Board #82  MAY 31  2:00 PM - 3:30 PM
Gas Exchange Fatigue Thresholds From Ramp Versus Step Incremental Cycle Ergometer Tests
Miranda T. Goodman, Jorge M. Zuniga, Chad Harris, FACSM, F.A.C.S.M. Western New Mexico University, Silver City, NM. (Sponsor: Chad Harris, FACSM)
(No relationships reported)

PURPOSE: The purpose of this study was to compare the VO2 (L·min-1) associated with the gas exchange threshold (GET) and respiratory compensation point (RCP) for ramp versus step incremental cycle ergometer tests.

METHODS: Seven male and seven female subjects (age = 23.36 ± 3.34 years; body mass = 71.65 ± 11.10 kg) performed a ramp (15 W·min-1) and step (30 W every 2 min) incremental cycle ergometer tests to exhaustion (in random order) to determine the VO2 max (L·min-1) and RCP (W·min-1). The values GET and RCP were determined using the V-slope method. GET and RCP were defined as the VO2 values corresponding to the intersection of 2 linear regression lines derived separately from the data points below and above the breakpoints for VCO2 vs. VO2 (GET) and VCO2 vs. VO2 (RCP). In addition, the total work performed (kJ) during each protocol was calculated from the integral of power output versus time. Paired t-tests were used to analyze the mean differences between the ramp and step protocols.

RESULTS: The results showed no significant differences in VO2 (L·min-1) between ramp and step incremental cycle ergometer tests for VO2 max (ramp = 2.94 ± 0.74 L·min-1, step = 2.91 ± 0.70 L·min-1, p = 0.91), GET (ramp = 1.86 ± 0.51 L·min-1 and step = 1.90 ± 0.57 L·min-1, p = 0.83) and RCP (ramp = 2.46 ± 0.63 L·min-1 and step = 2.47 ± 0.56 L·min-1, p = 0.95). A significantly greater (p = 0.01) amount of total work was performed for the step (118.27 ± 45.51 kJ) versus the ramp (108.12 ± 39.70 kJ) test.

CONCLUSION: The results of the present study indicate that despite the increased amount of work performed for the step versus the ramp incremental cycle ergometer test, there were no significant differences in the VO2(L·min-1) associated to the gas exchange fatigue thresholds that demarcate the moderate from heavy (i.e., GET) and heavy from very heavy (i.e., RCP) exercise intensity domains.

2408  Board #83  MAY 31  2:00 PM - 3:30 PM
Metabolic Responses When Jogging on an Anti-Gravity Treadmill
Michael A. Figueroa1, James Manning, FACSM1, John M. Woitkstein1, Patricia Escamilla1, 1William Patterson University, Wayne, NJ. 2MCRC Physical Therapy, West Orange, NJ. (No relationships reported)

PURPOSE: To determine whether there would be any significant differences in metabolic work when jogging to maximal aerobic capacity on an anti-gravity treadmill, using differential air pressure, at different percentages of body weight (100%, 90% and 80% BW).

METHODS: Metabolic data were collected on 10 subjects (5 males, 5 females) on three separate days, which were separated by two weeks. The order in which body weight was manipulated was randomized on each day of testing. Maximal oxygen consumption was assessed using the Bruce Protocol and a metabolic cart.

RESULTS: Absolute VO2max values (L/min) were significantly different between, but not within genders, at each percentage of body weight (100% BW: males = 3.4 ± 1.1 vs. females = 2.4 ± 0.25; 90% BW: males = 3.3 ± 1.1 vs. females = 2.4 ± 0.4; 80% BW: males = 3.4 ± 0.9 vs. females = 2.3 ± 0.3, p<0.05). Relative VO2max (mL/kg/min) was not found to be significantly different at 100%, 90% or 80% BW (42.8 ± 8.3 vs. 43.9 ± 7.9 vs. 42.7 ± 8, p=0.99). Heart rate (HR), respiratory exchange ratio (RER) values and substrate utilization were also not found to be significantly different between body weight percentages during any stage of testing.

CONCLUSION: Removal of up to 20% bodyweight did not alter metabolic responses (VO2, HR, RER, substrate utilization) during jogging to maximal aerobic capacity. Prescribed cardiovascular training intensities can be achieved with a reduction in ground reaction forces. This type of weight-assisted device may be an effective alternative during rehabilitation or recovery after an event in order to maintain cardiovascular fitness.

2409  Board #84  MAY 31  2:00 PM - 3:30 PM
Exercise Tolerance During Cardiopulmonary Exercise Testing
Adrian Midgley1, Peter Clough1, Fiona Earle1, Earle Keith1, Jason Siegler, FACSM2, 1University of Hull, Hull, United Kingdom, 2University of Western Sydney, Sydney, Australia. (No relationships reported)

PURPOSE: Subjects are expected to continue exercising to their limit of tolerance during a cardiopulmonary exercise test (CPET), since a maximal or near maximal effort is generally considered necessary for valid test results. However, very little is known about exercise tolerance during CPET.

METHODS: Fifty apparently healthy men visited the laboratory on two occasions. The first visit was mainly to familiarise the subjects with the equipment and test procedures and to complete questionnaires and a pain threshold test. On the second visit, subjects performed a maximal incremental treadmill test. After the test they completed a questionnaire to establish why they terminated the test when they did, to rate how helpful they found the verbal encouragement given during the test, how long they estimated it would have been before they would have collapsed on the treadmill or fell off the back if they did not terminate the test at the moment they did (time to collapse), and whether they set themselves any performance goals. Maximum jump height and lung function were measured before and after the CPET.

RESULTS: Twenty-three men terminated the test mainly due to leg fatigue and discomfort, 11 due to breathing discomfort, 2 due to safety concerns, and 14 because of other reasons. The mode for the total number of reasons that subjects stated influenced why they terminated the test when they did was six (range = 12). The median (IQR) estimated time to collapse was 45 (60) s. Correlates of time to collapse were perceived pre-exercise mental and physical readiness (rs = -0.32, p = 0.024), self-reported preference for (rs = -0.41, p = 0.011) and tolerance to (rs = 0.70 L·min-1) associated with the gas exchange threshold (GET) and respiratory compensation point (RCP) for ramp versus step incremental cycle ergometer tests.

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0.35, p = 0.031) high-intensity exercise, and change in maximal voluntary ventilation (r = -0.37, p = 0.011). The change in maximal jump height (r = 0.17, p = 0.26) and pain threshold (r = -0.19, p = 0.20) were not significantly correlated to time to collapse. The median (IQR) perception of the usefulness of verbal encouragement was 70 (37), where zero was ‘not at all helpful’ and 100 was ‘extremely useful’. Thirty-nine of the subjects set themselves some sort of performance goals before or during the CPET.

CONCLUSIONS: The present study indicates that psychological factors result in termination of a CPET a relatively long before any physiological catastrophe occurs.

2410 Board #85  MAY 31  2:00 PM - 3:30 PM
Influence Of Endurance Training On The Development Of Hemoglobin Mass During Adolescence
Jon P. Wehlin, Thomas Steiner. Swiss Federal Institute of Sport, Mugglingen, Switzerland. (Sponsor: Ben Levine, FACSM)
(No relationships reported)
It is well known, that adult elite endurance athletes are characterized by about 30% higher hemoglobin mass (Hbmass) than untrained subjects. However, it is unclear, if this is due to endurance training, a better genetic predisposition of the athletes combined with a selection process, or other factors. Interestingly, Hbmass at age 16 yrs is reported to be not different between endurance athletes and untrained subjects.

PURPOSE: To study the development of Hbmass in elite endurance athletes and age matched untrained controls during adolescence with a longitudinal approach.

METHODS: We measured Hbmass in 10 Swiss national team endurance athletes (AG: cross-country skiers and triathletes) as well as in 12 age matched non endurance training controls (CG) every 0.5 yrs from age 16 to 18.5 yrs (T1 - T6) with the optimized carbon monoxide re-breathing technique.

RESULTS: Hbmass increased (p<0.001) in the AG and was 797±96 g (T1), 826±110 g (T2), 852±114 g (T3), 876±120 g (T4), 897±116 g (T5) and 902±123 g (T6) as well as in the AG (p<0.001) from 766±95 g (T1) to 797±90 g (T2), 833±100 g (T3), 845±84 g (T4), 855±85 g (T5) and 864±88 g (T6). There were no differences between the groups in the initial Hbmass level and in the rate of increase per year between the AG (5.2±1.2%) and the CG (5.6±4.7%). These rates of increase were individually highly different and ranged between 2.5 and 9.3% in the AG and between 1.2 and 16.9% in the CG. The correlation between the increase in Hbmass and the increase in body weight was r=0.81 (p<0.01). Body weight related Hbmass increased (p<0.05) during the measurement period from 12.7±1.0 g/kg(T1) to 13.1±1.3 g/kg (T6) in the AG as well as from 12.1±0.9 g/kg (T1) to 12.6±0.7 g/kg (T6) in the CG (p<0.05).

CONCLUSION: Hbmass increases during adolescence, but there is no difference in increase rates between national team endurance athletes and untrained subjects. The amount of endurance training seems, therefore, not to influence the development of Hbmass in adolescent subjects. The increase in Hbmass is strongly correlated with the increase in bodyweight and increase rates are highly individually different. Other unknown factors may be responsible for these different increase rates in Hbmass during adolescence.

2411 Board #86  MAY 31  2:00 PM - 3:30 PM
All-out Critical Power Test Predicts Time-to-exhaustion During Ramp Incremental And Constant-work-rate Exercise
Weerapong Chidnok1, Fred J DiMenna2, Stephen J Bailey1, Daryl P Wilkerson1, Anni Vanhatalo1, Andrew M Jones, FACSM1. University of Exeter, Devon, United Kingdom. 2Adelphi University, Garden City, NY. (No relationships reported)

The power-duration relationship for severe-intensity exercise is defined by two parameters: the critical power (CP) and the W1 which represents a fixed amount of work that can be performed above CP. These parameters can be established in a 3-min all-out cycling test, where the end-test power represents the CP and the work done above CP represents the W1. According to the power-duration principle, the total work done ≥CP(W1) during exhaustive exercise is the same irrespective of the work-rate forcing function, provided that the work-rate does not fall below CP.

PURPOSE: To test the hypothesis that the CP and W1 derived from the 3-min all-out test accurately predict time-to-exhaustion (Tlim) during ramp incremental and constant-work-rate (CWR) exercise ≥CP.

METHODS: Following ethical approval, seven recreationally-active male subjects (mean ± SD: age 21 ± 4 years) completed a ramp incremental test, a 3-min all-out test for the determination of CP and W1, and a CWR test until exhaustion on a cycle ergometer. The CWR was predicted to result in exhaustion in 3 min using the power-duration equation [P = (W1/180 s) + CP] and the predicted Tlim in the ramp test (Tlim) was calculated as: Tlim = CP/S + √(2W1/S), where S is the ramp slope (0.5 Watts/s). Data were analyzed using paired samples t-tests and Pearson correlation coefficients. Significance was accepted at P<0.05.

RESULTS: The CP and W1 estimated in the 3-min all-out test were 260 ± 60 W and 16.5 ± 4.0 kJ. The WC1 during the CWR (16.5 ± 7.4 kJ) and the ramp incremental test (16.4 ± 8.4 kJ) were not different from the W1 measured in the all-out test (P>0.05). The predicted Tlim (754 ± 122 s) for the ramp incremental test was not different from (P>0.05), and was highly correlated with, the actual Tlim (753 ± 121 s; r=0.92, P<0.01). The predicted Tlim in the CWR test of 180 s was not different from (P>0.05), and was highly correlated with, the actual Tlim (185 ± 24 s; r=0.99, P<0.01).

CONCLUSION: The 3-min all-out test accurately predicted the Tlim during both ramp incremental and CWR exercise. These results provide further evidence that the power-duration parameters estimated in a single-visit all-out protocol provide meaningful predictions of exercise tolerance, and support the notion that only a finite amount of work is achievable above CP before exhaustion.

2412 Board #87  MAY 31  2:00 PM - 3:30 PM
The Effect of a Priming Exercise on Cardiac Output Kinetics
Ryan A. Seeto, Greg D. Wells, Scott G. Thomas. University of Toronto, Toronto, ON, Canada. (No relationships reported)

A priming or warm-up exercise has been shown to accelerate oxygen uptake kinetics in a subsequent exercise; however, the mechanisms in which these changes occur is not well understood. One possible explanation for the accelerated oxygen uptake kinetics following a priming exercise may be due to adaptations in cardiac output (Q).

PURPOSE: To determine the effects of a priming exercise on Q kinetics.

METHODS: Following an assessment day to determine VO2max and lactate threshold, seven moderately trained cyclists (VO2max: 58.4±11.6 mL•min^-1•kg^-1; height: 1.75±0.07 m; weight: 73.9±14.1 kg; age: 29±4 yrs) performed 6 minutes of cycling at a work rate equal to 10% above lactate threshold (unprimed; U) followed by a 5 minutes of no cycling and 6 minutes of cycling at an equivalent work rate to U (primed; P). Biopeludical impedance was used to determine Q. Kinetics were modeled using a monoeponential equation and comparison between U and P trials were made using ANOVA.

RESULTS: While the Q time constant (τ) was not significantly different between U and P trials (42.3±9.6 vs. 39.7±10.7 s, p=0.62), baseline Q was trended higher in the P trial (5.1±0.8 vs. 6.6±1.9 L•min^-1, p=0.08). The absolute asymptotic Q value was significantly higher in the P trial (15.9±2.1 vs. 16.7±2.1 L•min^-1, p<0.05). Heart rate (HR) kinetics shared a similar trend with Q. The HR τ was not significantly different between U and P (41.1±7.2 vs. 40.9±9.1 s, p=0.95) while baseline HR (68.9±8.8 vs. 83.7±14.0 beat•min^-1, p<0.05) and absolute asymptotic HR (152.8±13.3 vs. 159.7±14.3 beats•min^-1, p<0.005) were significantly higher in the P trial.

CONCLUSIONS: There was no significant difference in baseline HR during both U and P trial and there was significant increase in baseline HR and close to a significant increase in baseline Q in the P trial. Differences in Q response with priming may be due to absolute stroke volume. Faster VO2 kinetics with priming does not reflect a faster rate of Q adjustment.

2413 Board #88  MAY 31  2:00 PM - 3:30 PM
Changes of Incremental Exercise VO2 Kinetics between Different Fitness Levels
Pei-Fan Wang, Li-Lan Fu, Yi-Tzu Chen. National Taiwan Sports University, Taoyuan, Taiwan. (No relationships reported)
The analysis of VO2 kinetics in the previous studies focused more often in continuous exercise test. However, incremental exercise as a evaluation test or prescription raised clinical attention recently, but research evidence is still scant.
PURPOSE: The purpose of this study was to investigate the changes of incremental exercise VO2 kinetics between people with different fitness levels.

METHODS: Physically active college male students were recruited into this study. There were two groups of subjects, high-fitness (HF: 20.22 ± 2.11 yr, 177.89 ± 4.48 cm, 72.06 ± 10.88 kg, VO2max: 58.87 ± 1.62 ml·kg⁻¹·min⁻¹; n=9) and low-fitness (LF: 19.33 ± 1.12 yr, 177.78 ± 5.95 cm, 79.82 ± 13.34 kg, VO2max: 44.10 ± 2.31 ml·kg⁻¹·min⁻¹; n=9). All subjects completed two 6-min bouts of moderate-intensity (63% VO2max) and severe-intensity (95% VO2max) running incremental exercise test (separated by 10 min of rest). Breath-by-breath pulmonary gas exchange (SensorMedics, Vmax 29) and HR were measured. One-way repeated-measure ANOVA was used to compare the ∆VO2 of each minutes between the 2 groups under different intensity.

RESULTS: The ∆VO2 during SI exercise (HF: ∆VO2: 2.1±1.3, 1.6±1.3, 1.6±1.3, 1.5±1.4, 1.4±1.4, 1.3±1.3, 1.2±1.2, 1.1±1.1); LF: ∆VO2: 2.1±1.3, 1.6±1.3, 1.6±1.3, 1.5±1.4, 1.4±1.4, 1.3±1.3, 1.2±1.2, 1.1±1.1) 60.0, 6.49, 1.31, 0.54, 0.54 ml·kg⁻¹·min⁻¹, respectively) was plateaued at third minute for LF groups (VO2 between 3 and 4 min, p = .87), but at second minute for the HF group (VO2 between 2 and 3 min, p = 1.5).

CONCLUSIONS: Under moderate-intensity exercise, subjects at different fitness level achieved stages of stable VO2 at different timing. HF participants can reach stable VO2 earlier than participants in LF.

2414 Board #89 May 31 2:00 PM - 3:30 PM
Effect Of Exercise Order On Cardiorespiratory And Perceptual Responses To Concurrent Exercise
Nicholas W. Aguirre,1 Jeremy G. Tan,1 Daniel R. Coats,2 Barry A. Spiering3, Lee E. Brown, FACSM1, Jared W. Coburn, FACSM1, Daniela A. Rubino1, Daniel A. Judelson, FACSM.1, California State University, Fullerton, Fullerton, CA. 2United States Army Research Institute of Environmental Medicine, Natick, MA.

A training bout combining resistance (RE) and endurance exercise (EE) in a single session is termed concurrent exercise (CE). To date, few investigations have characterized the acute physiological and perceptual responses to CE order despite its popularity of its use for sport, recreational and health reasons. Since exercise order might influence RE and/or EE quality (and thereby overall training adaptations), elucidating these acute responses is integral for optimizing program design.

PURPOSE: To examine the effects of CE order on cardiorespiratory and perceptual responses.

METHODS: Nine healthy, concurrently trained subjects (age = 22.7 ± 1.7 yr; mass = 84.8 ± 11.9 kg; height = 176.1 ± 7.4 cm) performed two CE trials: one in which RE (squat, bench press, lat pulldown: 60% 1-RE, 4 sets x 10 reps, 90-s rest) preceded EE (RE-EE) and one in which EE (cycling: 80% ventilatory threshold for 30 min) preceded RE (EE-RE). Heart rate (HR) and rating of perceived exertion (RPE) were recorded following each exercise set of RR and every five minutes during EE. In addition, VO2 and respiratory exchange ratio (RER) were recorded every 2.5 minutes during EE.

RESULTS: Subjects experienced significantly greater HR throughout RE in EE-RE (151 ± 5 bpm) compared to RE-EE (136 ± 5 bpm), concomitant with increased RPE during the squat exercise (EE-RE = 15 ± 2; RE-EE = 13 ± 1). Similarly, the HR and RPE elicited by EE during EE-RE significantly exceeded RE-EE for the first 10 and 15 min of exercise, respectively. Finally, VO2 significantly increased and RER significantly decreased during periods of EE in EE-RE compared to EE-RE.

CONCLUSIONS: In conclusion, 1) preceding RE with EE increases RE cardiovascular and perceptual demands, and 2) preceding EE with RE increases EE caloric expenditure, fat oxidation, HR and RPE. This study supports performing RE before EE if superior caloric expenditure and fat oxidation is desired during EE, albeit at a higher physiological and perceptual cost.

2415 Board #90 May 31 2:00 PM - 3:30 PM
Strength And Cardiovascular Fitness Measures Over Time Regarding Sex, Age, And Season Of Testing
Katherine E. LaBarbera,1 Justin Keadle,1 Kevin S. O’Fallon2, Priscilla M. Clarkson, FACSM1, Linda S. Pescatello, FACSM2, Beth A. Parker3, Paul D. Thompson, FACSM.1, University of Massachusetts Amherst, Amherst, MA. 2University of Connecticut, Storrs, CT. 3Hartford Hospital, Hartford, CT.

Muscular strength and cardiovascular fitness are often assessed during short- and long-term research studies. Familiarization sessions are intended to habituate participants with testing procedures, but they are typically used before initial data collection and not prior to follow-up testing.

PURPOSE: To examine the repeatability of muscular strength and VO2max measures over 6 months regarding age, sex, and season of initial testing, and to determine if repeating a familiarization session after a 6 month time period is necessary.

METHODS: 208 participants (100 men and 108 women, aged 20-76 yr) completed a familiarization session at visit 1 consisting of all strength assessments. Baseline testing occurred 3 days later and consisted of handgrip, isometric, and isokinetic strength measures of the dominant arm and leg at visit 2 and visit 3, which were also separated by 3 days; VO2max was assessed only at visit 2. After 6 months, participants completed the same strength assessments at visit 4 and 5; VO2max was assessed only at visit 4. A second familiarization visit was not performed prior to visit 4 or 5. Data were analyzed using a repeated measures analysis of variance (ANOVA). Significant interactions were investigated post hoc using a Tukey’s HSD test.

RESULTS: No changes in strength over time with regard to sex, age cohort, or season were observed in grip strength, isometric elbow flexor and knee extensor strength, and isokinetic elbow flexor strength at 60 and 180 deg·sec⁻¹. For example, isometric elbow flexor strength was similar at baseline (51.5 ± 1.4 Nm) and 6 months (52.0 ± 1.4 Nm), and VO2max did not change from baseline (33.3 ± 0.7 ml·kg⁻¹·min⁻¹) to 6 months (33.0 ± 0.7 ml·kg⁻¹·min⁻¹). A Time X Age Cohort interaction was observed for isokinetic knee extensor strength at 60 and 180 deg·sec⁻¹ (p<0.01), and further analysis showed that younger adults increased in strength for isokinetic knee extensor exercise at 180 deg·sec⁻¹ (118.6 ± 4.8 Nm to 127.0 ± 4.8 Nm).

CONCLUSIONS: Remarkable stability in strength and VO2max measures was observed over time for both sexes across the lifetime, and season of testing did not affect changes in strength from baseline to 6 month testing. Repeating a second familiarization after a 6-month time period may not be necessary.

2416 Board #91 May 31 2:00 PM - 3:30 PM
A Simplified Approach For Estimating VT And RCT
Giancarlo Condello, Ezekiel Reynolds, Aimée Schneider, Erica Wherry, Megan Knutsen, Erika Casolino, Scott Doberstein, Mark Gibson, Jos J. de Koning, FACSM, Carl Foster, FACSM. University of Wisconsin-La Crosse, La Crosse, WI.

Determining absolute values for training intensity (e.g. running speed) often requires extensive laboratory evaluation that is not widely available or practical beyond the setting of elite athletes.

PURPOSE: This study evaluates whether physiologic thresholds, useful for training prescription (ventilatory threshold (VT) & respiratory compensation threshold (RCT)), can be determined as simple percentages of maximal running velocity during an incremental treadmill test.

METHODS: Thirty-one physically active students (16 male: age 22.5 ± 2.2y, height 183 ± 5cm, weight 81.9 ± 11.1kg, VO2max 59.3 ± 8 ml·kg⁻¹·min⁻¹; 15 female: age 21.8 ± 2.5y, height 163 ± 6cm, weight 61.8 ± 7.8kg, VO2max 50.6 ± 4.4 ml·kg⁻¹·min⁻¹) performed incremental, maximal treadmill running (1% grade, start @ 5 km·h⁻¹ for 3 min @ 0.8 km·h⁻¹ every minute) with respiratory metabolism measured using open circuit spirometry. In stages where 1 min was not completed, maximal speed was interpolated based on proportional stage time. The speed at VT and RCT were determined by visual inspection of each individual test.

RESULTS: The mean ± sd maximal running speed for all subjects combined was 15.4 ± 2.1 km·h⁻¹. The mean ± sd running speed at VT (10.1 ± 1.6 km·h⁻¹) and RCT (12.9 ± 1.8 km·h⁻¹) represented 67 ± 9 and 84 ± 6 % of maximal running speed, respectively. Using lower and upper 95% confidence intervals for VT and RCT, respectively, 26%4% and 28%6% of maximal speed should produce conditions consistent with <VT and >RCT.

CONCLUSIONS: The VT and RCT can be predicted from simple percentages of the maximal running speed with reasonably accuracy, and may provide a simplified method of training prescription.
compared to level walking, the intensity when holding the rails on an incline is not as great compared to incline walking without the rails.

Level and inclined treadmill walking is a common form of exercise in the home and at fitness centers. While rails (handrails) are available for balance purposes when walking on a treadmill, exercisers will often use the rails as supports, most noticeably when walking on an incline.

CONCLUSION: Using the rail as a support may be beneficial with the use of an incline when greater workloads are warranted and an increase in speed is not desired. Handrail use while walking on an incline will result in a lowered metabolic response compared to not holding the rail. While greater intensity can be achieved with holding the handrail during incline walking compared to level walking, the intensity when holding the rails on an incline is not as great compared to incline walking without the rails.

PURPOSE: To compare the effect of capillary blood sampling on peak oxygen consumption (VO2 peak; l·min⁻¹), heart rate at VO2 peak (HRpeak; b·min⁻¹), Total Cycle Time (TCT;min), and Ventilatory breakpoint (Vvt) during a load incremented cycle protocol.

METHODS: Eleven males (22.9±3.4 years), and ten females (22.1±2.7 years) performed two load incremented cycle ergometer tests (Trial A and Trial B) to obtain VO2 peak(l·min⁻¹), Ventilation (Ve; l·min⁻¹), VCO2 (l·min⁻¹), VO2 (l·min⁻¹), and HR (b·min⁻¹) were recorded each min. The Vpt was determined as the %VO2peak at which Ve:VO2 increased without an increase in energy expenditure.

RESULTS: Level walking resulted in significantly lower responses compared to graded walking while holding the rails for heart rate (119.6±20.6 vs 140.6±22.9 b/min, p<.05), VO2 (19.6±3.6 vs 25.6±3.5 ml/kg/min, p<.05), and RPE (9.6±2.1 vs 11.9±2.4, p<.05). Likewise, graded walking while holding the rails resulted in significantly lower responses compared to graded walking without holding the rails for heart rate (119.6±20.6 vs 140.6±22.9 b/min, p<.05), VO2 (19.6±3.6 vs 25.6±3.5 ml/kg/min, p<.05), and RPE (9.6±2.1 vs 11.9±2.4, p<.05).

CONCLUSION: Capillary blood sampling does not appear to adversely influence aerobic fitness variables during exercise testing. This finding supports incorporating capillary blood sampling into exercise testing protocols.

Aerobic Performance Recovers Within One Week After Blood Donation, With or Without Iron Supplementation

Joel R. Krentz, Tyler B. Judd, Philip D. Chilibeck. University of Saskatchewan, Saskatoon, SK, Canada.

PURPOSE: To examine the effects of iron supplementation on recovery of aerobic performance and red blood cell components after blood donation.

METHODS: 8 subjects (6 males, 2 females, 36 y, peak aerobic power 52.7 ml/kg/min) participated in the study. In a counter-balanced double-blind design subjects were randomized to receive either iron (65 mg) or placebo daily after donating blood. Subjects underwent 2 baseline testing days prior to donation. Recovery was monitored 24 hours post-donation and then weekly thereafter for 5 weeks. Exercise consisted of 45 minutes of cycle ergometry at ~50% peak work rate immediately followed by a 5 km time trial. At each time point pre-exercise hemoglobin and hematocrit levels were measured and ratings of perceived exertion (RPE) were taken at the 15, 30, 45 minute points of the pre-time trial exercise bout.

RESULTS: There were time main effects for both time trial performance and hemoglobin values (p<0.05). Post hoc analysis revealed that performance of the pre-time trial was 5.5% slower the day after donation compared to baseline (417 SD 42 s vs. 395 SD 31 s; p<0.01) but then recovered by week 1 (406 SD 37 s). Hemoglobin decreased after donation (baseline = 15.4 SD 0.9 g/dL; 1 day after donation = 13.8 SD 1.1 g/dL; p<0.05) and never recovered to pre-donation levels (13.3 SD 1.4 g/dL at 5 weeks). There was a time main effect of “time of exercise” for RPE with values increasing as exercise duration increased (p<0.001). No significant group by time interactions were observed for any of the measures.

CONCLUSION: Aerobic performance is significantly reduced the day after blood donation but recovers within one week, even in the absence of hemoglobin recovery. Iron supplementation does not affect aerobic performance or blood component recovery after donation.

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2420 Board #95  MAY 31  2:00 PM - 3:30 PM
Total Hemoglobin Mass, Erythrocyte Volume and VO2max in Overweight and Normal Weight Healthy Subjects

(No relationships reported)

Endurance athletes have significantly higher hemoglobin mass than recreational athletes and total hemoglobin mass correlates well with maximal oxygen uptake (VO2max). Less data is available on total hemoglobin mass in inactive overweight subjects.

PURPOSE: In a cross sectional study compare total hemoglobin mass, erythrocyte volume and VO2max between overweight and normal weight subjects.

METHODS: In 20 physically inactive overweight subjects (12 women/8men, age 41 ± 9 Yr, BMI 30 ± 3), and 20 normal weight subjects (12 women/8 men, age 40 ± 15 Yr, BMI 23 ± 3), total hemoglobin mass and erythrocyte volume was measured with the improved CO-rebreathing method. Maximal oxygen consumption was measured in all subjects with an individualized ramp protocol to exhaustion.

RESULTS: Total hemoglobin mass was 758 ± 159 g and 736 ± 199 g in overweight compared to normal weight subjects respectively (n.s.). Total erythrocyte volume was 2.24 ± 0.44 L and 2.16 ± 0.56 L in overweight compared to normal weight subjects respectively (n.s.). Relative haemoglobin mass and erythrocyte volume was significantly reduced in overweight subjects compared with normal weight subjects. As the mean body weight in the overweight group was 20 kg greater than in the normal weight group relative hemoglobin mass was lower in overweight versus normal weight subjects (8.5 ± 1.5 g · kg⁻¹ and 10.4 ± 1.5 g · kg⁻¹ (p = 0.001)), and relative erythrocyte volume was lower in overweight versus normal weight subjects (25.1 ± 4.0 ml · kg⁻¹ and 30.8 ± 3.7 ml · kg⁻¹ (p = 0.001)). Absolute VO2max (L · min⁻¹) was not significantly different between the two groups, while relative VO2max was significantly reduced in the overweight subjects versus in the normal weight subjects (36.3 ± 6.9 ml · kg · min⁻¹ and 50.0 ± 9.0 ml · kg · min⁻¹). Total hemoglobin mass was significantly correlated with absolute VO2max (r = 0.807, p = 0.001) in the measured subjects.

CONCLUSIONS: Total hemoglobin mass and erythrocyte volume was identical in overweight and normal weight subjects, and was within the expected range for untrained subjects. Relative hemoglobin mass, erythrocyte volume and VO2max was reduced in the overweight subjects due to 20 kg larger body weight compared to the normal weight subjects. Reduced relative VO2max is unrelated to total haemoglobin mass in overweight inactive subjects.

2421 Board #96  MAY 31  2:00 PM - 3:30 PM
Maximal Physiologic And Kinematic Parameters During Partial Weight Unloading Treadmill Testing
Boris Gojanovic, Phil Cutti, Rebecca Shultz, Gordon O. Matheson. Stanford University, Stanford, CA.

(No relationships reported)

PURPOSE: This study investigated maximal cardio-metabolic stimulation while running in a lower body positive pressure treadmill (AG), that reduces body weight (BW) and impact. The AG allows reduction of BW down to 20% and is used in rehabilitation of musculoskeletal injuries, but could have potential for high speed running in healthy athletes, especially if workload can remain maximally elevated at high speeds.

METHODS: 14 trained (9 male) runners (age 27 (5), 10k personal best 38.1 (1.1) min) completed a classical short 10 to 15 minutes treadmill incremental test (CON) to measure aerobic capacity and heart rate (VO2max and HRmax). They completed 4 identical tests (48 hours apart) on the AG at BW of 100%, 95%, 90% and 85% (AG100 to AG85). Stride length (SL) and rate (SR) were measured at peak velocities (Vpeak) by high-speed video analysis.

RESULTS: VO2max (ml · kg⁻¹ · min⁻¹) was similar across all conditions (Men: CON=66.6 (3.0), AG100=65.5 (4.0), AG95=65.0 (5.4), AG90=65.6 (4.5) and AG85=65.0 (4.8). Women: CON=63.0 (4.6), AG100=61.3 (4.3), AG90=60.6 (4.7), AG90=61.4 (3.3) and AG85=62.8 (3.9)). Similar results were found for HRmax, excepted AG85 in men, AG100 and AG90 in women which were lower than CON. Vpeak (km · h⁻¹) in men was 19.7 (0.9) in CON, which was lower than every other condition: AG100=21.0 (1.9) (p<0.05), AG95=21.1 (1.8) (p<0.01), AG90=22.3 (2.1) (p<0.01) and AG85=22.6 (1.6) (p<0.001). In women Vpeak (km · h⁻¹) was similar between CON (17.3 (1.1)) and AG100 (19.3 (1.0)), but higher at AG95=19.5 (0.4) (p<0.005), AG90=19.5 (0.8) (p<0.005) and AG85=21.2 (0.9) (p=0.01). SL increased with the higher speeds in men, from CON=98.5 (5.3), AG100=99.6 (6.5), AG95=99.6 (6.2), AG90=99.1 (4.9) and AG85=100.8 (4.9). Only SL increased in women with higher speeds.

CONCLUSIONS: The AG can be used to elicit maximal exercise intensities at BW of 85 to 95%, reaching faster running speeds than normally feasible, and higher stride rate in men only. This could be potentially used for overspeed training in distance runners. The AG can help maintain aerobic conditioning during rehabilitation at lower BW.

2422 Board #97  MAY 31  2:00 PM - 3:30 PM
Assessment Of Carotid Versus Radial Heart Rate Palpation Accuracy Following A Submaximal 3-min Step Test
Nathan C. Winn, Andy Bosak, Thomas Andre, Felisa Glover, David Porley. Georgia Southwestern State University, Americus, GA.

(No relationships reported)

Previous studies have evaluated the accuracy of subjects palpating their carotid heart rate (HR) post-submaximal exercise. But, very few studies have assessed the accuracy of palpating HR at different artery sites. Post-exercise recovery HR palpation is a critical and symbiotic relationship with step tests and accurate palpation of post exercise recovery HR is extremely important for more precise exercise prescription.

PURPOSE: To evaluate subjects’ ability to accurately palpate their step test post-exercise recovery HR at the carotid and radial sites.

METHODS: Above averagely fit male subjects (n = 31) were connected to an Electrocardiogram (EKG) and completed two 3-min step tests at a cadence of 24 steps/min, separated by 48-72 hours, in a counterbalanced order. Upon completion of stepping activity, subjects palpated their HR at the carotid and/or radial sites within 5 secs and then counted their post-exercise recovery HR for the next 15 secs.

RESULTS: The post-exercise EKG HR (CARkeg and RADekg) was compared with their respective post-exercise recovery palpated carotid (CARpal) and radial (RADpal) HR using MANOVA statistical methods with significant differences considered at p ≤ 0.05. Differences between CARkeg vs CARpal and RADekg vs RADpal were significant.

CONCLUSIONS: Despite the results suggesting that subjects palpated their CARpal (± 2.48 bbs off) more accurately than RADpal (± 4.12 bbs off), subjects were not 100% accurate at palpating their post-exercise recovery HR when compared to the post-exercise HR EKG recording. Future research may be required to determine whether longer familiarization trials of pre-exercise HR palpation are needed to ensure greater accuracy in palpating post exercise recovery HR.

2423 Board #98  MAY 31  2:00 PM - 3:30 PM
Metabolic And Hormonal Responses To Modality Of Exercise And Sequence Of Aerobic And Resistance Exercise In College Aged-women
Dong-Ho Park1, Do-Yun Kim2, Chang-Sun Kim2, 1Inha University, Incheon, Korea, Republic of. 2Dongduk Women's University, Seoul, Korea, Republic of.

(No relationships reported)

PURPOSE: This study compared the effects of 4 different exercise programs [Aerobic exercise only (A), Resistance exercise only (R), Aerobic-Resistance exercise (A-R), and Resistance-Aerobic exercise (R-A)] on metabolic factors and hormones in untrained college aged-women.

METHODS: Eight females (18.5±0.76 years) completed Aerobic exercise Only (A, 65% VO2max), Resistance exercise only (R, 65% of 1-RM with an isometric rest period of 105s), Aerobic-Resistance exercise (A-R), and Resistance-Aerobic exercise (R-A) experimental conditions. Aerobic exercise consisted of 25 minutes of treadmill exercise. VO2 was determined during treadmill exercise and after each exercise treatment. Resistance exercise consisted of 7 lifts with 3 sets. Blood was obtained pre-, post-, 30 min after- and 60 min after exercise.

RESULTS: There were significant interaction effects on Growth hormone (p<0.05), cortisol (p<0.01) and testosterone (p<0.007) by exercise mode (R and A) and exercise sequence (A-R and R-A). No significant difference was seen in the levels of estradiol between exercise mode (p>0.01), but just showed the significant increase after R-A exercise (time, p <0.01) which maintained

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the highest concentration among the exercises mode and sequence. Glucose (p = 0.007), free fatty acids (p = 0.000) and lactic acid (p = 0.000) had significant interaction effect by exercise mode and sequence respectively, especially glucose showed higher concentration of R-A than A-R, but lower than R only at post-exercise. EPOC and RER had significant interaction effects by exercise mode and sequence (p = 0.000 and p = 0.000, respectively), particularly EPOC in R-A was higher than R only and A-R (p = 0.014, p = 0.000, respectively). During R-A, rating of perceived exertion (RPE) during treadmill exercise was significantly increased (p = 0.001) above that of A-R and A only.

CONCLUSIONS: Either aerobic or resistance exercise alone increases the levels of estradiol and testosterone, but the increases are greatest with R-A exercise. Therefore, the R-A exercise might be more beneficial to increase bone density by the secretions of estradiol and testosterone, whereas the A-R exercise might be suitable for elderly people or a beginner because of relatively lower exercise intensity in regard to the RPE.

2424  Board #99  MAY 31  2:00 PM - 3:30 PM  
Combining Heart Rate And Accelerometer Data To Estimate Physical Fitness  
No relationships reported  

Monitoring changes in physical fitness is relevant in many conditions and groups of patients, but its estimation demands substantial effort from the person, personnel and equipment. Besides that, present (sub)maximal exercise tests give a momentary fitness score, which depends on many (external) factors. Obtaining a fitness score based on measures gathered during longer periods of time and in natural conditions, like in daily life, would be an attractive alternative for the present methods. We performed an explorative lab-experiment to study the feasibility of fitness estimation during an activity commonly encountered in daily life: walking.

PURPOSE: To investigate the feasibility of physical fitness estimation from combined heart rate and accelerometer data obtained during treadmill walking.

METHODS: Forty-one subjects (23m, 18f) aged between 21 and 29 walked at three speeds on a treadmill (4, 5.5 and 6 kmh⁻¹) wearing a heart rate monitor and a hip mounted 3D accelerometer. The acceleration signal was converted into activity counts per 10 seconds. Stepwise linear regression analysis to estimate VO₂max was performed on the slope and intercept of the linear relation between heart rate and activity counts during steady state exercise (> 3min), together with gender, weight, length and BMI. Reference VO₂max was obtained by performing a sub-maximal single stage treadmill walking test.

RESULTS: The model with the highest percentage of explained variance (R²=0.93) combined the slope and intercept parameter of the relation between heart rate and activity counts, together with gender. The model had a standard error of the estimate of 1.78 ml O₂kg⁻¹min⁻¹.

CONCLUSION: Results of the model are comparable with commonly used sub-maximal laboratory tests to estimate VO₂max. Fusing heart rate and accelerometer data during steady state activities seems promising for ambulant estimation of VO₂max and would not require the subject to carry out a high performance test.

This research was supported by the Dutch Alpe d’HuZes foundation.

2425  Board #100  MAY 31  2:00 PM - 3:30 PM  
Effects of Time of Day for Exercise on 24-hour Ambulatory Blood Pressure in Normotensive Female Adults  
Chia-Hua Chau, Chien-Yu Pan. National Kaohsiung Normal University, Kaohsiung, Taiwan.  
No relationships reported  

Time of day for exercise may influence blood pressure reduction in hypertensives because of the diurnal variation of blood pressure and the duration of blood pressure reduction following a single bout of exercise (Park, Jastremski, & Wallace, 2005). However, knowledge about the response of blood pressure following at different time of day for exercise is limited and often were not be disclosed by study investigators.

PURPOSE: To compare different time of day for aerobic exercise on 24-hour ambulatory blood pressure (ABP) in normotensive female adults.

METHODS: Fifteen nonobese (BMI 23.07 ± 3.38 kg·m⁻²) and normotensive middle-aged women (45.40 ± 5.40 years) volunteered to participate. They underwent a single bout of aerobic exercise (30 min, 60% heart rate reserve) 2 times in random fashion on separate days: (a) in the morning (between 0630-0800 hours, AMex), (b) in the afternoon (between 1630-1800 hours, PMex), and (c) a control (no exercise) session. Each participant’s 24-hour ABP was measured after AMex, PMex, and control treatments using SpaceLabs model 90217. The dependent variables used for analysis were average 24-hour, daytime, and night time blood pressure. A repeated measure analysis of variance (ANOVA) was used to assess the effect of varied time of day for aerobic exercise on 24-hour ABP. In the case of a significant F-value, a Tukey post hoc test was used to identify differences under various time of day.

RESULTS: The 24-hour systolic (SBP), diastolic (DBP), mean arterial blood pressure (MAP) and daytime SBP were significantly lower after PMex than after AMex and control sessions (all p<0.05). After PMex, 24-hour SBP was reduced an average of 4.46 ± 2.86 and DBP by 2.6 ± 0.4 mmHg; and daytime SBP by 3.1 ± 0.2 mmHg.

CONCLUSION: The post-exercise ABP reduction observed in normotensive middle-aged women depends on time of day for exercise; that is, the PMex significantly decreased daytime and 24-hour ABP. Supported by Taiwan NSC grants 99-2410-H-017-035.

2426  Board #101  MAY 31  2:00 PM - 3:30 PM  
A New Method For Determining Exercise Intensity To Meet Cardiovascular Needs  
Ronald Gainer, Jessica Gengler, Brandon Lynn, Jeremy Rindlisbacher, Cassidy Robertson, Natalie Schreher, Eli Lankford. 1Utah State University, Logan, UT.  
2BYU-Idaho, Rexburg, ID.  
No relationships reported  

PURPOSE: The purpose of the study was to determine whether work at lactate threshold (LT) or ventilatory threshold (VT) is optimal for improvements in cardiovascular fitness.

METHODS: 27 college-aged students (7 females, 20 males) participated in the study. Subjects were separated into groups based on fitness levels, sedentary (SED), average (AVG) and fit (FIT). Subjects participated in a graded exercise test (GXT) to determine LT followed by a VO₂max test. VO₂ at LT was used to determine work rate for a final run where time to exhaustion (TTE) was recorded.

RESULTS: No differences (p = 0.079) in TTE were found between groups SED, AVG, and FIT, therefore all groups were combined for further analysis. TTE = 33.96 ± 10.97 min; HR at LT =167.77 ± 9.12 bpm; RPE at LT = 13.19 ± 1.46; VO₂max = 53.35 ± 7.67 ml/kg/min; 1; O₂ at LT = 39.46 ± 6.02; ml/kg/min-1. Percent VO₂max at LT = 74.04 ± 5.26% TTE was not related to VO₂max (p = 0.9; r = 0.009). Additionally, TTE was not related to VO₂at LT (p = 0.24; r = 0.06). The study determined no correlation between TTE and fitness level measured as both VO₂max, and VO₂ at LT.

CONCLUSIONS: General guidelines typically recommend between 30-60 min of exercise most days of the week. Other guidelines use RPE, % VO₂max, or HR to determine exercise intensity. The varying recommendations can cause confusion as to proper exercise prescription. We found that by exercising at LT, total exercise time fell within the recommended guidelines of the ACSM and the CDC for both duration and intensity. Exercise at LT or VT fell within the recommended guidelines for duration of exercise regardless of fitness level. We recommend using LT or VT as the guideline for determining exercise intensity.
PURPOSE: The purpose of the present investigation was to examine the ratio between total accumulated CO₂ expiration and O₂ consumption and examine the relationship to VO₂ at the point of test termination or oxygen consumption plateau.

METHODS: Twenty male (age: 20.0±1.0yrs, weight: 71.3±9.7kg, VO₂max: 56.6±8.6 ml O₂/kg*min) and eighteen female (age: 21.1±0.6yrs, weight: 55.8±7.2kg, VO₂max: 44.8±9.9 ml O₂/kg*min) college aged students who were recreationally active volunteered for the present investigation. The participant underwent a custom ramped treadmill protocol with expiratory gases monitored via computerized metabolic measurement system. After the testing third order polynomial regression was undertaken for the VO₂ and VCO₂ by time (r=0.95). Regression equations were then integrated from 60seconds after the start of the test (to negate any initial hyperventilation) until the point at which maximum oxygen consumption was determined to have occurred. This area under the curve calculation was equal to the total accumulated expired CO₂ and consumed O₂ during this time period. The values for carbon dioxide were then divided by the values for Oxygen and a ratio score was created (AOC ratio). This ratio was then compared against the results of the VO₂ max test.

RESULTS: Data analysis examining the relationship between the AOC ratio and VO₂ max was undertaken utilizing partial correlation analysis (controlled for gender). The results of the analysis showed a significant negative correlation between AOC ratio and VO₂ max (r=-0.602, p<0.001).

CONCLUSION: Based upon these results it would appear that during the course of the test of maximum aerobic capacity, individual who are more fit produce less carbon dioxide over the course of the test per unit of oxygen utilized.

D-22 Free Communication/Poster - Health Equity
MAY 31, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2428 Board #103 MAY 31 3:30 PM - 5:00 PM
Does Physical Activity Explain Racial/Ethnic Differences in Cardiorespiratory Fitness among Young U.S. Adults?
Tyrone Ceaser, Eugene Fitzhugh, Dixie Thompson, FACSM. University of Tennessee-Knoxville, Knoxville, TN.
(No relationships reported)

PURPOSE: Cardiorespiratory fitness (CRF), an outcome of regular physical activity (PA), decreases the risk of heart disease in adults. Expressed as maximal oxygen uptake (VO₂max), previous research has shown differences in CRF levels among racial/ethnic groups. However, it is unclear how much of these differences in fitness can be explained by physical activity. Thus, we sought to answer this question.

METHODS: A total of 3115 adults (18-49 years) completed a submaximal graded treadmill exercise test from NHANES (1999-2004) to estimate VO₂max, the dependent measure. Independent variables included demographics (race, education, gender, partner status, and waist circumference), behavioral measures (smoking and alcohol consumption), self-reported PA from three different domains: leisure-time, domestic, and transportational PA (MET-min/week), and the proportion of PA of a vigorous intensity (VMET). Multiple linear regression was performed using SUDAN statistical software.

RESULTS: Results indicated that VO₂max was significantly higher for Mexican Americans (40.9 ± 0.5 ml/kg/min), and Non-Hispanic Whites (40.2 ± 0.3 ml/kg/min) compared to non-Hispanic Blacks (37.9 ± 0.6 ml/kg/min) (P = 0.01). Demographics including race explained 18.5% of the variance in VO₂max, with race being significant (P = 0.01) in the model. When PA was added to the model, the variance in VO₂max explained increased by 0.8% to 19.3% (P = 0.001). VMET was more predictive of VO₂max than overall PA, and the model including VMET explained 20.5% of the variance in VO₂max. Race remained a significant, independent predictor of VO₂max after VMET and overall PA were added to the model.

CONCLUSIONS: Race and VMET are important factors in explaining differences in CRF. However, after accounting for demographics, PA, and VMET, a large proportion of the variance in CRF remains unexplained by the models. This suggests that other factors should also be considered when examining racial/ethnic differences in CRF.

2429 Board #104 MAY 31 3:30 PM - 5:00 PM
Comparing Levels of Anti-Fat Bias Between Mexican and American Athletes and Undergraduate Physical Education and Exercise Science Students
Miriam M. Wood, James R. Whitehead, FACSM, Sandra E. Short, Martin Short. University of North Dakota, Grand Forks, ND.
(No relationships reported)

Anti-fat bias is “an obesity prejudice in which the attribute of being obese influences the expectations about the individuals, often in terms of negative character assessment such as laziness, lack of discipline, and incompetence” (Puhl & Brownell, 2001) displayed either in an implicit or explicit way. Anti-fat bias is “an obesity prejudice in which the attribute of being obese influences the expectations about the individuals, often in terms of negative character assessment such as laziness, lack of discipline, and incompetence” (Puhl & Brownell, 2001) displayed either in an implicit or explicit way. The present study compared anti-fat bias ratings between American and Mexican athletes and undergraduate physical education and exercise science students (a replication and extension of Chambers et al., 2004). It also investigated the possible threat of socially desirable response tendencies are threat to the validity of the explicit anti-fat bias measure.

METHODS: Students from the US (n = 63) and Mexico (n = 40) and Mexican athletes (n = 15) filled out questionnaires to investigate their levels of anti-fat bias (Implicit Association Test (IAT)) and Anti-fat Attitudes Test (AFAT). The IAT was used to measure socially desirable response tendencies, the AFAT was used to measure socially desirable response tendencies.

RESULTS: for the AFAT, there were no statistically significant differences between the Mexican and American students. On the IAT, when good vs. bad was paired with thin vs. fat, there was an effect revealing that American students scored higher than Mexican students (M = 4.68 vs. 2.63, p < .01). Similarly, when smart vs. stupid was linked to thin vs. fat the results revealed that the Mexican students (M = 6.76) scored higher (p < .001) than the Mexican athletes (M = 4.08) and significantly higher (p < .05) than the American students (M = 3.62), and when motivated-lazy was paired with fat vs. thin, there was a significant interaction effect (F [2, 111] = 3.66, p < .05). Most IAT sub-sample scores were significantly different from zero indicating implicit anti-fat bias. There were no significant correlations between the IAT and IAT-AFAT. Only 6% of the variance in the AFAT items was explained by socially desirable response tendency, indicating no substantive threat to validity.

CONCLUSION: the results suggested that anti-fat bias is an issue with future exercise science professionals, and thus, further research on incidence levels and prevention strategies is warranted. Also, given the lack of association between measurement methods, further research should investigate if implicit bias does, or does not affect an individual’s explicit bias.

2430 Board #105 MAY 31 3:30 PM - 5:00 PM
Understanding Cultural Perspectives On Physical Activity Among Older Mexican Women Through Visual Research Methods
Andiara Schwingle, Wojtek Chodzko-Zajko, FACSM, Salva Najib. University of Illinois at Urbana Champaign, Champaign, IL.
(No relationships reported)

Older Latina women are a particularly vulnerable group for physical inactivity for whom public health messages and interventions appear to be less effective.

PURPOSE: The purpose of this study was to evaluate the benefits of using visual and participatory research techniques with this population.

METHODS: Perceptions of physical activity were assessed using a visual research method known as photo-elicitation from a sample of 37 older women of Mexican background living in Illinois.

RESULTS: Following analyses of photographs and interviews, we collected a number of prominent themes emerging from the qualitative data. Categorized according to the Social Ecological Model, major themes representing factors that may influence physical activity choices were: (1) Individual Level: health status; beliefs about physical activity, health and wellness; previous physical activity behavior (2) Social Environment: family influence and support; support from social networks and friends; community involvement and activity (3) Physical Environment: availability of physical activity resources and opportunities; weather; neighborhood safety (4) Cultural and Social Norms: cultural values and perceptions on physical activity and being healthy; perceptions on the role of women in the household; the role of religion in everyday life.

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CONCLUSIONS: Findings suggest that this method may be a valuable tool in extracting rich and meaningful data from target audiences while fostering a sense of partnership between researchers and community members. Innovative interdisciplinary research techniques may present improved ways to reach and impact underserved populations.

2431  Board #106  MAY 31  3:30 PM - 5:00 PM
Development And Evaluation Of A Culturally-responsive Fitness Instructor Training Program For Underserved Latinos.
(No relationships reported)
Few opportunities exist for Spanish-speaking community members to become certified exercise and fitness professionals.

PURPOSE: Adapt, implement and evaluate a culturally-responsive, Spanish-language training program for community members to become certified fitness instructors.

METHODS: A print-based English-language self study course for group fitness instructors (the ACE® Group Fitness Instructor self study course) was culturally adapted using principles of Culturally Responsive Teaching for delivery as a Spanish-language, 14-week face-to-face course. Bilingual, bicultural exercise scientists and group fitness instructors were part of the expert panel that completed the cultural adaption of the curriculum. Live training was delivered by public health background certified fitness professionals.

RESULTS: The 14-week training program comprised of 4 distinct modules with pedagogical emphasis on diverse instructional strategies such as lecture, small class discussion, case studies, role playing, peer mentoring, and shadowing. Twenty-seven Spanish-speaking community members were recruited to a training Academy (Academia Fit) for Latino fitness professionals. Twenty-six participants (mean age = 40 yr, 70% female) completed the 14-week course with a mean training exposure of 104.5 hours (± 35.97) per candidate (54% in class). Eighteen candidates sat the certification exam, with a pass-rate of 61% (37% first time). Adherence to training was 87% (% classes attended), and a mean of 3.57 (±2.8) hours per week was reported as self-study outside of class, 60% of that recommended by the instructor. After adjusting for age and education level, the correlation between attendance (# classes attended) and out-of-class study time with exam score was r = 0.19 and r = 0.63, respectively.

CONCLUSION: A culturally responsive Spanish-language training program that helps Latino community members become certified fitness professionals helps build capacity to offer culturally sensitive quality opportunities for physical activity.

Funded by research grant (1R18DP002138-01) from Centers for Disease Control and Prevention.

D-23  Free Communication/Poster - Landing, Jumping, Cutting
MAY 31, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2432  Board #107  MAY 31  3:30 PM - 5:00 PM
The Effects of Hydration and Fatigue in Mild and Hot Environments on Landing Technique
Jessica C. Martinez, Lindsay J. DiStefano, Rachel Kardo, Megan VanSumeren, Robert A. Huggins, Rebecca L. Stearns, Julie K. DeMartini, Carl M. Maresh, FACSM, Douglas J. Casa, FACSM. University of Connecticut, Storrs, CT.
(No relationships reported)

Improper landing technique increases the risk of lower extremity injury. Fatigue has been shown to impair landing technique but it is unknown if hypohydration and hyperthermia have a similar negative effect.

PURPOSE: To examine the effects of hydration and fatigue in mild and hot environments on landing technique.

METHODS: Twelve healthy, physically active males (age=20±2 yrs, height=182±8 cm, body mass=74±8.2 kg, body fat=9±3%, VO2max = 57.0 ± 6.0 mL·kg⁻¹·min⁻¹) completed 4 test sessions in randomized hydration and environmental conditions: Euthydrated Temperate (EUT), Euthydrated Hot (EUH), Hypohydrated Temperate (HYT), Hypohydrated Hot (HYH). Temperate and hot condition sessions were performed in 18±0.2ºC, 50±3.5% relative humidity (RH), and 34±0.3ºC, 45±4.5% RH, respectively. Subjects completed a 90-min treadmill exercise protocol wearing a 20.5 kg backpack (5% incline, 1.34-1.78 m·s⁻¹). Landing technique was evaluated 3 times a session (before exercise (PRE), after exercise (POST), after 60-min recovery session (REC)). One rater evaluated the landings using the Landing Error Scoring System (LESS), which is a valid and reliable movement screening tool. A high LESS score indicates a greater number of errors committed and poor technique. Change scores between time points (PRE, POST, REC) were calculated. Separate within-subjects ANOVAs evaluated differences in LESS change scores (POST-PRE, PRE-REC, REC-POST) between conditions.

RESULTS: Body mass loss differed across sessions (HYT=-3.80 ± 1.22%, HYH=-5.66 ± 1.57%, EUT=-0.10 ± 0.90%, EUH=-1.30 ± 0.85%). HYH (POST-PRE Change Score: 0.69, 95% CI: 0.13, 1.26) resulted in a greater increase in LESS scores between PRE and POST than HYT (-0.19, 95% CI: -0.55, 0.16), EUH (-0.56, 95% CI: -1.15, 0.02), EUT (-0.03, 95% CI: -0.60, 0.54)(p=0.002). HYH (REC-PRE Change Score: 0.67, 95% CI: 0.21, 1.13) also resulted in a greater increase in LESS scores between PRE and REC than HYT (0.03, 95% CI: -0.53, 0.48), EUH (-0.31, 95% CI: -0.93, 0.31), EUT (+0.67, 95% CI: -1.08, -0.25)(p=0.001),

CONCLUSION: Landing technique is impaired when an individual is hypohydrated and in a hyperthermic environment, regardless of acute fatigue. Hypohydration in hot environments needs to be prevented to protect individuals from a possible increase in lower extremity injury risk.

2433  Board #108  MAY 31  3:30 PM - 5:00 PM
Leg Extension Strength Effects Plantar Loads While Landing from a Drop Jump
David Hudson, Chris Wilson, Lauren Parker, Mary Ann Pascutti. Western Carolina University, Cullowhee, NC.
(No relationships reported)

PURPOSE: To determine if there are differences in structure and function in the lower limb among groups that land plantar force more medially, centrally, or laterally when landing form a drop jump.

METHODS: A pedobarograph mat measured the force under the right foot of thirty-three subjects when landing from a 30cm drop jump. Proprietary software was used to extract data for 15 frames before and 15 frames after the peak vertical force. The pressure map was then divided into medial and lateral halves; a Plantar Force Index (PFI) was calculated from the ratio: medial force / whole force. Each subject was also measured for the following structural and functional measurements: calcaneal eversion excursion (subtalar joint neutral to relaxed standing); navicular drop normalized to foot length; knee valgus; hip depth normalized to body height; repetitions of single leg squats and calf raises performed in 30 seconds. Subject data were stratified into three groups based on PFI (lateral pressure, mid-pressure, and medial pressure). A MANOVA with Tukey’s post-hoc test was used to determine if differences existed among the three groups for the variables measured.

RESULTS: Significant differences were found in the PFI among all three groups (lateral pressure: 46.3%; mid-pressure 53.1%; medial pressure 60.2%; p ≤ 0.001). Compared to subjects that landed with more medial pressure, subjects that loaded the foot more laterally had significantly greater normalized hip depth (13.2% vs. 10.6%; p ≤ 0.03) and were able to perform significantly more repetitions of squats (38.6 vs. 31.2; p < 0.03).

CONCLUSIONS: Subjects with greater strength in the large lower limb extensors and greater gluteal size landed more laterally on the foot, which was interpreted as a more stable landing pattern than landing those that landed more medially. These results indicate that proximal strengthening should be part of the management of hyperpronation.
Noncontact anterior cruciate ligament (ACL) injuries have been reported to occur with the ankle in a dorsiflexed position (rearfoot landing) during cutting maneuvers. Few studies have attempted to quantify the knee position and loading during a cutting task when performed with different landing techniques.

PURPOSE: To evaluate the effects of two landing techniques (rearfoot and forefoot) on lower extremity biomechanics while performing a sidestep cutting task (SS).

METHODS: Lower extremity biomechanics of nineteen healthy female collegiate soccer athletes (20±0.9 years; 1.67±0.1m; 63.2±10.1kg) were obtained while performing a SS with forefoot (FF) and rearfoot (RF) landing techniques. Subjects performed five trials of each landing technique which were verified by video and counterbalanced between subjects. Kinematic measures of the lower extremity were captured using an eight-camera high-speed motion capture system, and ground reaction force data were obtained through two force plates sampling at 500 Hz. Repeated measures ANOVAs were conducted to assess differences between foot-landing techniques in knee flexion and abduction angles and moments at initial contact and peak stance. Alpha level set a priori at $\alpha<0.05$.

RESULTS: Knee flexion (KF) angle at initial contact was higher for FF (42±10º) than RF (-33±6º, $p<0.05$). The knee was in a more abducted position with the RF (-3±9º) than with the FF (-6±11º, $p<0.05$), and had a higher adductor moment with the FF (0.03±0.01Nm/kgm) than with the RF (0.001±0.03Nm/kgm). At peak stance, KF was significantly higher for the RF than FF (-56±5º vs. -53.7±7º, $p<0.05$). No significant difference was found for knee abduction angle and adductor moment at peak stance between landing techniques ($p>0.05$).

CONCLUSION: There are essential differences in lower extremity biomechanics between landing techniques. The rearfoot landing technique increasingly affects knee position and loading at initial contact (e.g., less flexion, greater abduction angle and moment), which can potentially place a higher strain on the ACL. This study supports the observational findings that rearfoot landing technique may increase the likelihood of ACL injury. Intervention programs should address foot-landing technique as a preventive measure to decrease ACL loading.

Influence of Hip Strength and Flexibility on Qualitative Jump-Landing Performance in Adolescent Males and Females

Michelle C. Boling1, Anh-Dung Nguyen2, Bernadette Buckly1, Lindsay J. DiStefano1. 1University of North Florida, Jacksonville, FL. 2College of Charleston, Charleston, SC. 3University of Connecticut, Storrs, CT. (Sponsor: Kevin Guskewicz, FACSM)

PURPOSE: To determine the influence of hip muscle strength and flexibility on qualitative jump-landing performance in adolescent males and females.

METHODS: Fifty-four (27 females, 27 males; 161±1yrs, 64±12kg, 172±11cm) adolescent athletes participated in this investigation. Frontal and sagittal plane views were recorded with video cameras as participants performed three trials of a jump-landing task. Isometric strength of the hip abductors, extensors, internal rotators, and external rotators was assessed over two trials using a hand-held dynamometer. Hip abduction, internal rotation, and external rotation range of motion (ROM) were assessed with a digital inclinometer over three trials. Jump-landing trials were later evaluated by a trained rater using the Landing Error Scoring System (LESS), a valid and reliable tool for assessing lower extremity movement patterns. The average of total LESS scores (higher score indicates poor jump-landing performance), hip strength (normalized to body mass (%BM)), and hip ROM were used for data analysis. Separate regression analyses were performed to determine the influence of hip strength and ROM on total LESS score in males and females.

RESULTS: Strength and flexibility of the hip musculature did not influence total LESS score in females ($p>0.05$). In males, strength of the hip extensors ($R^2=0.37±0.09$%BM) significantly influenced total LESS score ($R^2=0.53±1.20$) ($R^2=0.16, P<0.04$). No other strength or flexibility measures were found to influence total LESS score in males ($p>0.05$).

CONCLUSION: Decreased strength of the hip extensors appears to influence poor jump-landing performance in adolescent males. The lack of additional significant findings indicates that more research needs to be performed to understand the intrinsic factors influencing lower extremity movement patterns in adolescent males and females.

Residual Compromised Knee Performance During Single Leg Landings in People with ACL Reconstruction

Maggie Dewitz, Caitlin Gollehon, Jenna Kokes, Ryan Mizner. University of Montana, Missoula, MT.

PURPOSE: To identify significant differences between limbs during SLL in active patients who have had unilateral ACLR.

METHODS: Participants included 17 subjects with unilateral ACLR (age= 22±4 years, BMI=24.6 ± 2.5, 7 males) who were physically active (≥4 on the Tegner Physical Activity Scale) and good clinical results (IKDC score ≥85% ± 10.0). Subjects participated in a one-time session where each limb’s performance was analyzed using a 3D Vicon system with force plates during a SLL off a 20 cm platform. The variables of interest included peak knee flexion angle and moment during weight acceptance of landing, peak vertical ground reaction force (VGRF), and the knee’s contribution to the total support moment. The VGRF and joint moments were normalized to body weight. We compared the mean values between limbs using paired t-tests (alpha $p<0.05$).

RESULTS: Peak knee moments were statistically less in the involved (p=0.004, mean=2.53±0.47) compared to the uninvolved limb (mean= 2.81±0.31). The knee’s percentage of the total support moment was significantly less (p=0.003) in the involved limb as well (mean inv=36% ± 5%, mean unin=40% ± 5%). No significant differences were found between limbs in VGRF (p=0.192, mean inv= 3.55±0.29, mean unin= 3.49±0.33) or in peak knee flexion (p=0.081, mean unin=56.61 ± 13.03 mean inv=53.23 ±12.43).

CONCLUSION: There were significant deficits in weight acceptance between limbs during a SLL task in an active population with good clinical outcome scores. Compromised ability to utilize the operated knee to decelerate body weight is concerning in light of the repetitive stresses placed on the limb during these patients’ daily life. The findings of this study have potential implications for the high risk for early degeneration and re-injury.
CONCLUSIONS: These data suggest greater hip strength may decrease knee valgus, but does not contribute to decreased ground reaction forces. Thus other components in landing mechanics may have an effect on ground reaction forces. However, improved hip strength incorporated with neuromuscular training programs may decrease knee valgus loads and likely decrease the risk of ACL injury resulting from poor landing mechanics. Programs emphasizing hip strength should be examined in future research to determine the effect on landing mechanics.

2438 Board #113 MAY 31 3:30 PM - 5:00 PM
Relationship Between Knee Extensor Strength And Knee Angle At Landing: Implications For ACL Injury Risk
Zachary J. Domire, Drutny Okorokov, Katie Hughes. Texas Tech University, Lubbock, TX.
(No relationships reported)

Anterior cruciate ligament (ACL) injury is common, costly, requires a lengthy rehabilitation, and results in increased risk of osteoarthritis. For these reasons, prevention of ACL injury is critical. While the mechanism for non-contact ACL injury is unclear, injuries normally occur with the knee near full extension. Therefore, increasing knee flexion at ground contact may dramatically reduce ACL injury rates. One factor that may contribute to landing with an extended knee is knee extensor weakness, as an extended knee reduces demand on knee extensors.

PURPOSE: To determine the relationship between knee extensor strength and knee flexion angle at landing.

METHODS: Healthy, active participants (10M 11F) were asked to perform landings from 64cm. 3D kinematic data was recorded and knee flexion angle was calculated at the instant of ground contact. Knee extensor strength was measured during landing using 60º/s isokinetic contractions. Correlations were calculated between strength and knee angle at landing.

RESULTS: Strength was significantly related (p<0.05) to knee angle at landing in male subjects. In female subjects a similar trend existed between the two variables. However, the relationship was not significant.

CONCLUSION: A relationship exists between knee extensor strength and knee flexion angle at landing in male subjects. Additional testing is needed to confirm this finding in female subjects. A significant relationship between these variables does not prove a causal relationship. However, knee extensor weakness is a logical cause for landing with an extended knee. If additional testing confirms this relationship, knee extensor strengthening should be tested as a simple intervention for ACL injury prevention.

2439 Board #114 MAY 31 3:30 PM - 5:00 PM
Fear and Muscle Strength are Correlated to Knee Kinetics During Jump Landings after ACL Reconstruction
Jenna Kokes, Caitlin Gollehon, Maggie Dewitz, Alessander D. Santos, Ryan Mizner. University of Montana, Missoula, MT.
(No relationships reported)

Patients with unilateral anterior cruciate ligament reconstruction (ACL-R) can exhibit a hesitancy to accept load through the involved limb that could impact long-term outcomes. Impaired thigh muscle strength, high fear of re-injury, and decreased standing balance can also linger after surgery.

PURPOSE: To assess the interaction between the independent variables of muscle strength, fear of re-injury, and diminished standing balance to the performance variables of the operated knee kinetics during a single leg landing (SLL).

METHODS: Seventeen (7 males) physically active (≥ 4 on Tegner Physical Activity Scale) subjects, ages 16-31 with unilateral ACL-R participated. A one-time testing session was used to assess peak knee flexion moment and the knee’s contributions to the total support moment during the weight acceptance phase of a SLL off a 20 cm platform. A Kin Com dynamometer assessed quadriceps and hamstring strength (MVIC). The ACL-Return to Sport Index (ACL-RSI) questionnaire was completed which quantifies the emotional response to injury (e.g. fear), confidence in the operated knee, and re-injury risk appraisal. Standing balance was quantified using the area contained by the center of pressure during unilateral standing balance. The relationship between the impairments and landing performance was assessed using Pearson Correlation Coefficients (alpha: 0.05).

RESULTS: Quadriceps strength was related to both the knee flexion moment (r=0.57, p<0.018) and the knee’s contribution to the total support moment (r=0.74, p<0.001). The ACL-RSI questionnaire score was significantly correlated to both peak knee flexion moment (r=0.70, p<0.002) and the knee’s contribution to the total support moment (r=0.68, p<0.002). The hamstring muscle strength was only related to the knee’s contribution to the support moment (r=0.69, p=0.002) and the standing balance assessment was not significantly correlated to either knee kinetic assessment (r=0.398, p=0.114).

CONCLUSION: Muscle strength along with fear and a lack of confidence in the operated knee were related to a reduced amount of knee loading during the weight acceptance phase of jump landing. Future assessments should consider both of these variables as part of post-operative care to insure optimal knee performance during jump landing tasks.

2440 Board #115 MAY 31 3:30 PM - 5:00 PM
Landing Patterns in Subjects with Chronic Ankle Instability
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(No relationships reported)

The most common symptoms after ankle sprains were chronic ankle instability, proprioception defect and probable neuromuscular adaptation.

PURPOSE: The purpose of this study was to identify the normal landing pattern using detailed biomechanical analysis including analysis of the kinematics and ground reaction force, and to compare the landing pattern in the subjects with recurrent ankle sprain and normal subjects.

METHODS: 20 male adults were recruited in this study (10 subjects with recurrent lateral ankle sprains group, 10 subjects with normal control group). All subjects would be asked to perform maximal standing jumps and drop landing from 3 platforms with different heights (0.37 m, 0.67 m, & 0.97 m, respectively). Those movements were collected by VICON 512 (Oxford Metrics, UK) motion analysis system and the kinematics was analyzed using self making software with MATLAB. The ground reaction force of both lower limbs was recorded by two AMTI force platforms, and the kinetic data were calculated with inverse dynamics.

RESULTS: In the different landing height, the main differences of kinematics were the maximum flexion angles of hip and knee joints in normal landing patterns and the flexion angles increased with the landing height, as well as the flexion of pelvis, hip abduction, and knee external rotation in the subjects with recurrent ankle sprains. When compare those two groups, the landing pattern in the subjects with recurrent ankle sprain was significant smaller than normal subjects in knee flexion (65.71°±6.43° vs. 70.19°±13.76°) and hip flexion (34.15°±5.42° vs. 42.54°±10.07°). The time to maximum angles in ankle dorsiflexion and foot pronation were also quite different between these two groups. The maximum vertical ground reaction force in sprain group was significant smaller than normal group.

CONCLUSION: In this study, we have revealed the adaptation of performing drop landing in the individuals with recurrent ankle sprains. It could be considered as a recommendation of the rehabilitation.

2441 Board #116 MAY 31 3:30 PM - 5:00 PM
Landing on Inverted Surface Increased Frontal Plane Loading to Ankle and Knee Joints
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(No relationships reported)

Landing on inverted surface (IS) has been shown to introduce smaller medial ground reaction force (GRF) and greater ankle inversion compared to normal landing on flat surface (FS). It is, however, still unknown if the surface would also introduce greater mechanical loading to the ankle and more proximal lower extremity joints.

PURPOSE: To examine effects of inverted surface and ankle brace on lower extremity joint kinetics during a drop landing movement.

METHODS: Eleven healthy subjects performed five drop landing trials from a 0.45m on FS and IS without (NB) and with (BR) a semi-rigid ankle brace. Simultaneous collection of three-dimensional kinematic and GRF data were performed. The internal moments were computed and normalized to body mass (Nm/kg) using Visual 3D. A 2 x 2 (brace x surface) repeated measures ANOVA was used (p < 0.05).
CONCLUSIONS: In sagittal plane, the peak ankle plantarflexion moment was smaller in IS (+1.28 vs -1.46 Nm/kg, p = 0.045) and NB (+1.22 vs -1.52 Nm/kg, p = 0.012) landing conditions compared to FS and BR conditions, respectively. The peak knee extension moment for the IS landing was also increased compared to FS (2.50 vs 2.75 Nm/kg, p = 0.001) but no brace effect was observed. For peak hip extension moment, it was smaller in IS landing compared to FS (p = 0.001) but greater in BR compared to NB (p = 0.001). The peak eversion moment was significantly increased only in IS (+0.92 vs -0.28 Nm/kg, p = 0.001) conditions compared to FS. The peak adduction moment of 0.93 vs 0.27 Nm/kg, p = 0.001 was increased while the peak hip abduction moment (-0.92 vs -0.44 Nm/kg, p = 0.01) were reduced in IS landing only.

CONCLUSION: The results indicate that the landing on IS reduced the extensor’s effort of ankle, knee and hip. This is in line with the reduced vertical GRF previously reported for IS landing and increased lateral GRF. In the frontal plane, the IS landing increases loading on ankle and knee joints reflecting increased frontal plane demands, due to the increased peak lateral GRF and downward momentum in IS landing. This contradiction may be related to the increased friction in IS landing, which in turn requires greater ankle eversion and knee adduction moments to prevent the body from moving more laterally. The ankle brace application does not seem to cause any significant changes of frontal plane loading to the lower limb joints.

RESULTS:

METHODS: Twenty-nine young adults (22±3 years; 13 women) with no history of knee injury completed 3 randomized blocks of trials: 7 preplanned (PP) drop landings (DL), 7 PP drop-jumps (DJ), and 14 randomized DM trials consisting of 7 DL and 7 DJ. Surface EMG activity of the gluteus medius and adductor longus was sampled at 1080 Hz. From the rectified, normalized EMG, average proactive and reactive activation of each muscle was computed over 100 ms before and 120 ms after ground contact, respectively. Proactive and reactive co-contraction ratios (CCR) were computed, as was average activation of the less active muscle. Comparisons were made using 3-way condition x task x sex, repeated-measures ANOVA

RESULTS: After Posterior Cruciate Ligament (PCL) injuries, some patients, copers, are capable of returning to normal activities. Other patients, non-copers, remain symptomatic and often require surgeries. The purpose of this study is to investigate the landing strategy between copers and non-copers, in order to have a better understanding of the functional adaptation strategy in asymptomatic PCL injured patients.

METHODS: Twenty isolated posterior cruciate ligament injured patients and ten normal subjects were recruited in this study. These subjects were divided into three groups, coper, non-coper and control group respectively. The kinematic and kinetic parameters of landing were recorded. One-way analysis of variance was used to compare the differences between three groups.

RESULTS: There were no significant differences in age, height, and weight between three groups. The average injury time were 23.36 and 35.80 months for copers and non-copers respectively. At the moment of landing, there were no significantly differences in joint angle and moment between the three groups, neither than two limbs of copers and non-copers. The loading rate and ground reaction force (GRF) were significantly different among the three groups. Copers had greater loading rate and ground reaction force than non-copers. (Table 1.) There were also significantly lesser loading rate (p=0.0079) and ground reaction force (p=0.0117) of the involved side in non-coper group.

CONCLUSIONS: Non-copers attempted to decrease the impact when landing by lowering loading rate and GRF to protect the injury limb. These findings may be helpful for clinicians to design a proper rehabilitation program for patients with PCL deficiencies.

RESULTS:

METHODS: Loading rate and ground reaction force were significantly different among the three groups. Copers had greater loading rate and ground reaction force than non-copers. (Table 1.) There were no significantly differences in joint angle and moment between the three groups, neither than two limbs of copers and non-copers. The loading rate and ground reaction force (GRF) were significantly different among the three groups. Copers had greater loading rate and ground reaction force than non-copers. (Table 1.) There were also significantly lesser loading rate (p=0.0079) and ground reaction force (p=0.0117) of the involved side in non-coper group.

CONCLUSIONS: Non-copers attempted to decrease the impact when landing by lowering loading rate and GRF to protect the injury limb. These findings may be helpful for clinicians to design a proper rehabilitation program for patients with PCL deficiencies.
To evaluate jump technique by assessing GRF via DPA and FPCA.

METHODS: Twenty female dancers and twenty female athletes performed single-leg countermovement jumps to 50% of their max height. Joint kinematics were measured with eight infrared cameras and 22 markers. For each subject, the velocity profile of each joint was normalized to the maximum velocity achieved by that joint. Repeated-measures ANOVA (Group x Joint) were used to compare the timing of peak joint velocities as well as the percentage of peak velocity of each joint when the other two were maximal.

RESULTS: Peak joint velocities occurred later in the dancers compared to the athletes (Main Effect: Group, P = 0.037) (see table). Additionally, a Joint by Group interaction was found for hip and knee velocities at peak ankle velocity (P = 0.024). Post-hoc t-test revealed that dancers had lower relative hip velocities at peak ankle velocity than the athletes (72% vs. 79%, P = 0.031).

CONCLUSIONS: The delayed peak velocities seen in female dancers may indicate a strategy to maximize storage of elastic energy prior to takeoff and result in a less ballistic, more aesthetically pleasing takeoff. It also appears that dancers utilize the ankle more than the hip at the final phase of takeoff.

Percent of propulsive phase at which peak joint velocities occurred. * = grp diff; P < 0.05

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<th>Hip</th>
<th>Knee</th>
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<tr>
<td>Female Dancer</td>
<td>79.3 ± 5.3</td>
<td>77.0 ± 4.0</td>
<td>96.1 ± 2.6</td>
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<tr>
<td>Female Athlete</td>
<td>67.7 ± 9.6</td>
<td>72.6 ± 7.5 *</td>
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Analysis Of Jumping Technique Via Functional Principal Components Data Analysis Versus Peak Ground Reaction Force

Randall L. Jensen, FACSM, Sarah K. Leissring, Erich J. Petushek, William P. Ebben, Chris Richter, Northern Michigan University, Marquette, MI; University of Wisconsin-Parkside, Kenosha, WI. CLARITY: Centre for Sensor Web Technologies, Dublin, Ireland.

Analysis of the force curves during jumping is typically done using a single point, often the peak of the ground reaction force (GRF), or rate of force development to describe the performance. A weakness of this discrete data point (DPA) technique is that changes in the entire curve are not analyzed. Conversely techniques using functional principal component analysis (FPCA) assess differences throughout the entire curve.

PURPOSE: To evaluate jump technique by assessing GRF via DPA and FPCA.

METHODS: Twenty recreationally active college students (Mean ± SD Age = 23.1 ± 4.8 years; Height = 1.76 ± .09 m; Weight = 72.1 ± 13.6 kg) performed a maximal counter-movement jump, with arm swing, from a force platform sampling at 1000 Hz. The jumps studied were single leg jumps using the left leg (LCMJ), right leg (RCMJ), and a jump with both legs simultaneously (BCMJ). GRF curves were analyzed via Repeated Measures ANOVA using DPA of the peak GRF and via FPCA to analyze the entire curve and test for differences between jump conditions. Steps to identify FPC were continued until they described 95% of the variability in the data set and were VARIMAX rotated to increase reliability. The resulting FPCA scores were then compared between the jump conditions via ANOVA.

RESULTS: Peak GRF did not differ (P = 0.126) between the three jump conditions: BCMJ = 2533 ± 466 N; LCMJ = 2193 ± 593 N; RCMJ = 2158 ± 603 N. Seven functional principal components were needed to describe 95% of the variability in the data; of these, FPC scores of components 1, 2, and 4 differed between the jump conditions (BCMJ < LCMJ, RCMJ; p < 0.05).

CONCLUSION: FPCA identified differences in the curves of the three jump conditions that were not apparent when comparing peak GRF. Specifically, statistical analyses of the functional principal component scores showed that components 1, 2, and 4 for the BCMJ were different from either of the single leg jumps. These components were analogous to the following temporal aspects of the force curve: 1) the rapid increase in force, 2) just after the minimal force during the counter-movement, and 4) the rapid drop in force just prior to takeoff from the ground.
Previous studies have demonstrated that dissimilarity between the dominant and non-dominant legs with relation to noncontact anterior cruciate ligament injuries; the non-dominant leg being the involved side in 48-67% of reported incidents.

**PURPOSE:** To evaluate lower extremity biomechanical differences in leg dominance during an unanticipated sidestep cutting task.

**METHODS:** Twenty-nine female collegiate soccer players (19.3±1.0 years, 1.66±0.1m, 63.26±6.3Kg) completed trials of an unanticipated sidestep cutting task. Subjects were required to complete three valid trials for both the dominant and non-dominant leg, with the dominant leg being defined as the leg the subject would use to kick a soccer ball furthest. Trials were performed in a randomized order, with task cues graphically projected in front of the subject through a custom-designed computer program. An 8-camera motion capture system, and two force plates, captured data at rates of 250Hz and 2000Hz, respectively. A MANOVA was used to determine the effect of leg dominance on hip and knee mechanics at initial contact (IC) and peak knee abduction moment (PKABM). Dependent variables consisted of hip and knee flexion, abduction, and rotation joint angles and moments. The alpha level was set a priori at 0.05, with a Bonferroni adjustment applied.

**RESULTS:** No significant differences (p>0.05) were found at initial contact or peak knee abduction moment for joint angles and moments of the hip and knee. Though not significant (p=0.05), at IC the knee abduction angle was comparable between the dominant and non-dominant legs (-1.35±4.23 and -1.86±4.21), yet demonstrated a divergence at PKABM (-0.88±4.84° and -2.10±4.2°), with the non-dominant leg shifting to a more abducted position.

**CONCLUSION:** As no significant differences for the biomechanics of the hip and knee were demonstrated between limbs at IC or PKABM, it is believed that the discrepancy between involved limbs in noncontact anterior cruciate ligament injuries may stem from other neuromechanical characteristics. Such neuromechanical characteristics can include muscular strength, rate of force development, muscular activation amplitude and timing, and cortical activation patterns which can differ between limbs, yet still demonstrate similar mechanical outcomes.

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**Purpose:** The single-leg squat (SLS) is commonly used by physical therapists (PTs) in the clinical assessment of the lower limb. SLS performance is associated with hip muscle function, knee loading patterns and risk of musculoskeletal injury. The kinematic parameters relating to clinician observations of SLS quality, however, are yet to be illuminated. Furthermore, it is unknown if such parameters are related to clinician experience.

**Purpose:** To reveal the pelvis, hip and knee kinematic parameters used to determine SLS quality by experienced and inexperienced clinicians.

**Methods:** Eight student and eight post-graduate level musculoskeletal PTs agreed to rate each SLS. Twenty-two healthy, young adults (23.8 ±3.1 years) were videored while performing three SLSs on each leg. 3D motion of the pelvis, hip and knee was recorded using a 10-camera optical motion analysis system (Vicon, Oxford, UK). Quality of each SLS performance was rated from video data using a 10-point ordinal scale (i.e. 1 = lowest, 10 = highest). SLSs were re-scored two weeks later by all assessors. Stepwise multiple regression analysis was performed to determine kinematic predictors of stability scores for experienced PTs and student PTs. Inter- and intra-rater reliability was determined using a two-way mixed model to generate intra-class correlation coefficients (ICC) of consistency.

**Results:** The second SLS on each side was analyzed for each participant, providing 44 SLSs for analysis. Experienced PT scores were greater than student PT scores (6.4 ±1.8 vs 6.1 ±1.5; p = 0.02). Variance in experienced PT scores was predicted by peak knee flexion, peak hip adduction, and knee medio-lateral displacement (R² = 0.64, p = 0.01). Inter-rater reliability was good for PTs (ICC = 0.71) and students (ICC = 0.60). Intra-rater reliability was excellent for PTs (ICC = 0.81) and good for PT students (ICC = 0.71).

**Conclusion:** Experienced PTs and student PTs are both capable of reliable assessment of SLS stability; however experienced PT assessments bear somewhat stronger relationships to lower limb kinematics. PT ratings were related to hip and knee motion, while student PT ratings were specific to the knee.
RESULTS: CMJ: \( CV_{\text{WS}} \) was 4.8% for center of mass JJ. For unilateral measures, \( CV_{\text{WS}} \) was 8.7%-12.6%. \( CV_{\text{WS}} \) was 3.1% - 4.3%. \( MVC; CV_{\text{WS}} \) was 7.7%-14.1%. HD increased at restest (95% CI: [-8.1 : -0.1] and [-11.5 ; -2.0]) in both legs. Asymmetry ratios in unilateral CMJ were 100%, 80%, 80% for ROM, peak and mean knee moment, respectively, and 96% for HD and 73% and 85% for isometric knee flexor and extensor MVC, respectively.

CONCLUSION: Good to moderate reliability was observed for all measured variables. However, a small but systematic increase was observed for hop for distance. Signs of between-leg asymmetry were observed in healthy males. Future research should investigate accuracy before this test battery can be applied to determine when/if an injured subject is fully recovered.

(3) Jensen et al, Osteoarthr and Cartil, in press 2011

**Board #127 MAY 31 3:30 PM - 5:00 PM**

**Electromyographic Analysis of the Biceps Femoris During Conventional and Rubber-Based Band Squats**

Ty B. Palmer\(^1\), Kevin W. McCurdy\(^2\), James S. Williams, FACSM\(^2\), John L. Walker, FACSM\(^2\), Oklahoma State University, Stillwater, OK; Texas State University, San Marcos, TX.

(No relationships reported)

Recently, various variable resistance methods of attaching bands to the power rack during the back squat exercise have been established.

PURPOSE: To compare the electromyographic (EMG) output of the long head of the biceps femoris (BF) muscle amongst 3 resistance conditions on the back squat exercise. The no band (NB) condition used only the barbell plus weighted-plates. The bottom band (BB) and top band (TB) conditions combined weighted-plates with bands attached to the barbell originating from the bottom and tops of the power rack, respectively.

METHODS: Twenty-two healthy, physically active college males volunteered to participate (age = 22.4 ± 2.6 yr; height = 177.8 ± 9.7 cm; weight = 78.0 ± 19.0 kg). Initial 1-repetition maximum (IRM) testing was conducted in order to assess each subject’s maximum strength for each resistance condition. Eighty percent (%) of each IRM was used as the external load during EMG testing. To compare EMG activity across the entire range of motion (ROM), both the eccentric and concentric phases of movement were divided into % intervals based upon the time it took each subject to complete the measured repetition. A pair of disposable bipolar surface electrodes (2-cm interelectrode distance, 1-cm\(^2\) circular conductive area) was placed along the longitudinal axis of the BF (50% of the distance from the ischial tuberosity to the lateral epicondyle of the tibia), connected to an amplifier, and continuously streamed through an analog to digital converter using an EMG telemetry system. The EMG signals (gain = 500, bandwidth frequency = 10-500 Hz, CMRR = 110 dB) were sampled at 1000 Hz, smoothed using root mean square, and averaged in millivolts (mV) over the durations of the 90 and 10% intervals (top and bottom portions of the ROM, respectively).

RESULTS: At the 90% interval there was significantly higher EMG output in the TB (0.039 ± 0.029 mV) condition than the NB condition (0.033 ± 0.023 mV, p < 0.05). At the 10% interval there was significantly higher EMG output in the NB condition (0.020 ± 0.013 mV) than both the BB (0.016 ± 0.008 mV) and TB (0.017 ± 0.010 mV) conditions (p < 0.05).

CONCLUSION: The TB condition elicited greater BF EMG activity at the top of the ROM when compared with the NB condition. However, at the bottom of the ROM, the NB condition elicited greater BF EMG activity than both the BB and TB conditions.

**Board #128 MAY 31 3:30 PM - 5:00 PM**

**Gender Differences in Lower Extremity Kinematics during an Unanticipated Side-Cut**

Donald E. Fowler, III, Robert J. Butler, Wesley Oglesby, Claude T. Moorman, III, William E. Garrett, Jr, FACSM, Robin M. Queen, Duke University, Durham, NC.

(No relationships reported)

Female athletes have a higher incidence of anterior cruciate ligament (ACL) injury compared to men playing the same sports. The majority of these injuries are attributed to a non-contact pivoting mechanism, as seen in cutting and jumping tasks. Gender differences in lower extremity kinematics are documented in the literature, with most of these studies being conducted in the laboratory setting, which do not simulate in-game competition.

PURPOSE: To compare differences in lower extremity kinematics between males and females when completing an unanticipated side-cut on FieldTurf, wearing a firm ground cleat.

METHODS: Twenty-nine subjects (13 males, 16 females) were included in the study. All participants were skilled soccer players with no history of lower extremity or ACL injury within the last 6 months. Eight infrared cameras (Motion Analysis, Inc) were positioned around the FieldTurf field and used to record the trajectories of the retro-reflective markers. A single firm ground cleat was used for every trial. Each subject completed 45 degree unanticipated cuts to the right or left depending on which light flashed in front of them while running until 7 acceptable trials were recorded.

RESULTS: Males demonstrated larger peak hip abduction at 25.71 degrees, versus 20.23 degrees in females (p<0.03). Females exhibited greater peak hip adduction (p<0.03). No other dependent variables were statistically different. Females had greater peak hip flexion (54.2 vs. 51.8 degrees). Men demonstrated larger peak knee flexion (54.2 vs. 51.8 degrees). Women had slight knee abduction (2.0 degrees) at heel-strike when cutting compared to men (57.4 vs. 51.4 degrees). Men demonstrated larger peak knee flexion (54.2 vs. 51.8 degrees). Women had slight knee abduction (2.0 degrees) at heel-strike when cutting, compared to men who exhibited slight knee adduction (1.3 degrees).

CONCLUSIONS: Minor gender differences in joint kinematics were demonstrated during an unanticipated side-cut on FieldTurf in cleats, which better recreates in-game activity. The lack of statistically significant differences similar to those that have been reported between genders in recreational athletes is most likely the result of testing highly skilled soccer players. As a result of this study it appears that assessing multiple domains of movement may be important in examining an individual’s injury risk.

**Board #129 MAY 31 3:30 PM - 5:00 PM**

**Discrete Vs. Functional Based Data To Analyze Countermovement Jump Performance**

Chris Richter, Noel E. O'Conner, Kieran Moran, Dublin City University, Dublin, Ireland. (Sponsor: Randall Jensen, FACSM)

(No relationships reported)

While discrete point analysis (DPA) (e.g. peak power) is by far the most common method of analyzing movement data, it may have significant limitations because it ignores the vast majority of a signal’s data. In response, there has been a slow but growing use of methods, such as functional data analysis (FDA), which allow an investigation of the underlying structure of the continuous signal and may therefore provide a more powerful analysis. However, a direct comparison between DPA and FDA has not been previously reported.

PURPOSE: To directly compare DPA and FDA for the identification of performance determining factors for the countermovement jump (CMJ).

METHODS: Twenty-five male participants performed 15 CMJs, and the highest jump was selected for further analysis. Joint and whole body kinematic and kinetic measures were determined using position data (Vicon, 250 Hz) and force plate data (AMTI, 1000Hz). Participants were divided into good (n=10) and poor (n=10) groups based on jump height. A t-test (α = 0.05) was performed on the timing and magnitude of key variables (DPA) and functional derived points (FDA) during the propulsion phase to examine differences between the groups.

RESULTS: Both techniques found differences (p<0.05) in knee angular peak velocity, CoM peak velocity, CoM peak power and CoM work done. However, the FDA alone found significant higher (p<0.05) ankle moment (79 - 83%, peak at 67%), ankle power (54 - 67%, peak at 81%), knee angular velocity (28 - 100%), CoM velocity (56 - 100%), CoM power (49 - 91%) and a delay in CoM position (10 - 90%) and CoM velocity (10 - 60%) for the good performance group. Finally, the DPA alone found differences in ankle peak moment, ankle peak power and hip peak angular velocity.

CONCLUSIONS: In contrast to FDA, DPA found three events which were not detected by FDA. However, only FDA was able to identify important differences in phases of the CMJ and explains differences between good and poor performance better than DPA. Finally, the ability to examine data with continuous techniques appears to provide a deeper insight into human movement than DPA.
PURPOSE: An age-related decline in muscular power may have a detrimental effect on sports performance and tasks of daily living. This study assessed lower extremity muscular power in a group of middle-aged adults (40-59 yrs) who elected to participate in a cardiology-based prevention program.

METHODS: The study involved a single visit observation of the participants. Ninety-nine apparently healthy adults (70% male) were assessed for lower extremity muscular power with the Counter Movement Jump (CMJ) Test. Participants performed 5 consecutive vertical counter movement jumps with the hands on the hips. The jumps were performed in a medical exam room on a hard carpeted surface while wearing shoes. None of the participants reported a physical limitation or injury at the time of testing. A Myostest accelerometer was attached to the waist and it instantaneously calculated the average height jumped, force produced, velocity and power from the best 3 jumps.

RESULTS: The mean age of the participants was 50.8 yrs (SD = 5.4). The overall mean height, force, velocity and power scores for men (n=69) and women (n=30) were 23.8 cm (SD = 4.1), 23.1 cm (SD = 6.5), 161.9 cm/s (SD = 31.1) and 142.4 cm/s (SD = 25.3) and 25.6 W/Kg (SD = 7.4) Vs 20.6 W/Kg (SD = 5.0) respectively. The mean scores on the same measures for men 40-49 yrs (n=30) and 50-59 yrs (n=39) were 26.3 cm (SD = 6.4) Vs 22.6 cm (SD = 4.8), 20.1 N/Kg (SD = 2.1) Vs 18.7 N/Kg (SD = 2.2), 169.6 cm/s (SD = 35.4) Vs 157.1 cm/s (SD = 26.6) and 24.0 W/Kg (SD = 8.6) Vs 24.0 W/Kg (SD = 8.6) respectively. The mean scores for women 40-49 yrs (n=59) and 50-59 yrs (n=21) were 17.7 cm (SD = 4.1) Vs 13.8 cm (SD = 3.7), 17.4 N/Kg (SD = 1.1) Vs 17.5 N/Kg (SD = 2.1), 153.2 cm/s (SD = 18.1) Vs 137.7 cm/s (SD = 26.9), 22.2 W/Kg (SD = 3.2) Vs 19.9 W/Kg (SD = 5.5) respectively.

CONCLUSIONS: The Myostest accelerometer is a small user friendly portable device that can be used to assess muscular power in a clinical setting. This type of technology may assist in the design of exercise programs to improve muscular fitness. A larger, more representative sample is needed to determine age, gender and race norms for CMJ Test scores using the Myostest accelerometer.
Modern acupuncture is a technique of inserting small, thin, thread-like (filiform), single use needles into specific points (acupoints or energy meridians) on the body for therapeutic purposes. The use of acupuncture is known to reduce discomfort/pain sensation and may permit improvements in strength or flexibility.

PURPOSE: This study was designed to evaluate the effect of serial acupuncture treatment (8 treatments) on hamstring strength and flexibility.

METHODS: 15 subjects (7 male, 8 female, age 21.9±1.6 yr, ht 173±9.9 cm, body mass 74.9±13.7 kg) volunteered to perform a unilateral hamstring strength assessment (Cybex 6000 isokinetic seated knee flexion) and a unilateral flexibility assessment (modified WellsSit and Reach test). Following the baseline trials, subjects served as their own control with one leg assigned as the placebo (P) and the other leg as the acupuncture intervention (A). In this double blind design, subjects entered the lab blindfolded, assumed a prone position on a plinth, and eight acupuncture needles were inserted inferior to the gluteal fold and superior to the popliteal fossa in the intervention leg. In addition, needles were inserted at the same locations and removed within 2 sec in the control leg. The points in the intervention leg included UB36, UB37, UB38 and UB40, as well as 5 additional Ashi points that were placed at areas of particular tightness in the hamstring muscle. The thirty minute treatments were separated by a minimum of 48 hours and conducted twice each week for four weeks. Statistical analysis by paired t test was applied to these data (p<0.05).

RESULTS: The following data were obtained for treatment A and P, pre- and post-treatment, respectively: Peak Torque 118.5 & 114.2 vs 119.4 & 114.2 ft/lbs, mean work/exp 128.1 & 122.2 vs 128.2 & 122.1 ft/lbs, and hamstring flexibility 46.2 & 48.5 vs 46.7 & 47.9 cm, respectively. Hamstring flexibility evidenced significant improvement in the treated limb.

CONCLUSION: Four hours of accumulated acupuncture treatment significantly improved limp flexibility, which may, in part, be attributed to change in tension within the muscle, allowing for relaxation and elongation.

Pre-operative function has been shown to be the greatest overall predictor of post-operative function for those undergoing total knee arthroplasty (TKA), and quadriceps strength is one of the greatest contributors to function in this population. Although pre-surgical interventions (prehabilitation) aiming to increase quadriceps strength have recently been investigated, their effects on post-operative outcomes are not clear.

PURPOSE: This pilot study aimed to examine the effect of a six-week, pre-surgical strength training program on post-operative quadriceps strength, mobility, pain, self-reported function, health-related quality of life, and arthritis self-efficacy for patients undergoing TKA.

METHODS: Participants who were booked for TKA (n = 22) were randomized to either a lower body strength-training program or a placebo upper body strength-training program for six weeks before TKA. Measures included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Medical Outcomes Study Short Form 36 (SF-36), Arthritis Self Efficacy Scale, a flat surface walking test, a stair ascent/descent test, and an isometric quadriceps strength assessment. Measures were taken at baseline, before surgery, and 6 and 12 weeks post-operatively. Between-group comparisons were made using repeated measures ANOVAs.

RESULTS: The effect sizes associated with the lower body strength program were larger for quadriceps strength, F(3,18) = 0.89, p = 0.47, n² = 0.13, and walking speed, F(3,18) = 1.47, p = 0.26, n² = 0.20, with clinically meaningful differences emerging before TKA. These benefits were not evident after surgery, however. Although there were no significant time x treatment interactions for pain F(3,18) = 0.35, p = 0.54, n² = 0.054, self-reported function F(3,18) = 0.32, p = 0.67, n² = 0.08, or self-efficacy F(3,18) = 0.51, p = 0.08, n² = 0.08, the effect sizes were in the moderate to large range, and in the expected direction.

CONCLUSIONS: The intervention was effective at increasing post-operative strength and walking speed, but this study was underpowered to detect statistically significant benefits after surgery. Replication with a larger sample size is recommended.

Functional muscle imbalance at the knee is a cause and consequence of numerous injuries and diseases. Coordinated muscular contraction is critical to dynamic control of knee segments during functional activities and loading during functional activities impacts cartilage morphology and composition. Relationship of muscle imbalance with functional loading and cartilage composition is unknown.

PURPOSE: To investigate the relationship between muscle imbalance, functional loading and cartilage composition in young healthy adults using quantitative MRI.

METHODS: 33 young healthy subjects (20-35 years, BMI < 28 kg/m²) had 3-T knee MRI to calculate T1p and T2 relaxation times for articular and meniscal cartilage. T1W MRI was used to calculate mid-thigh muscle cross-sectional area (CSA) for the quadriceps (Q) and hamstrings (H). 3-D motion analysis during self-selected walking speed was used to calculate peak kinetic and kinematic variables during stance phase in sagittal and frontal planes. Pearson’s correlations were used to correlate medio-lateral (ML) and Q:H muscle CSA ratios with T1p and gait variables followed by multiple linear regression.

RESULTS: Greater Q:H ratio was related with greater Tibiofemoral T1p (r = 0.327, p = 0.035) and T2 (r = 0.401, p = 0.009). Greater M:L ratio was associated with greater meniscal T1p (r = 0.337, p = 0.029). Greater M:L Q ratio was associated with greater knee adduction moment (KAM) peaks (r = 0.357, p = 0.024) and impulse (r = 0.461, p = 0.003), and greater frontal rate of loading (r = 0.303, p = 0.057). Greater Q:H ratio was associated with greater peak frontal (r = 0.645, p = 0.000) and sagittal moments (r = 0.360, p = 0.023) and greater dynamic frontal malalignment (r = 0.330, p = 0.038).

CONCLUSION: Results show for the 1st time that muscle imbalance (high Q:H and M:L CSA ratios), is related to high T1p- and T2 relaxation times for articular and meniscal cartilage indicating loss of proteoglycans and collagen disruption. Muscle imbalance is also related to high KAM peak/impulse, high dynamic varus, all of which are known risk factors for cartilage degeneration. These novel findings suggest that people with greater muscle imbalance might be at risk for developing knee degeneration. Hence, muscle balance training would be a critical component of preventive programs.
underlying, if any, impact that this residual weakness has on submaximal electrical and mechanical aspects of function, as measured by electromyography (EMG) and mechanomyography (MMG), has not been previously investigated.

**PURPOSE:** To examine the EMG and MMG responses of the vastus lateralis (VL) during isometric muscle actions in individuals with a history of ACL surgery.

**METHODS:** The participants included 6 healthy individuals (control) with no history of ACL injury (age 21.8 ± 1.3 yrs, BW 73.5 ± 12.1 kg) and 6 individuals who were post ACL reconstruction from 6 months to 18 months (age 20.2 ± 1.2 yrs, BW 66.2 ± 6.0 kg) and fully cleared to return to recreational activities. Each participant performed three, 6-second maximal and three, 20-second sub-maximal (15%, 30%, 45 %MVC) isometric leg extensions at angles of 15° and 60° below the horizontal plane on a Humac Dynamometer. EMG (µV) and MMG (mV) amplitude was measured from the VL. Independent T-tests examined group (control, ACL) differences in maximal torque and EMG and MMG amplitude at each %MVC for both angles. An alpha of 0.05 was used to determine statistical significance.

**RESULTS:** The ACL group was weaker than then control group at 15° (50.8 ± 25.7 Nm vs. 76.1 ± 25.1 Nm) and significantly weaker at 60° (106.8 ± 36.9 Nm vs.190.8 ± 61.0 Nm). In comparison to the control group at 15 and 60°, the EMG amplitude for the ACL group was greater at 100%MVC and less at each submaximal level, but these differences were not significant. The MMG amplitude at 15° was similar for each group. At 60°, however, the MMG amplitude for the ACL group was greater at 100%MVC and significantly less than that of the control group at each submaximal %MVC.

**CONCLUSION:** The group differences in EMG and MMG amplitudes suggested that the apparent strength deficit the ACL group may manifest in the inability to control submaximal force outputs, particularly at the larger joint angle of 60°. These findings indicate that residual strength deficits in individuals who have recently undergone ACL reconstruction may be associated differences in motor unit recruitment strategies to control a submaximal force.
PURPOSE: Our primary aim was to profile standing flexion angle responses to ipsilateral hamstrings tendons autograft ACL reconstruction in physically active patients. We hypothesized autograft harvest would yield related deficits. A secondary aim was to explore associations among subjective outcome measures and standing knee flexion angle.

METHODS: A retrospective cohort of 15 patients (age = 21.2 ± 2.6 years, height = 1.7 ± 0.1 m, mass = 68.7 ± 12.6 kg, Tegner = 6.9 ± 1.6) were matched to 15 healthy control participants (age = 21 ± 1.1 years, height = 1.6 ± 0.1 m, mass = 67.4 ± 10.3 kg, Tegner = 6.3 ± 1.3) and assessed in a laboratory setting. The independent variable was the operative technique. Dependent variables included standing flexion angle, using a reliable technique, and subjective subscale scores for the reliable Knee Outcome Survey (KOS) and Kneecare Injury and Osteoarthritis Outcome Score (KOOS). Group means and standard deviations were calculated. Respective one-tail dependent and independent t-tests were calculated. Correlation coefficients were computed among the KOS and KOOS to standing flexion angle. P < 0.05 denoted statistical significance.

RESULTS: Data were normally distributed. A lesser standing flexion angle was demonstrated for the involved (113.3 ± 7.0°) compared to uninjured (116.7 ± 6.7°) leg (P = 0.019). Significant correlations existed among subjective subscale scores and standing flexion angle (KOS-ADLS: r = 0.578, P = 0.024; KOAS-ADLS: Function: r = 0.578, P = 0.024; KOOS: Symptoms: r = 0.553, P = 0.033; KOOS Pain: r = 0.785, P = 0.001; KOOS Function: r = 0.683, P = 0.005). These results suggest that ACL patients with better subjective strength recover quadriceps strength better than those with lower subjective strength. Preoperative quadriceps activation activation may be mediated by other factors such as pain and effusion. Rehabilitation programs for ACL patients should focus on maximizing quadriceps strength prior to surgery.

CONCLUSIONS: Decreased standing knee flexion angle may be attributed to hamstring deficits. Linear associations among subjective and objective data indicate better clinical outcomes with greater standing knee flexion angle. Our findings advocate continued investigation for determining factors associated with knee HQRL post-ACL reconstruction.

**Board #142**

**MAY 31 3:30 PM - 5:00 PM**

**Preoperative Quadriceps Strength is Associated with Postoperative Quadriceps Strength Following Anterior Cruciate Ligament Reconstruction**

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(NO relationships reported)

Quadriiceps activation failure is considered, in part, to contribute to the quadriceps weakness that lingers following anterior cruciate ligament reconstruction (ACLR). Higher levels of preoperative quadriceps activation, therefore, may be associated with improved recovery of quadriceps strength following ACLR. Understanding this association could help improve ACL rehabilitation programs.

**PURPOSE:** To determine if quadriceps activation and strength prior to ACLR are related to postoperative quadriceps strength.

**METHODS:** Twenty-eight individuals post-ACL injury (12 male, 16 female; age 18.46±4.2 yrs; height 1.72±0.01 m; mass 70.32±13.3 kg) were recruited for testing on two occasions: prior to ACLR (t1=2.4±2.34 mo) and upon return to activity post-ACLR (t2=2.3±0.44 mo). Quadriiceps activation was assessed preoperatively using the burst superimposition technique and quantified via the central activation ratio (CAR). CAR was assessed at both time points and quantified via an isokinetic dynamometer at 60°/second. Three maximal knee extension trials were averaged and normalized to subject body mass (Nm/kg). Linear regressions were used to examine the relationship between preoperative CAR and postoperative quadriceps strength and preoperative strength and postoperative strength.

**RESULTS:** Greater preoperative quadriceps strength was associated with greater postoperative quadriceps strength (R²=0.157, P=0.037). Preoperative quadriceps activation was not associated with postoperative quadriceps strength (R²=0.032, P=0.363).

**CONCLUSION:** These results suggest that ACL patients with better preoperative strength recover quadriceps strength better than those with lower preoperative strength. Preoperative quadriceps activation failure may be mediated by other factors such as pain and effusion. Rehabilitation programs for ACL patients should focus on maximizing quadriceps strength prior to surgery.

Supported by NIH Grant K08 AR053152-01A2 and the University of Michigan’s Rackham School of Graduate Studies.
CONCLUSION: Significant differences were observed in the levels of BMD, BAP, NTx, homocysteine, and pentosidine. On the other hand, TRAP 5b levels were 409.9 ± 209.3 and 318.6 ± 81.6 mU/dL in the stress fracture and control groups, respectively. A significant increase in TRAP 5b in female group levels was observed in the stress fracture group (p < 0.05).

RESULTS: Muscle's electromyographic activity showed a greater than 50 ms window prior to contact with the ground (1.19 ± 0.84 - 1.43 ± 0.62).

PURPOSE: To characterize the unique features of ACL injury and reconstruction in obese patients.

METHODS: We conducted a retrospective cohort analysis of 131 patients with an ACL injury treated with ACL reconstruction at a single university-affiliated hospital from November, 2007 to March, 2011. Thirty-two obese patients (BMI greater than or equal to 30) were identified (Group 1) and compared with 99 non-obese control patients (Group 2). Fisher’s exact test, Wilcoxon test, and multivariate logistic regression analyses were performed with respect to various parameters including mechanism of injury, frequency of instability prior to reconstruction, and incidence of osteochondral injury.

RESULTS: The mean BMI was 35 (range 30 - 54) in Group 1 vs 24 (range 16 - 29) in Group 2. Forty percent of patients in Group 1 sustained a low energy mechanism of injury compared with 14% in Group 2 (OR = 4, p = 0.004). Fifty-six percent of patients in Group 1 experienced at least two episodes of symptomatic instability prior to undergoing ACL reconstruction vs 32% of patients in Group 2 (p = 0.02). The diagnosis of osteochondral injury (Outerbridge grade greater than or equal to 3) on arthroscopic evaluation was 56% in Group 1 vs 16% in Group 2 (p = 0.0001).

CONCLUSIONS: Anterior cruciate ligament injury in obese patients is characterized by a lower-energy mechanism of injury, a greater degree of symptomatic instability with non-operative management, and a higher incidence of high-grade osteochondral lesions on arthroscopic evaluation. Although these individuals do not match the current or desired future activity level profile of the typical patient undergoing ACL reconstruction, we challenge the bias toward non-operative treatment and recommend surgical consideration providing other medical comorbidities are stable. In our experience, non-operative management in this sedentary cohort often leads to episodes of instability with activities of daily living and may predispose to the earlier onset of degenerative joint disease.

CONCLUSIONS: The results show that there were significant changes in muscle activation of the volunteers with history of stress fracture, these changes may explain the dynamic behavior observed in the group.

RESULTS: The results showed statistically significant differences between groups under conditions of anteroposterior displacement. In this condition, the experimental group showed a decreased time to peak force (0.20±0.09s - 0.15±0.09 s) and an increased growth gradient (12.63 ±10.04s to 20.7±18.31s) when compared to the control group. The parameters related to muscle activation in the same condition were different for the control and experimental groups. At the time of transition from anterior to posterior displacement, the medial gastrocnemius muscle’s electromyographic activity showed a greater than 50 ms window prior to contact with the ground (1.19 ± 0.84 -1.43±0.62).

CONCLUSIONS: The results show that there were significant changes in muscle activation of the volunteers with history of stress fracture, these changes may explain the dynamic behavior observed in the group.

RESULTS: No significant differences were observed in the levels of BAP, NTx, and TRAP 5b between the stress fracture and control groups in all or male subjects. In the female players, no significant differences were observed in the levels of BAP, NTx, homocysteine, and pentosidine in blood samples were measured in both groups.

RESULTS: No significant differences were observed in the levels of BAP, NTx, and TRAP 5b between the stress fracture and control groups in all or male subjects. In the female players, no significant differences were observed in the levels of BMD, BAP, NTx, homocysteine, and pentosidine. On the other hand, TRAP 5b levels were 409.9 ± 209.5 and 318.6 ± 81.6 mL/dL in the stress fracture and control groups, respectively. A significant increase in TRAP 5b in female group levels was observed in the stress fracture group (p < 0.05).

CONCLUSION: We suggest that TRAP 5b is a useful bone metabolism marker that reflects the dynamics of bone condition, particularly in female athletes.

RESULTS: Differences between Attending and Resident Management of Acute Ankle Injuries in a Tertiary Care Emergency Department

Objective: Management of acute ankle injury in the Emergency Department can vary by level of physician training. Variations occur in radiologic evaluation, documentation, medications given, immobilization techniques and follow up. This study evaluates the differences in care between Resident and Attending physicians with regards to acute ankle injury management.

METHODS: Retrospective chart review of all ankle injuries during a one year period at a tertiary care Emergency Department (January 1, 2010 through December 31, 2010). A sample of 637 patients greater than 18 years old presenting with acute ankle injury was included. Descriptive statistics and Chi-Square Tests were used in data analysis. Variables analyzed include narcotic medications, radiographs, immobilization, follow-up and documentation of Ottawa Ankle Rules.

RESULTS: Of the 637 patients evaluated with ankle injury, 55% were primarily cared for by a Resident with Attending supervision, with the remaining 45% cared for by an Attending only. 600 patients received x-rays, 283 were ordered by a registered nurse, 274 were ordered by a physician and 43 had multiple x-rays ordered by both a registered nurse and physician. Residents accounted for 69% of all x-rays ordered by a physician, however results were not statistically significant. Both Attendings and Residents were more likely to document incomplete Ottawa Ankle Rules as opposed to complete (p < 0.001) and immobilize with an Aircast as opposed to an ACE wrap (p < 0.001). Residents were more likely to provide narcotic pain medication in the ED (p < 0.001) and write a prescription for narcotic pain medication (p < 0.003).

CONCLUSIONS: Ankle injuries are a common ED presentation. In an academic medical center, variances in management between Residents and Attendings were identified specifically
related to medication choices. Residents were more likely to order and prescribe narcotic pain medications for ankle sprains in comparison to Attendings alone. Residents were also more likely to obtain radiographic confirmation, although not statistically significant. This study suggests Residents are less strictly supervised in the management of acute ankle injury as evidenced by statistically significant variations in practice from that of Attending physicians.

2473  Board #148  MAY 31  3:30 PM - 5:00 PM  
Risk Factors Of Stress Fracture Of The Fifth Metatarsal Bone In University Soccer Players
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PURPOSE: The purpose of this study was to investigate university soccer players with stress fracture of the fifth metatarsal bone regarding their physical factor, the relationship of such fracture with a history of sporting injuries, and the ground surfaces as well as shoes used.

METHODS: A total of 154 male soccer players from one university were evaluated between 2004 and 2010. The foot arch ratio, toe flexor muscle strength, Q-angle, leg-heel angle, one-leg standing time with eyes closed, range of motion (ROM) of the ankle joint, and general joint laxity were measured, and the Functional Reach Test was conducted at the time of admission to the university. We also evaluated the subjects’ histories of sporting injuries to the foot and ankle joint, and ground surfaces and shoes used at the time of injury, and whether tapes or supporters were used for the ankle joint. All subjects who developed a stress fracture of the fifth metatarsal bone during the investigation period presented to one of our medical centers. The subjects were divided into those with and without stress fracture of the 5th metatarsal bone (injured (11 players, 12 feet) and non-injured (143 players, 296 feet)) groups, and each measurement as well as other investigated items were compared between the groups at the time of admission to the university.

RESULTS: The toe flexor muscle strength tended to be weaker in the injured (16.4±1.9 kg) than in the non-injured (17.3±4.9 kg) group (p=0.06). The Q-angle also tended to be smaller in the injured (13.9±2.0 degrees) than in the non-injured (15.1±4.9 degrees) group (p=0.07). The rate of using elastic bandages for the foot joint was higher in the injured group (p<0.05). There were no significant difference in any other measurement and survey items.

CONCLUSIONS: Stress fracture of the fifth metatarsal bone was suggested to be caused by excessive weight-bearing on the fifth metatarsal bone, which resulted from the difficulty of shifting the body weight to the hallucal side due to a small Q-angle and toe flexor muscle strength. As the rate of using elastic bandages for the foot joint was higher in those with such fracture, the influence of elastic bandages on the fifth metatarsal bone needs to be evaluated.

2474  Board #149  MAY 31  3:30 PM - 5:00 PM  
Groin Wrapping And Its Effects On Skating Performance In Ice Hockey Players
Howard W. Theberge, Julie Bigelow, Stacie Lee, Brittany Pelkey, Lara A. Carlson, FACSM. University of New England, Biddeford, ME. (No relationships reported)

Groin injuries are a common overuse injury in ice hockey. Preventative groin wrapping is a technique that is used to accelerate return to play in the rehabilitative stage of injury treatment. However, it is unknown whether this treatment negatively impacts skating performance.

PURPOSE: To examine the effect of standard groin wrapping on sprint and agility performance in collegiate ice hockey players.

METHODS: Seven healthy male NCAA ice hockey players without lower limb pathology participated in this study (age, 25.7 ± 3.9 yr; weight, 85.2 ± 8.9 kg; height, 174.5 ± 10.0 cm; body fat, 14.3 ± 3.5%). Subjects took part in on-ice familiarization of tests 48 hours prior to data collection and were instructed not to engage in exercise 24 h prior to testing. Subjects then performed two on-ice skating testing sessions (randomly controlled) where either the dominant leg of each player was wrapped (TAPE) or not wrapped (CON). Testing sessions were separated by 24 hrs. During each testing session subjects performed 3 trials of both 40-yd sprint and agility tests while wearing full uniform and equipment. Mean sprint and mean agility times were compared via paired t-tests.

RESULTS: The % CV for both the sprint and agility tests were under 4%. There were no differences (p > 0.05) in mean 40-yd sprint times between TAPE (5.34 ± 0.23 s) and CON (5.25 ± 0.23 s). Mean times for the agility test were also not different (p > 0.05) between TAPE (38.7±4.17 s) and CON (37.61 ± 3.43 s).

CONCLUSION: Findings suggest that preventative groin wrapping does not appear to negatively alter on-ice sprint and agility performance and may be considered an efficacious treatment for groin injuries that does not affect overall skating performance.

2475  Board #150  MAY 31  3:30 PM - 5:00 PM  
Developing a Functional Test for Athletes Following a Lower Extremity Injuries
Rebecca K. Shultz, Melissa Hodgins, Karyn Hatz, Jessica Popish, Gordon O. Matheson. Stanford University, Stanford, CA. (No relationships reported)

Knowing when to return an athlete to sport following an injury is a complex decision and should involve a standardized testing protocol. Few such protocols exist.

PURPOSE: To develop a lower extremity injury function evaluation and to assess it’s face validity.

METHODS: The Functional Lower Extremity Injury Test (FLEET) is a battery of 8 tests, including single leg (SL) squat, box jump and SL hop for distance, purported to assess an athlete’s functional ability post injury. FLEET was developed by a committee of sports medicine clinicians based on their clinical experience and using data from a literature review. A survey distributed to Pac-12 physicians, physical therapists, and athletic trainers (over 200 recipients) assessed the face validity of the test. Respondents were asked to evaluate the level of importance (0-4, 4 being very important), frequency of clinical usage (0-100%), and the ability of a test to measure the clinical components of functional performance (0-4, with 4 being significant), such as balance and strength, for each test. The test’s importance was calculated as the number of respondents who rated the test a 3 or 4 divided by the total number of respondents. The test was considered frequent if the respondent stated they used the test 70-100% of the time.

RESULTS: 73 clinicians with an average of 13 years and 30 hours per week of sports medicine experience responded. The top five sports for which respondents made return to play decisions were football, basketball, soccer, baseball, and volleyball. Given that lower extremity injuries are most common in field and court sports, this population was considered appropriate for assessing FLEET. 80% of respondents used functional testing (FT) as part of their RTP decision “Often” or “Always” and 70% used FT to follow an athlete through rehabilitation “Often” or “Always”. The results of the survey showed that the level of importance for each test was rated considerably higher than the clinical usage. Sports medicine clinicians also agreed that FLEET assesses each of the 11 clinical components of FT, except for Range of Motion.

CONCLUSION: Results show that the FLEET is considered relevant and an important part of clinical decision making. Future research should assess the reliability and content validity of the FLEET and why the usage of the tests is lower than the relevance.
The time elapsed between the onset of electrical muscle activation and the onset of force development is termed the electrical mechanical delay (EMD). Resistance training adaptations can affect musculotendinous stiffness and force transmission, possibly altering EMD.

PURPOSE: To examine and compare the effects of three days of dynamic constant external resistance (DCER) and isokinetic (ISOK) training and subsequent detraining on EMD.

METHODS: Thirty-one apparently-healthy untrained men (mean ± SD age = 22.2 ± 4.2 yrs; body mass = 77.9 ± 12.9 kg; height = 173.9 ± 5.4 cm) were randomly assigned to a DCER training group, ISOK training group, or control (CONT) group. Subjects visited the laboratory eight times, the first visit was a familiarization session, the second visit was a pre-training assessment, the subsequent three visits were for training (if assigned to a training group), and the last three visits were the post-training assessments (48 hrs, 1 wk, and 2 wks after the final training session). One training group performed ISOK leg extension exercise and the other performed DCER leg extension exercise for three sets of ten repetitions in each of the three days of training. A third group took part in a CONT condition and did not train. In each testing assessment visit, five, single, 200-µs duration, square-wave, supramaximal transcutaneous electrical stimuli (each separated by 5 seconds) were delivered to the femoral nerve at rest in order to examine the EMD.

RESULTS: No significant changes were found for EMD from pre- to post-training assessments 1, 2, and 3 (mean SE = 4.5 ± 0.2 ms, 4.7 ± 0.2, 4.5 ± 0.1, and 4.5 ± 0.2, respectively) (p > 0.05). There was no significant interaction for time × group (Table 1) (p > 0.05). In addition, there were no significant main effects for time or group (p > 0.05).

CONCLUSION: To our knowledge, this was the first study to investigate the effects of short-term resistance training on EMD. It can be hypothesized that increases in strength observed following a short-term resistance training program may not be attributed to stiffness changes in the series elastic component. Future studies should investigate the precise physiological components responsible for short-term training strength gains.

The risk of developing knee osteoarthritis (OA) increases greatly after sustaining an anterior cruciate ligament (ACL) injury. Two common reconstruction procedures include the quadruple-bundled semitendinosus, gracilis (STG) autograft, and harvesting of cadaveric tissue (ie., allograft). In previous work we have shown the STG autograft results in profound morphological changes to the hamstrings muscle group, while minimal changes are seen in those after allograft reconstruction. This is relevant in the context of OA as muscle forces are the dominant contributor to joint loading; and altered loading is believed to be associated with the onset and progression of knee OA. These findings lead us to believe there will be differences in joint loading depending on graft type.

PURPOSE: To investigate if there is a differential effect in joint loading associated with graft type in a group of healthy, young active patients during natural cadence walking.

METHODS: Medial and lateral compartment contact forces for 5 individuals after STG autograft reconstruction and 5 subjects who had the allograft procedure were compared six months after surgery. EMG and motion analysis data were used as inputs to an EMG-driven musculoskeletal model to predict knee joint loading. The model included 10 lower extremity muscles crossing the knee, and all forces were normalized to bodyweight (BW). The interval of interest was limited to the stance phase of natural cadence walking.

RESULTS: Peak medial contact force for subjects with an allograft was 2.05 BW’s (SD = 0.25), while peak loading for the STG autograft group was 2.49 BW’s (SD = 0.37). Peak loading occurred at 24% and 22% of stance respectively. Peak lateral contact force for the autograft group (mean = 1.25 BW; SD = 0.44) coincided with the timing of peak medial loading; in contrast the allograft group had smaller lateral loading (1.09 BW’s; SD = 0.34) reaching a peak value earlier during stance (12%).

CONCLUSION: It is premature to draw strong conclusions given our small sample size, however our preliminary data suggest disrupting the hamstrings during the reconstructive process impacts joint loading in patients undergoing reconstruction.

As we know, most of the badminton players have better muscle strengths, agility, suddenly stop, and intermittent running abilities than the normal people. The resistance training of badminton players also focuses on the lower limb. Are the mechanical properties of the tendon and joint proprioception of the badminton players better than the normal?

PURPOSE: The purpose of this research is to investigate the difference of patellar tendon stiffness and knee joint proprioception between badminton players and normal subjects with similar age.

METHODS: Fourteen university badminton players and twelve university students without training were recruited in this study. All of them are healthy and without any lower extremity injuries within one year. Following the warm-up, the dynamometer was used for patella tendon stiffness and knee joint proprioception measurement. In the patellar stiffness measurement, the patella tendon length elongation at 100%, 75%, 50% 25%, and 0% (rest) of maximum isometric torque was detected by the ultrasound image. The slope of regression between tendon force and tendon elongation is defined as tendon stiffness. Joint position sense (JPS) was used as the index of joint proprioception in both passive and active movements. Two sample t-test was used to detect the difference of tendon stiffness and joint proprioception between players and normal.

RESULTS: In the knee joint proprioception test, badminton players have better performance than normal in the active JPS (8.58±5.85 degrees vs. 4.90±2.37 degrees, p<0.05). However, the tendon stiffness between badminton players and normal did not show significant difference (669.11±345.82 N/mm vs. 805.46±223.51 N/mm, p>0.05).

CONCLUSIONS: According to this study, the stiffness of patellar tendon in badminton players is not stronger than normal university students as expected. We also found that the badminton players have better joint proprioception than the normal university students. That may be the reason the players have better agility and movement ability. Moreover, the poor proprioception may also lead to injuries easily during exercise in untrained people.
CONCLUSION: The mean distance between the CO and individual origins was 0.7 mm (CI: 0.5 mm - 0.9 mm). The mean angle and 95% CI between the resultant AP, ML, and PD axis and each subject's axis was 1.3° (CI: 0.9° -1.7°), 3.0° (CI: 1.8° - 4.2°), and 3.2° (CI: 2.1° - 4.3°) respectively. The mean distance between the CO and individual origins was 0.7 mm (CI: 0.5 mm - 0.9 mm).

METHODS: 3D patella surface models (PSM) were isolated from CT images (512x512, 0.625 slice thickness) of 10 subjects’ knees (5 M, 25±4.2 yrs; 5 F, 26±2.3 yrs). The center of mass of the PSM defined the origin of the ACS. The 3rd principal axis of inertia served as the anterior/posterior (AP) axis. The proximal/distal (PD) axis was aligned with the posterior vertical ridge by rotating the 1st and 2nd inertial axes about the AP axis until the variation in the medial/lateral (ML) location of the ridge was minimized. We determined inter-subject ACS repeatability by registering all PSM’s and their associated ACS to a single PSM, using a best-fit alignment algorithm. We computed a resultant AP, ML, and PD axis from the vector sum of all AP, ML, and PD axes. We then calculated the centroid (CO) from all ACS origins. We quantified differences between whole bone morphology and the ACS by computing the angle between the resultant axis and each subject’s axis, and the distance between the CO and each origin.

RESULTS: The mean angle and 95% CI between the resultant AP, ML, and PD axis and each subject’s axis was 1.3° (CI: 0.9° -1.7°), 3.0° (CI: 1.8° - 4.2°), and 3.2° (CI: 2.1° - 4.3°) respectively. The mean distance between the CO and individual origins was 0.7 mm (CI: 0.5 mm - 0.9 mm).

CONCLUSION: The low inter-subject variability of the ACS suggests that this patellar morphology based method is robust.

CONCLUSION: The influence of hamstring stiffness on loading biomechanics.

PURPOSE: To determine an anatomical coordinate system (ACS) using the morphology of the patella.

METHODS: 3D patella surface models (PSM) were isolated from CT images (512x512, 0.625 slice thickness) of 10 subjects’ knees (5 M, 25±4.2 yrs; 5 F, 26±2.3 yrs). The center of mass of the PSM defined the origin of the ACS. The 3rd principal axis of inertia served as the anterior/posterior (AP) axis. The proximal/distal (PD) axis was aligned with the posterior vertical ridge by rotating the 1st and 2nd inertial axes about the AP axis until the variation in the medial/lateral (ML) location of the ridge was minimized. We determined inter-subject ACS repeatability by registering all PSM’s and their associated ACS to a single PSM, using a best-fit alignment algorithm. We computed a resultant AP, ML, and PD axis from the vector sum of all AP, ML, and PD axes. We then calculated the centroid (CO) from all ACS origins. We quantified differences between whole bone morphology and the ACS by computing the angle between the resultant axis and each subject’s axis, and the distance between the CO and each origin.

RESULTS: The mean angle and 95% CI between the resultant AP, ML, and PD axis and each subject’s axis was 1.3° (CI: 0.9° -1.7°), 3.0° (CI: 1.8° - 4.2°), and 3.2° (CI: 2.1° - 4.3°) respectively. The mean distance between the CO and individual origins was 0.7 mm (CI: 0.5 mm - 0.9 mm).

CONCLUSION: The low inter-subject variability of the ACS suggests that this patellar morphology based method is robust.

PURPOSE: To determine the influence of movement anticipation on ACL loading using a musculoskeletal model.

METHODS: Twenty healthy recreationally active females (21 ± 1 year, 61.8 ± 6.4 kg; 1.66 ± 0.05 m) completed a cutting tasks that consisted of four conditions: anticipated (AC) and unanticipated (UC) cutting, a straight run, and a stop. Three-dimensional kinematic and kinetic data were then input into a subject-specific musculoskeletal model created using OpenSim to estimate muscle forces during the AC and UC trials. The musculoskeletal model outputs were used in a three-dimensional model of the knee to calculate ACL force. Dependent t-tests were used to assess differences in ACL force between AC and UC trials. Other variables of interest included the timing peak ACL force, as well as the planar components (sagittal, frontal and transverse) of ACL loading. Significance for all tests was set at p<0.05.

RESULTS: Peak ACL loading significantly increased during UC trials (AC: 11.02 ± 4.65 N·kg⁻¹, UC: 12.40 ± 3.79 N·kg⁻¹, p=0.001). However, there was no difference in the timing of this peak.

CONCLUSION: The results of this study suggest that increases in ACL loading during UC maneuvers is primarily due to changes in sagittal plane loading. Furthermore, while peak knee abduction moment has been prospectively identified as an ACL injury risk factor, the current model supports the hypothesis that knee adduction loads in isolation may not large enough to injure the ACL.

PURPOSE: To evaluate the influence of hamstring stiffness on landing biomechanics.

METHODS: In 8 men (27±3y) and 8 women (26±4y) we studied the dorsiflexors during and following 5 sets of 30 lengthening contractions performed on a Biodex. A 30 second rest period separated each set. The entire session was performed on isokinetic equipment at 2482 revolutions per minute.

RESULTS: Both men and women showed a significant decrease in MVC during the 30 lengthening contractions (p<0.05). Both groups had similar impairments in maximal shortening velocity (~4%) and peak power (~1%). However, women had a larger reduction in MVC than men throughout recovery (p<0.05). Both groups had similar impairments in maximal shortening velocity (~4%) and peak power (~1%). However, women had a larger reduction in MVC than men throughout recovery (p<0.05). Power was reduced preferentially at higher loads (i.e., >50% MVC) with a greater loss (~20%) in women than men (p<0.05), whereas maximal shortening velocity was minimally affected in both groups.

CONCLUSION: Greater impairments in isometric RTD following muscle damage can explain the greater loss of power at higher loads in women than men. However, the similar change in OPT and neural activation cannot explain the power loss difference between men and women. Thus, it seems, following muscle damage RTD is a critical component for dynamic muscle performance and the disparity between the sexes needs further elucidation.

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PURPOSE: To evaluate the influence of hamstring stiffness on landing biomechanics.
RESULTS: Thirty-six healthy volunteers (18 males, 18 females) participated in this investigation. Stiffness was assessed from the damping effect imposed by the hamstrings on oscillatory knee flexion-extension. Lower extremity biomechanics were captured during a double leg landing task via a motion capture system interfaced with a force plate. Simple bivariate correlations were used to evaluate relationships between hamstring stiffness and landing biomechanics. Stiffness data were also arranged into tertiles, and landing biomechanics were compared between the highest and lowest tertiles (i.e. High vs. Low stiffness groups) via independent t-tests.

RESULTS: Peak internal knee varus moment was negatively correlated with hamstring stiffness (r = -0.414, p = 0.006) and was 4x smaller in the High stiffness group (0.049W@ vs. 0.014W@, p = 0.019). The High stiffness group also demonstrated greater knee flexion at the instants of peak anterior tibial shear force (62 vs. 77, p = 0.049) and internal knee extension (56 vs. 69; p = 0.048) and varus (45 vs. 62; p = 0.018) moments.

CONCLUSION: Large frontal plane knee loading increases ACL injury risk. Additionally, greater knee flexion reduces ACL loading for given joint kinetics. Our data indicate that individuals with greater hamstring stiffness display landing biomechanics consistent with lesser ACL loading and injury risk. As muscle stiffness can be modified via training, exercises which enhance hamstring stiffness may be important additions to future ACL injury prevention programs.

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**Reliability Of Transcranial Magnetic Stimulation-related Measurements Of Plantar Flexor Muscles In Healthy Subjects**

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(No relationships reported)

Despite the widespread use of transcranial magnetic stimulation (TMS), only few studies focusing on the elbow, wrist and quadriceps muscles have described the reliability of the measure(s) being used. To date, the applicability and reliability of a TMS twitch interpolation technique for measuring cortical voluntary activation of the plantar flexors is unknown.

PURPOSE: This study aimed at comprehensively evaluating the test-retest reliability of TMS-related measurements linked to the cortico-spinal control of the plantar flexor muscles in healthy subjects.

METHODS: Cortico-spinal responsiveness and cortical voluntary activation were assessed from the plantar-flexor muscle group in 15 healthy adults (32 ± 4 years) on two visits separated by 4 weeks - i.e. where they maintained their normal lifestyle - by measuring motor evoked potentials produced with microscopic titanium particles (Aquatitan). Possible mechanisms are increased tendon compliance or modulated peripheral nervous-system activity.

Purposes: To determine the magnitude of increase in ankle joint ROM, Achilles tendon compliance, and reflex response with Aquatitan tape 48-h following a 40-min intermittent treadmill run.

METHODS: In a double-blind crossover, 10 males performed two 3-d trials comprising: 1) baseline measures, randomly-allocated Aquatitan- or placebo-taped treatment covering the triceps surae, treadmill run; 2) recovery; 3) post-treatment outcomes. Compliance was determined by isometric dynamometry during plantarflexion, utilising simultaneous real-time ultrasound imaging of the Achilles-medial gastrocnemius muscle-tendon junction, and motion analysis of landmarks. Motor reflex latency was determined using tendon tap and electromyography. An exponential curve was fitted to force-length data to model tendon compliance. Data were log-transformed prior to mixed modelling and magnitude-based inference.

RESULTS: The application of Aquatitan tape during recovery resulted in a small 5.1% (90% CI: ±4.5%) increase in plantar-flexor ROM relative to placebo tape, but the impact on dorsiflexion ROM was unclear (-1.6% ±15.2%). Placebo tape application had trivial impact on Achilles compliance (-5.8% ±19.5%), but Aquatitan tape increased compliance (22% ±25% with the difference small (23% ±18%). In the tendon-tap experiment, placebo tape had trivial impact (0.2% ±3.0%) on reflex latency, while Aquatitan tape reduced latency (-6.7% ±2.8%) with a moderate difference (~7.3% ±4.6%).

CONCLUSIONS: Increased plantarflexor ROM and Achilles tendon compliance suggests that the application of Aquatitan tape to primary movers during and after high-intensity running reduces tendon stiffness and improves reflex reaction time. Increased compliance may enhance tendon function warranting further investigation on the effect of Aquatitan on running economy and to explore therapeutic applications relating to reduced tendon stiffness.

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**Influence of Lean Mass on Lower Extremity Biomechanics during a Prolonged Exercise Bout**

Melissa M. Montgomery, Randy J. Schmitz, Sandra J. Shultz, FACSM. 1California State University, Northridge, Northridge, CA. 2University of North Carolina at Greensboro, Greensboro, NC.

(No relationships reported)

The ability of the lower extremity (LE) musculature to maintain proper function and provide dynamic joint stability is likely a crucial factor in reducing injury risk during exercise. Possessing a greater relative proportion of LE lean mass (LELM) may delay the adoption of high risk biomechanics. However, little is known regarding the influence of body composition, specifically available LELM relative to total body mass, on resistance to deleterious changes in biomechanics during a prolonged exercise bout.

**PURPOSE:** To investigate the influence of LELM on LE biomechanics during a prolonged exercise bout designed to simulate a soccer match. We expected that a lower relative amount of LELM would predict high risk frontal and transverse hip and knee motions linked to ACL injury risk; further, that the strength of these relationships would increase with greater exercise duration.

**METHODS:** 26 females (1.7±0.1m, 61.7±9.5kg, 20.7±2.5yrs) and 28 males (1.8±0.1m, 75.1±7.1kg, 20.3±2.0yrs) were assessed for LELM using dual-energy x-ray absorptiometry (DXA) and completed a 90 minute intermittent over ground running protocol that was individualized to his/her fitness level to control for exercise intensity across participants. 3D biomechanical data were collected during drop jump landings performed every 15 minutes during the protocol. Linear regressions examined the extent to which LELM predicted frontal and transverse hip and knee kinematics collected at 4 time points during the exercise protocol (T1, T2, T3, T4), corresponding to measurements taken immediately before and after two 45-minute running intervals.

**RESULTS:** LELM was a significant negative predictor (p<0.05) of peak hip abduction (R²=0.08, 0.12, 0.10, 0.08) and knee valgus (R²=0.12, 0.11, 0.09, 0.12) at T1-T4 and for knee valgus excursion at T2-T4 (R²=0.13, 0.12, 0.08, respectively). LELM predicted increased knee external rotation excursion at T4 only (R²=0.07).

**CONCLUSIONS:** Lower amounts of LELM were related to various "at-risk" landing variables and in the case of knee rotation, became apparent as exercise duration increased. This implies that greater amounts of LELM may aid in avoidance of high risk LE mechanics, thus potentially reducing increased injury risk documented with longer exercise duration. Supported by NFL Charities Medical Grant

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**Unchanged Anconeus Motor Unit Recruitment Thresholds At Maximal Velocity In Response To Submaximal Velocity-dependent Fatigue**


(No relationships reported)

Motor unit (MU) discharge rates of the anconeus decrease during maximal velocities in response to submaximal velocity-dependent fatiguing elbow extensions, but the relative change of MU recruitment thresholds in this paradigm is undefined.

**PURPOSE:** To determine the effect of submaximal velocity-dependent fatiguing elbow extensions on anconeus MU recruitment thresholds recorded during a maximal velocity-dependent elbow extension.

**METHODS:** Motor units (n=5) of the anconeus from 5 healthy young men were tracked throughout a series of submaximal and maximal velocity-dependent fatiguing elbow extensions performed over 60° range of motion. Subjects first performed 3 maximal voluntary contractions (MVCs) followed by 3-5 maximal velocity-dependent elbow extensions at a load of 40%MVC (Vmax40), each separated by 2 minutes rest. Subjects then performed a submaximal fatiguing task comprised of 10 submaximal (60%MVC40) elbow extensions followed by 2 maximal (Vmax40) elbow extensions. The protocol continued until subjects failed to reach 60%MVC40, and a single MVC was performed immediately following task failure. Motor unit recruitment thresholds were determined for each submaximal and maximal contraction as the relative force a which the first MU action potential began discharging consistently. The inclusion criteria required a MU to be active for greater than 90% of all contractions. Recruitment thresholds were expressed relative to MVC for individual comparison, and relative to the highest recorded threshold for group comparisons.

**RESULTS:** Recruitment thresholds ranged from 0%MVC to 65%MVC, with average thresholds of 13.0%, 15.1%, 13.1%, and 10.0% at 25%, 50%, 75%, and 100% of time to task failure, respectively. When expressed relative to the highest recorded MU recruitment threshold for each subject, there was no change in recruitment threshold as subjects progressed to task failure for both submaximal and maximal elbow extensions. However, there were tendencies (p=0.07) for an approximate 30% reduction in MU recruitment threshold for Vmax40 and for 60%MVC40 at task failure.

**CONCLUSIONS:** results support a maintenance of anconeus MU recruitment thresholds in response to submaximal fatiguing velocity-dependent elbow extensions when recorded at Vmax40. Supported by NSERC

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**Anconeus Discharge Rates Are Associated With Recovery Of Velocity Following A Submaximal Velocity-dependent Fatiguing Protocol**

In Ho Choi, Brad Harwood, Charles L. Rice, FACSM. University of Western Ontario, London, ON. Canada.

(No relationships reported)

In response to submaximal velocity-dependent fatigue, motor unit discharge rates (MUDRs) decline concurrently with the fatigue-induced reduction of power and velocity.

**PURPOSE:** To assess the short-term (10 mins) recovery profile of anconeus MUDRs following submaximal velocity-dependent fatiguing elbow extensions.

**METHODS:** Motor unit (MU) action potentials of the anconeus were tracked continuously in 5 healthy young men during baseline, fatiguing and recovery contractions using indwelling EMG wire electrodes. Subjects performed 3 maximal voluntary elbow extensions (MVCs) on a Biodex, followed by 3-5 maximal-effort velocity-dependent contractions at a load of 40%MVC (Vmaxa). Subjects then performed a fatiguing protocol comprised of 10 submaximal contractions per set at a speed of 60%Vmaxa followed by 2 elbow extensions at Vmaxa at the end of each set. Task failure occurred when the subjects could not reach 60%Vmaxa at the end of a set. Subjects also performed a single MVC immediately following task failure, and a MVC and two Vmaxa elbow extensions were performed at 30s, 2min, 5min, and 10min post task failure. Global EMG signals were sampled from the inserted wires in the long and lateral heads of the triceps brachii and MU trains were recorded using more selective wires from the anconeus. Elbow extensor power, contraction velocity, root mean square (RMS) of the long and lateral heads of the triceps brachii and anconeus, and individual MUDRs were determined at six time points (pre- and post-fatigue; and at 30s, 2min, 5min, and 10min recovery).

**RESULTS:** Torque, power and contraction velocity were reduced to 55%, 75% and 65%, respectively, at task failure (p<0.05). No significant differences in the global EMG of the long and lateral heads of the anconeus were observed during fatigue and recovery. Power and contraction velocity recovered within 5 min, but torque did not recover. Reduced (25%) MUDRs post-fatigue were restored to pre-fatigue MUDRs within 5 min (p<0.01). Regression analysis determined the greatest amount of shared variance to be between MUDR and velocity (R²=0.62), and MUDR and power (R²=0.58).

**CONCLUSION:** Results indicate that the reduced anconeus MUDRs recorded at Vmaxa following submaximal velocity-dependent fatigue recover at a similar rate to that of velocity and power. Supported by NSERC

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**Effects of Isometric Contraction on Stress Relaxation of the Plantar Flexors**

Andrew M. Stewart, Ilze R. Jacobs. 1Victoria University, Melbourne, Australia. 2Unitec, Auckland, New Zealand.

(No relationships reported)

Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation are techniques employed to increase flexibility. While these techniques are similar, they typically employ different contraction forces (% maximum). Previous studies have mainly investigated outcomes such as range of motion, but there has been little emphasis on physiological mechanisms of change.

**PURPOSE:** To explore the viscoelastic response (stress relaxation) during sub-maximal isometric contractions.

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CONCLUSIONS: Total stress relaxation led to a trend greater during decline in force during the sub-maximal protocol compared with the static stretch protocol. Negligible EMG activity lends support to a prominent viscoelastic adaptation.

METHODS: Twenty-seven females (18-25y) began this study. The data from 13 subjects were used for final analysis. All subjects acted as their own control. Subjects attended a familiarization session and two test sessions (each two weeks apart). A Kin-Com dynamometer was used to maintain subjects’ ankle at 80% of maximum dorsiflexion throughout the protocols. Subjects performed, in randomized order, either a sub-maximal protocol (20% MVIC) that consisted of three isometric contractions of five seconds, with five seconds rest between contractions, or a static stretch protocol in either test session. Stress (force) relaxation of the plantar flexor muscle-tendon unit and EMG activity were continuously recorded throughout both protocols.

RESULTS: A paired t-test between the initial peak passive force and final force indicated a substantial decline in both protocols (19.1% ± 5.5%, p = 0.002; and 14.8% ± 4.1%, p = 0.002 in the sub-maximal protocol and static stretch protocol respectively). The probability that the estimated difference between the protocols was clinically negative, trivial, or positive was 1%, 5%, and 93% respectively. Mean EMG activity was < 1% of maximum throughout.

CONCLUSIONS: Isometric MVC force decreased from pre- to post-stretching for the young group (P<0.001) but did not change in the elderly group (P=0.193). MVC force was also greater for the young group compared to the elderly at both time points (P<0.018) and decreased significantly more for the young group when baseline values were adjusted (P=0.006). There was a non-significant decrease in %VA for the young group (-3.9%) and no change (0.02%) for the elderly group (P=0.139). There was no aging or stretching induced changes in EMG SOL (P>0.05). However, normalized post-stretching EMG SOL values were significantly different (P=0.043) between the young (92.8%) and elderly group (104.0%).

CONCLUSIONS: These findings demonstrate that prolonged passive stretching results in significant decreases in MVC strength and are accompanied by changes in muscle activation (%VA and EMG MG amplitude) for the young group only. The lack of changes in MVC strength and muscle activation for the elderly group may suggest that the neural mechanism for the stretching-induced force deficit is gamma loop mediated.
2493  Board #168  MAY 31  2:00 PM - 3:30 PM  
**Influence Of Intensity Of Conditioning Contraction On The Extent Of Postactivation Potentiation Is Muscle Dependent**  
Atsuki Fukutani, Kosuke Hira, Naokazu Miyamoto, Hiroaki Keneishi, Toshimasa Yana, Yasuo Kawakami. 
1Waseda University, Tokorozawa, Japan. 2National Institute of Fitness and Sports in Kanoya, Kanoya, Japan.  

(No relationships reported)  

Twitch torque is increased after a high intensity voluntary contraction (conditioning contraction). This phenomenon is called postactivation potentiation (PAP). Because PAP occurs only in the muscle fibers that are activated by the conditioning contraction, it is likely that the extent of PAP is affected by the number of recruited muscle fibers. It is hypothesized therefore that the extent of PAP differs between muscles with different strategy of force increment (recruitment of muscle fibers and increasing firing frequency).

**PURPOSE:** To test the above hypothesis by comparing muscles with different recruitment patterns of muscle fibers (plantar flexor and adductor pollicis muscles).

**METHODS:** Eleven young adults (24.0 ± 1.4 years, 1.68 ± 0.08 m, 62.1 ± 8.8 kg) voluntarily participated in this study. Subjects performed plantar flexion and thumb adduction for 10 s as a conditioning contraction with an intensity set at each of 20, 40, 60, 80, and 100% of the maximal voluntary isometric contraction (MVC). Before and after each conditioning contraction, twitch torque was measured to evaluate the extent of PAP. The extent of PAP of each muscle was expressed with the normalized value with respect to the value of 100% MVC condition of each muscle.

**RESULTS:** For the plantar flexor muscles, the extent of PAP was significantly increased as the intensity of the conditioning contraction became higher (20% MVC: 6.7 ± 8.8%, 40% MVC: 20.4 ± 8.8%, 60% MVC: 44.8 ± 18.9%, 80% MVC: 81.4 ± 19.5%) (p < 0.05). For the adductor pollicis, while the extent of PAP was significantly increased up to 60% MVC condition (20% MVC: 25.6 ± 16.2%, 40% MVC: 63.1 ± 31.0%, 60% MVC: 111.0 ± 36.8%) (p < 0.05), there were no significant differences among 60%, 80% and 100% MVC conditions (80% MVC: 101.9 ± 34.5%).

**CONCLUSIONS:** The present study shows that the influence of intensity of conditioning contraction on the extent of PAP is different between plantar flexor and adductor pollicis muscles, suggesting that the extent of PAP is related to the amount of muscle fibers being recruited.

This study was supported by the Waseda University GCOE program.

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2494  Board #169  MAY 31  2:00 PM - 3:30 PM  
**The Influence Of Stiffness And Stretch Tolerance On The Viscoelastic Responses To Stretch**  
Eric Sobolewski, Eric D. Ryan, Brennan J. Thompson, Doug B. Smith. 
1University of North Carolina- Chapel Hill, Chapel Hill, NC. 2Oklahoma State University, Stillwater, OK. (Sponsor: Joel T Cramer, FACSM)  

(No relationships reported)  

**INTRODUCTION:** Skeletal muscle demonstrates properties of viscoelastic creep and stress-relaxation (SR) during passive stretching protocols and may be influenced by initial levels of passive stiffness and stretch tolerance.

**PURPOSE:** To examine the influence of passive stiffness and stretch tolerance on SR and creep during repeated passive stretching.

**METHODS:** Thirty-eight healthy participants (age = 24±3 yr) performed four 30-s constant torque passive stretches of their right plantar flexors on a calibrated Biodex System 4 dynamometer. All passive stretches were performed at a pre-determined torque threshold for the entire 30-s stretch. Prior to the 4 stretches, a maximal stretch tolerance test was performed to determine: (1) terminal passive stiffness, (2) common passive stiffness, and (3) maximal stretch tolerance. Position (°) and torque (Nm) signals were sampled at 2 KHz during each stretch and stretch tolerance assessment. Stress-relaxation was examined from the torque responses at 5-s intervals and creep was measured from the changes in position during subsequent stretches. Passive stiffness values were calculated from the slope of the angle-torque curve that was fit with a 4th order polynomial and normalized to corrected calf girth. The participants were then ranked by each of the three measures and the 10 highest and lowest participants were examined separately. A 4x2 mixed factorial ANOVA and independent t-test were used to examine the rate and relative change of SR and creep, respectively.

**RESULTS:** There was no difference (P>0.05) in the rate or relative change in SR between groups when ranked by terminal and common passive stiffness, except for stretch 3 (least stiff < most stiff) when ranked by common passive stiffness (P=0.005). There was also a main effect for stretch (1<2) when ranked by terminal stiffness (P=0.022). The group with the greatest stretch tolerance demonstrated a greater rate of change in SR (P=0.041), however the relative change in SR was similar between groups (P=0.578). There were no differences among any of the ranked groups (P>0.05) for the rate and relative change in creep.

**CONCLUSIONS:** These results indicated that differences in terminal stiffness, common passive stiffness, and stretch tolerance have little influence on the viscoelastic response to stretch.

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D-26  Free Communication/Poster - Pain  
MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall  

2495  Board #170  MAY 31  3:30 PM - 5:00 PM  
**Physical Activity is Related to Pain Sensitivity in Healthy Women**  
Laura D. Ellingson, Lisa H. Colbert, FACSM, Dane B. Cook, FACSM. 
University of Wisconsin-Madison, Madison, WI.  

(No relationships reported)  

There are many benefits associated with meeting current physical activity recommendations. At present, it is unknown whether a reduced sensitivity to pain is included among these benefits.

**PURPOSE:** To assess the relationship between pain sensitivity and physical activity and sedentary behaviors in a sample of healthy women.

**METHODS:** Self-reported and accelerometer measures of physical activity and sedentary behavior were collected and compared with pain intensity and unpleasantness ratings to noxious thermal stimuli in a sample of twenty-one healthy women (age 30.0 ± 5.8). Based on accelerometer data, participants were classified into two groups: meets recommendations (n=12) and insufficiently active (n=9). Independent samples t-tests were conducted to compare pain ratings and physical activity behaviors between groups and correlation coefficients (Spearman’s ρ) were calculated between average minutes per day spent in moderate, vigorous, and sedentary behaviors and average intensity and unpleasantness ratings.

**RESULTS:** Participants who met physical activity recommendations had significantly lower unpleasantness ratings than their insufficiently active peers. Correlational analyses demonstrated a significant relationship between minutes per day spent in vigorous physical activity and both pain intensity and pain unpleasantness ratings. Relationships were not significant for moderate activity or sedentary behavior.

**CONCLUSIONS:** These results provide preliminary evidence that meeting current physical activity recommendations may be beneficial for pain in women. Moreover, participation in vigorous activity appears to account for the decreased pain sensitivity. In our sample, sedentary behavior did not appear to have a deleterious effect on pain. Results from this study have a number of potential applications including aiding our understanding of why exercise functions as a treatment for those with chronic pain conditions, and providing a rationale for including physical activity assessment in pain research.
Pain complaints increase with age. Exercise is frequently utilized for pain relief but the optimal exercise prescription to relieve pain is not clear. Following static contractions, young adults experience the greatest pain relief with low intensity, long duration contractions. The pain response to static contractions in older adults however is unknown.

**PURPOSE:** To compare pain reports in healthy older adults before and after static contractions of varying intensity and duration.

**METHODS:** Pain perception was assessed in 23 healthy older adults (11 men, 12 women; 72.0 ± 6.3 yrs) using a pressure pain device consisting of a 10 N force applied to the right index finger through a Lucite edge (8 × 1.5mm) for two minutes. Subjects pushed a timing device when they first felt pain (i.e., pain threshold) and rated their pain intensity every 20 seconds using a 0-10 numerical rating scale. Pain threshold and pain ratings were measured before and immediately after static contractions of the left elbow flexors at the following three doses: 1) three brief maximal voluntary contractions (MVC); 2) 25% MVC sustained for 2 minutes; and 3) 25% MVC sustained until task failure. Experimental sessions were randomized and separated by one week.

**RESULTS:** Time to task failure for the 25% MVC contraction was 11.8 ± 5.1 minutes. A reduction in pain was found following all three tasks with no difference between tasks (trial x task effect: p > 0.05), despite the duration of the 2 minute low-intensity contraction being ~17% of the contraction held to task failure. Pain thresholds for all doses increased 20% from 51 ± 33 to 61 ± 37 seconds and pain ratings averaged over the six time points decreased 20% from 3.3 ± 2.8 to 2.6 ± 2.5 following static contractions (trial effect: p < 0.001 and p < 0.001, respectively).

**CONCLUSION:** Low and high intensity static contractions of both long and short duration produce similar levels of pain reduction in older adults. These preliminary data suggest that several different types of static contractions can induce significant pain relief in older adults. Age-related changes in the pain response to static contractions must be taken into account when prescribing static exercise for the management of pain.

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**Board #171**

**MAY 31 3:30 PM - 5:00 PM**

**Title:** Pain Relief in Older Adults Following Static Contractions is Not Task-Dependent

**Authors:** Kathy J. Lemley, Brenna Drewik, Lauren Miller, Sandra K. Hunter, FACSFM, Marie Hoeger Bement.

**Affiliation:** Marquette University, Milwaukee, WI.

**(No relationships reported)**

Pain relief is frequently utilized for pain relief but the optimal exercise prescription to relieve pain is not clear. Following static contractions, young adults experience the greatest pain relief with low intensity, long duration contractions. The pain response to static contractions in older adults however is unknown.

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**Board #172**

**MAY 31 3:30 PM - 5:00 PM**

**Title:** Robustness of Pain Catastrophizing Scores During Isokinetic Testing of Anterior Cruciate Ligament Deficient Patients

**Authors:** Elena D. Dianconescu, Sivan Almosnino, Dean Tripp, Davide D. Bardana, Joan M. Stevenson.

**Affiliation:** Queen’s University, Kingston, ON, Canada.

**(No relationships reported)**

Measurements of isokinetic knee musculature strength and pain catastrophizing behavior prior to Anterior Cruciate Ligament (ACL) reconstruction may serve as a baseline to which post-operative patient status may be compared. To attain maximal voluntary contractions during isokinetic testing, clinicians routinely employ various patient targeted psychological interventions with the purpose of enhancing motivation as well as reducing apprehension. However, these regular clinical practices may also influence immediate pain catastrophizing behavior, and hence confound baseline measurements of this psychological construct.

**PURPOSE:** To assess the robustness of pain catastrophizing scores obtained during knee strength testing of unilateral ACL deficient patients.

**METHODS:** 12 men (26±4 yrs) and 10 women (25±5 yrs) with unilateral ACL deficiency performed bilateral isokinetic knee musculature strength testing. The healthy knee was tested first, and testing of each leg encompassed 2 sets of 6 concentric extension-flexion repetitions at angular velocities of 60°·sec-1 and 180°·sec-1. During the warm-up phase and during testing, the examiner attempted to increase confidence and reduce possible fear of pain, or injury aggravation by providing targeted verbal and visual feedback on performance. Pain catastrophizing scores were obtained using the pain catastrophizing scale questionnaire prior to testing, between testing of the healthy and injured leg, and at completion of all efforts. Differences in pain catastrophizing scores within the testing session were assessed using one-way ANOVA with repeated measures.

**RESULTS:** Omnibus test results indicate nonsignificant statistical differences in pain catastrophizing scores as a function of questionnaire administration occurrence (mean pain catastrophizing scores 12.5, 11.9, and 11.2 for pre, mid, and post test occasions, respectively, p = 0.26).

**CONCLUSION:** The construct of pain catastrophizing was not affected by psychological interventions regularly employed during muscle strength testing. From a practical perspective, the pain catastrophizing scale questionnaire can be administered at a time of convenience during pre-operative isokinetic testing in this specific patient population.

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**Board #173**

**MAY 31 3:30 PM - 5:00 PM**

**Title:** Biopsychosocial Factors Influencing Physical Activity Participation Among People With Chronic Pain

**Authors:** Jennifer Hulburt, Angela Loucks-Atkinson, Sandra LeFort, LeAnne Petherick.

**Affiliation:** Memorial University of Newfoundland, St. John’s, NL, Canada. 2University of Manitoba, Winnipeg, MB, Canada.

**(No relationships reported)**

While it is known that a range of biological, psychological and sociological factors such as pain, perceived stress and exercise self-efficacy are associated with physical activity participation among people with chronic pain (CP), little is understood about the relationships among these variables and how they might impact physical activity participation in younger versus older adults with CP.

**PURPOSE:** To explore the relationships between pain, stress, exercise self-efficacy and physical activity participation among people with CP, and to examine the differences between older adults (50 years and older), and younger adults (under 50 years) in terms of the study variables.

**METHODS:** Self-administered surveys were collected from adults ranging in age from 19-79 years (N = 99). The Brief Pain Inventory (Cleeland & Ryan, 1994), Perceived Stress Scale (Cohen, Kamarck, & Mermelstein,1983), Baecke Questionnaire of Physical Activity (Baecke, Burema, Fritjers, 1982), and Exercise Self-Efficacy Scale (McAuley, 1993) were used to examine the relationships among pain (pain severity and pain interference), physical activity (PA) participation (Sport PA, Work PA, and Leisure PA), and exercise self-efficacy. Hierarchical regression, mediation analyses, and independent t-tests were used to test the hypothesis that greater stress prompts people to be more physically active because it helps them to cope with stress, and that those who are more physically active experience less pain.

**RESULTS:** Pain interference was more significantly associated with Sport PA, stress, and exercise self-efficacy than pain severity. Mediation analyses confirmed the buffer effect of physical activity participation on the association between stress and pain among the oldest adults (i.e. 70+ years). More active participants versus less active participants reported lower pain severity, lower pain interference, and higher levels of exercise self-efficacy.

**CONCLUSION:** An individual’s perception of the way pain interferes with their life and activities (e.g. mood, exercise, social relations, and work) is associated with their level of physical activity. People with CP, especially older adults, may reduce stress and pain in their lives by being more physically active.

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**Board #174**

**MAY 31 3:30 PM - 5:00 PM**

**Title:** Physical Activity, Pain, And Functional Limitations In Older, Overweight And Obese Knee Osteoarthritis Patients

**Authors:** Matthew J. Garver, Brian C. Focht, FACSFM, Steven T. Devor, FACSFM, Justin Dials, Charles F. Emsry, Alexander R. Lucas, Kevin Hackshaw.

**Affiliation:** Abilene Christian University, Abilene, TX. 2The Ohio State University, Columbus, OH.

**(No relationships reported)**

The pain and functional limitations accompanying knee osteoarthritis (KOA) are primary causes of age-related activity restriction and disability. Although it is well established that overweight individuals have significantly greater risk of developing KOA, it remains unclear if self-reported symptoms differ as a function of weight status among older KOA patients.

**PURPOSE:** The purpose of this investigation was to examine differences in pain and self-reported physical function in overweight, obese, and morbidly obese older adults with symptommatic KOA. A secondary purpose was to examine the relationship between physical activity (PA) participation, pain, and self-reported physical function.

**METHODS:** Seventy-one (58 women and 13 men; M age = 63 years) KOA patients classified as overweight (n=22), obese (n=36) or morbidly obese (n=13) completed assessments of the WOMAC pain and physical function subscales and pedometer-determined PA.
RESULTS: Results of univariate ANCOVA analyses controlling for age revealed that morbidly obese participants reported significantly greater pain symptoms ($p < 0.01$) and worse physical function ($p < 0.01$) relative to overweight or obese participants. No differences in pain or self-reported physical function were observed between the overweight and obese participants ($p > 0.05$). Results of partial correlation analyses controlling for age also revealed that pedometer-determined PA was inversely correlated with pain ($r = -0.31; p < 0.01$) and physical function ($r = -0.30; p < 0.01$).

CONCLUSIONS: The present results suggest that morbidly obese KOA patients report the highest pain symptoms and functional limitations. Additionally, higher levels of PA participation are associated with more favorable self-reported KOA symptoms. These findings underscore the potential importance of promoting successful weight management in the treatment of older KOA patients.

Supported by NIH/NIAMS Grant R21 AR054595

**D-27** Free Communication/Poster - Perceived Exertion

**MAY 31, 2012 1:00 PM - 6:00 PM**

**ROOM: Exhibit Hall**

### 2500 2:00 PM - 3:30 PM

**Board #175**

**Session RPE Is Not Different When Estimated 15 Minutes Vs 30 Minutes Post-exercise.**

Kyle R. Thompson¹, Justin A. Kraft¹, James M. Green, FACSM². Missouri Western State University, Saint Joseph, MO. ¹University of North Alabama, Florence, AL.

(No relationships reported)

Session RPE is considered a valid and reliable measure at a period of 30 minutes (min) post exercise. Recent research which recorded session RPE every 5 min for a 30 min post-exercise period showed the possibility of session RPE’s validity at all intervals 15 min through 30 min post exercise. However, the session RPE may have been influenced by the proximity of the previous rating.

**PURPOSE:** The purpose of this study was to corroborate previous research in order to confirm 15 min as an acceptable time for session RPE estimation.

**METHODS:** Participants performed three resistance training sessions (at 60% of their predetermined 1RM) consisting of the bench press, lat pulldown, overhead press, upright row, triceps extension, and biceps curl according to the following protocols: a) 3 sets x 8 reps x 1.5 min rest, b) 3 sets x 8 reps x 3 min rest, c) 2 sets x 12 reps x 3 min rest. A standard 2 min rest was provided between all exercises. Session RPE and recovery HR were recorded 15 min and 30 min after exercise. Session RPE was gathered by asking the question “How difficult was the overall workout?” according to the 10-point omni scale for resistance training. Session RPE was analyzed with a 3 condition x 2 time point repeated measures ANOVA.

**RESULTS:** No significant difference was observed in session RPE based on time recorded 15 min post exercise (5.1 ± 1.5) vs. 30 min post exercise (5.2 ± 1.6). However, mean recovery HR was significantly higher (81 ± 6 bpm) at 15 min post exercise than 30 min post exercise (74 ± 5 bpm).

**CONCLUSIONS:** No observed difference in session RPE when recorded 15 min post exercise vs. 30 min post exercise confirms the results of Singh et al., 2007 indicating that 15 min after exercise is a sufficient passage of time for accurate measurement of session RPE. No change in session RPE despite a significant decrease in recovery HR indicated recovery HR had no effect on session RPE at 15 min post exercise.

### 2501 2:00 PM - 3:30 PM

**Board #176**

**Relative Intensity Oxygen Consumption at Criterion RPE in Trained and Untrained Men following Memory Anchoring**

Randall F. Gearhart, Jr., FACSM¹, Beth J. Patton², David F. Vanata³, Bruce Mason³. Ashland University, Ashland, OH. ²University of Akron, Akron, OH.

(No relationships reported)

It has been shown that memory anchoring is sufficient for monitoring ratings of perceived exertion (RPE) in recreationally trained men and women. It is unclear if memory anchoring would also be appropriate for those that may not be as familiar with sensations experienced during exercise and their placement in the effort-perceptual response continuum.

**PURPOSE:** The current investigation compared percent of maximal oxygen uptake in recreationally trained (RT) versus untrained (UT) men at selected criterion RPE during graded, treadmill exercise following memory anchoring to the Borg 15-category scale.

**METHODS:** Eight men were assigned to each group. The RT (23.88 ± 1.77 yrs.) each received memory anchoring instructions. The experimental trial consisted of a graded, treadmill exercise test with small increases in intensity between stages. Linear regression with RPE as the independent variable and oxygen consumption as the dependent variable was used to calculate percent VO2peak for each criterion RPE (7, 9, 11, 13, 15, 17, and 19). An independent samples t-test was used to compare percent VO2peak between RT and UT at each criterion RPE.

**RESULTS:** As expected, VO2peak was higher for the RT than the UT. All other descriptive variables were similar between groups. Relative oxygen uptake at each criterion RPE was also similar.

**CONCLUSION:** The current results are similar to a previous investigation using trained and untrained young adult women. Memory anchoring saves time in estimation-production designs by allowing examiners to anchor participants and have them perform a follow-up experimental trial in a single laboratory session. Also, in the attempt to construct a prediction model using RPE as the independent variable, it is critical that memory anchoring instructions be presented before exercise. Pre-exercise memory anchoring yields similar relative VO2 for young men independent of training status, further validating Borg’s assumption for the application of a category scale that the perceptual range may be set equal for all individuals.

### 2502 2:00 PM - 3:30 PM

**Board #177**

**Accuracy Of Perceived Exertion In Older Adults Performing Common Daily Tasks**


(No relationships reported)

**PURPOSE:** To examine the relationship between ratings of perceived exertion (RPE) and metabolic effort in older adults performing common daily tasks. Though metabolic responses to physical activity explain the majority of RPE variance among young adults, few studies have evaluated whether metabolic effort is associated with RPE in older adults.

**METHODS:** Forty-five community-dwelling older adults (70-90 years) performed 14 daily tasks in a laboratory setting at a self-selected pace. During testing, participants wore a portable metabolic unit to measure pulmonary gas exchange. Metabolic equivalents (MET) were calculated as ventilation of oxygen ($V_{O2}$)/3.5 ml kg$^{-1}$ min$^{-1}$. Each task was performed for 9.1 ± 1.8 min to allow for a steady state metabolic rate to be reached. The RPE scale (CR-10) was administered using standardized instructions following the completion of each task.

**RESULTS:** Correlational analysis revealed a significant but weak association between RPE and METs ($r^2 = 0.07; p < 0.01$), indicating that physiological responses to physical activity only explains 7% of the variance in perceived exertion among older adults. Analyses to establish the directionality of the error revealed that of the 38% of participants demonstrating exertional error, 21% overestimated and 17% underestimated moderate/vigorous intensity exertion (>3 METs). Polytonous logistic regression indicated that higher MET cost of activity [Odds Ratio (OR): 0.38, 95% Confidence Interval (CI): 0.22-0.64], lower physical function (OR: 0.78, 95% CI: 0.67-0.91), older age (OR: 0.77, 95% CI: 0.63-0.94), exercising 30 minutes per day (OR: 0.70, 95% CI: 0.51-0.97), and lower cognitive function (OR: 0.66, 95% CI: 0.53-0.84) were associated with underestimating RPE compared to measured MET level. Higher body mass index (OR: 1.28, 95% CI: 1.05-1.54) and experiencing non-exertion related fatigue (OR: 1.77, 95% CI: 1.15-2.71) were associated with overestimating RPE.

**CONCLUSION:** Older adults inaccurately estimate their exertion while performing daily tasks. Physiological, psychological, and demographic factors differentially affect the magnitude and direction of RPE error in rating moderate intensity physical activity. These inaccuracies might complicate prescribing the recommended physical activity intensity to older adults.
Research investigating exertional responses to continuous aerobic exercise suggests that RPE increases over time during constant load work. Recent studies comparing predicted, momentary, and session RPE in response to continuous aerobic exercise suggest that RPE taken before and after exercise do not always match in-task assessments of effort. Predicted and session RPE values typically match peak exertion or exertion observed near the conclusion of the exercise session. One area not yet adequately addressed by the research literature relates to how sprint interval training impacts exertion.

**PURPOSE:** Determine the impact of sprint interval training on RPE responses obtained pre-exercise, during exercise (for work and recovery phases), and upon completion of exercise.

**METHODS:** Sixteen healthy participants (9 male, 7 female; mean age ± SD = 23 ± 2 years) completed a maximal cycle ergometer test and two counterbalanced sprint interval training sessions. Each session utilized the same work-to-rest ratio (1:1), work intensity (90% max), recovery intensity (10% max), and session duration (16 minutes). Trials differed on work duration, with a 30-sec trial and a 60-sec trial. RPE was assessed before, during, and after sessions. Sessions required the same amount of total work over the duration of the trial, but the manner in which the effort was distributed varied.

**RESULTS:** Data were analyzed using ANOVA and pairwise comparisons. Predicted, momentary, and session RPE were higher for the 60-sec trial than the 30-sec trial (p < 0.05) despite no difference in total work. Analyses also revealed that RPE increased significantly over time in the work and recovery phases of the interval, with greater increases occurring in the 60-sec trial (p < 0.05).

**CONCLUSIONS:** Findings suggest that sprint interval trials utilizing the same total external work and work-to-recovery ratio but differing on interval length produce significantly different RPE responses. RPE is significantly greater for sessions of exercise that utilize longer work intervals. These findings have implications for individuals who utilize interval training as part of their fitness program and suggest that shorter intervals may produce less fatigue and exertional discomfort.

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**Perception of Exercise Intensity Level in Recreationally Active Young Adults**

Kristofer Wisniewski, Alex Shafer, Monica Taylor, Elizabeth Nagle, FACSM, Robert Robertson, FACSM, Fredric Goss, FACSM. University of Pittsburgh, Pittsburgh, PA.

The American College of Sports Medicine (ACSM) defines moderate exercise intensity as 40% to < 60% oxygen uptake reserve (VO2R) that noticeably increases heart rate (HR) and breathing, and vigorous exercise intensity as ≥ 60% VO2R that results in substantial increases in HR and breathing. However, no previous studies have examined if individuals can identify these intensities as feeling moderate or vigorous.

**PURPOSE:** To determine how physically active young adults perceive moderate and vigorous exercise intensity based on ACSM definitions.

**METHODS:** Twenty (males, n=10; females, n=10) recreationally active adults (22.2 ± 3.0 yrs) performed a peak load-incremented cycle ergometer test. Subjects used a Perceived Intensity Level (PIL) scale with the following categories: 1-Light, 2-Light/Moderate, 3-Moderate, 4-Moderate/Vigorous, and 5-Vigorous. Subjects rated their PIL at the end of each 3 min stage. 40% and 60% VO2R (1 min-1) were calculated for each subject, and the stages these intensities occurred were identified. The PIL rated during the stages that 40% and 60% VO2R occurred were taken as the subject’s PIL at those intensities.

**RESULTS:** Paired Samples t-test showed the mean ± SD PIL ratings at 60% VO2R (2.7 ± 0.7) were significantly greater (p<0.05) than the ratings at 40% VO2R (1.4 ± 0.6). At 40% VO2R, 65% of subjects reported the intensity as Light, 30% reported the intensity as Light/Moderate, and 5% of subjects reported the intensity as Moderate. At 60% VO2R, 45% of subjects reported the intensity as Light/Moderate, 40% reported the intensity as Moderate, and 15% reported the intensity as Moderate/Vigorous.

**CONCLUSION:** ACSM guidelines state individuals should exercise at a moderate and/or vigorous intensity for health benefits. The majority of subjects in this study perceived moderate intensity as Light to Light/Moderate, and only 15% perceived the border between moderate and vigorous intensity (60% VO2R) as Moderate/Vigorous. These results suggest that the majority of recreationally active young adults underestimate their exercise intensity.

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**Validity of Three Alternative Versions of the Original OMNI Cycle Scale of Perceived Exertion**

George L. Panzak, Robert J. Robertson, FACSM, Fredric L. Goss, FACSM, Elizabeth F. Nagle, FACSM, Elaine N. Rubinstein, Tanya Shyrchenko, Alex B. Shafer. University of Pittsburgh, Pittsburgh, PA.

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**Exertional Responses To Sprint Interval Training: A Comparison Of 30-sec and 60-sec Conditions**

Marcus Kilpatrick, Samuel I. Grecley, Elizabeth A. Hubbard, Larry H. Collins, Jamie L. Ohanan. University of South Florida, Tampa, FL. Villanova University, Villanova, PA. (Sponsor: John Bartholomew, FACSM)

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RESULTS: Listed in Table 1 are the correlation/regression analyses for Concurrent Validity. Listed in Table 2 are the correlation/regression analyses for Construct Validity. ANOVA indicated signal dominance and signal integration for each of the three alternative scales.

CONCLUSION: Findings supported concurrent and construct validity of the three Alternative Adult OMNI-Cycle Scale formats where the zero category represented a resting state and not an exercise response.

<table>
<thead>
<tr>
<th>TABLE 1. Concurrent Validity: RPE expressed as a function VO2 and HR.</th>
<th>Alternative Scale I</th>
<th>Alternative Scale II</th>
<th>Alternative Scale III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion</td>
<td>RPE Predictor</td>
<td>r*</td>
<td>r*</td>
</tr>
<tr>
<td>VO2</td>
<td>Overall</td>
<td>0.92</td>
<td>0.90</td>
</tr>
<tr>
<td>Chest</td>
<td>0.90</td>
<td>0.92</td>
<td>0.86</td>
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<tr>
<td>Legs</td>
<td>0.92</td>
<td>0.89</td>
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<tr>
<td>HR</td>
<td>Overall</td>
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<td>0.89</td>
</tr>
<tr>
<td>Legs</td>
<td>0.84</td>
<td>0.88</td>
<td>0.92</td>
</tr>
<tr>
<td>Chest</td>
<td>0.80</td>
<td>0.88</td>
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<td>*P&lt;0.01</td>
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<thead>
<tr>
<th>TABLE 2. Construct Validity: RPE from alternative scales vs RPE from original scale.</th>
<th>Alternative Scale I</th>
<th>Alternative Scale II</th>
<th>Alternative Scale III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original-RPE Criterion</td>
<td>r*</td>
<td>r*</td>
<td>r*</td>
</tr>
<tr>
<td>Overall</td>
<td>0.94</td>
<td>0.95</td>
<td>0.92</td>
</tr>
<tr>
<td>Legs</td>
<td>0.94</td>
<td>0.96</td>
<td>0.93</td>
</tr>
<tr>
<td>Chest</td>
<td>0.93</td>
<td>0.96</td>
<td>0.95</td>
</tr>
<tr>
<td>*P&lt;0.01</td>
<td></td>
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</tbody>
</table>

1 Validity of Borg Ratings of Perceived Exertion During Active Video Game Play
Brandon S. Pollock1, Jacob E. Barkley1, Nick Potenzini2, Renee M. DeSalvo2, Stacey L. Buser2, Ronald Ottersatter2, Judith A. Juvancic-Heltzel1,2. 1Kent State University, Kent, OH. 2The University of Akron, Akron, OH. (Sponsor: Ellen L. Glickman, FACSM)

BACKGROUND: Borg’s rating of perceived exertion (RPE) scale has been shown to be a valid tool for predicting physiologic effort during differing modes of exercise (e.g. walking, running and cycling). However, an individual’s perception of their effort at a given exercise intensity can be altered with distracters such as listening to music while exercising. Increasingly, physically interactive video games (e.g. Nintendo Wii) have been studied as potential modes of exercise. RPE during game play is often assessed in these studies. However, during game play the user will be exposed to multiple potential distracters: the video of their interactive computer avatar, music and sound effects. These factors may reduce an individual’s ability to accurately predict their physiologic effort during game play.

PURPOSE: To determine the association between RPE scores and heart rate during physically-interactive video game play.

METHODS: Thirteen healthy adults (51.5 ± 11.5 years old) participated in two separate, 40-minute exercise sessions using the Nintendo Wii Fit Plus on non-consecutive days. During each session participants underwent a five-minute warm-up (running in place as part of the Basic Run game), played two separate Wii Fit Plus games (Yoga, Strength Training, Aerobics or Balance Training) for fifteen minutes each and then completed a five-minute cool down (identical to the warm up). Borg RPE and heart rate were assessed during the final 30 seconds of the warm up and cool down, as well as the final 30 seconds of minutes 15 and 30 of Wii Fit Plus play.

RESULTS: Correlation analysis combining data from both exercise sessions indicated a moderate positive relationship between heart rate and RPE (r = 0.32). Mixed-effects model regression analyses demonstrated that RPE scores were significantly associated with heart rate (p < 0.001). The average percentage of age-predicted heart rate maximum achieved (58 ± 6%) was significantly greater (p = 0.001) than the percentage of maximum RPE indicated (43 ± 11%)

CONCLUSIONS: Borg RPE scores were found to be positively associated with heart rate in adults during exercise sessions using the Wii Fit Plus. However, this relationship was lower than observed in past research that assessed RPE validity during different modes of exercise (e.g. walking, running and cycling) without distracters.

D-28 Free Communication/Poster - Physical Activity Assessment
MAY 31, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2508 Board #183 MAY 31 3:30 PM - 5:00 PM
Accuracy of Self-Reported Height and Weight among Basic Combat Trainees
Ryan Steelman1, Joseph J. Knarik, FACSM1, Marilyn Sharp2, Nathan Hendrickson3, Jan Redmond1, Bruce Cohen1, Bruce H. Jones, FACSM1, 1Army Institute of Public Health, Aberdeen Proving Ground, MD. 2US Army Research Institute of Environmental Medicine, Natick, MA. (No relationships reported)

Height (H) and weight (W) measurements are used to calculate body mass index (BMI) to indicate overweight and obese status. Studies looking at the relationship between self-reported and measured H and W have been mostly conducted using middle-aged men and women (Niedhammer, Int J Obesity, 2000;24:1111-18.; Spencer, Public Health Nutr, 2002;5:561-65). Few studies have specifically looked at the relationship of these measures in younger adults, the age group of basic combat trainees. If self-reported H and W are similar to measured values then self-reports may be adequate for epidemiological uses.

PURPOSE: To compare the accuracy of self-reported height, weight and resulting BMI among recruits entering Basic Combat Training (BCT).
RESULTS: Participants were 539 recruits entering BCT at Fort Jackson, South Carolina. They completed a questionnaire asking them to report their H and W. Immediately afterwards, H and W was measured with a stadiometer and digital scale, respectively. Age was calculated from the day of questionnaire administration to their date of birth obtained from the Defense Medical Surveillance System. BMI was calculated as W/H². Pearson correlations examined the relationship between self-reports and measured H, W, and BMI. t-tests examined the differences between the two values. Mean ± standard deviation (SD) differences were calculated by subtracting each recruit’s measured H, W, and BMI from their respective self-reported H, W, and BMI.

RESULTS: Participants were 20.7±3.8 years old. Average±SD measured and self-reported H, W, and BMI were, respectively, 172.5±9.4 and 173.7±10.0 cm (p<0.01), 73.9±13.8 and 72.8±13.9 kg (p<0.01) and 24.73±3.51 and 24.00±3.39 kg/m² (p<0.01). Correlations between self-reported and measured H, W, and BMI were 0.97, 0.99, and 0.97, respectively. Trainees over-reported their height by an average of 1.2±2.5 cm and under-reported their weight by an average of 1.2±2.0 kg. The calculated BMI was under-reported by 0.7±0.92 kg/m².

CONCLUSIONS: Among BCT recruits, there was a close relationship between self-reported and measured H, W, and BMI. Self-reported H and W appears adequately valid for use in epidemiological studies involving large numbers of basic trainees, although the direction of the biases should be considered in drawing conclusions from self-reports.

METHODS: Participants were 539 recruits entering BCT at Fort Jackson, South Carolina. They completed a questionnaire asking them to report their H and W. Immediately afterwards, H and W was measured with a stadiometer and digital scale, respectively. Age was calculated from the day of questionnaire administration to their date of birth obtained from the Defense Medical Surveillance System. BMI was calculated as W/H². Pearson correlations examined the relationship between self-reports and measured H, W, and BMI. t-tests examined the differences between the two values. Mean ± standard deviation (SD) differences were calculated by subtracting each recruit’s measured H, W, and BMI from their respective self-reported H, W, and BMI.

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The accurate assessment of physical activity (PA) is important to understand the relationship that exists between PA and chronic disease. There is a need for reliable and valid measures of PA in the Spanish-speaking population.

METHODS: The purpose of this study was to assess the test-retest reliability and criterion validity of the Spanish translation of two physical activity surveys, the Stanford Brief Activity Survey (SBAS), and Rapid Assessment of Physical Activity (RAPA), in a Spanish-speaking, Mexican-American population.

Participants were fourteen individuals who used manual wheelchairs. Each participant performed five different locomotion activities in a manual wheelchair. These activities included wheeling on a level surface that elicited a low rolling resistance at three different speeds (4.5, 5.5, and 6.5 km·hr⁻¹), wheeling on a rubberized 400m track that elicited a higher rolling resistance at one speed (5.5 km·hr⁻¹), and wheeling on sidewalk course that included uphill and downhill segments, and the participants self-selected speed. EE was measured using a portable indirect calorimetry system (Oxycon Mobile, Viasys Healthcare). Each subject wore an Actical (AC) and a SenseWear (SW) activity monitor on the right wrist and upper arm, respectively. A direct calorimetry system (MetaMax-3B, Cortex) measured energy expenditure (MET). The SW and the AC recorded body motion, we then measured EE to the estimates from the SW. Additionally, EE estimates from a wheelchair specific prediction equation using the SW data (Hiremath and Ding, 2011) was also compared. Bland-Altman plots were used to assess the agreement between the criterion values and the predicted values.

RESULTS: A repeated measures ANOVA demonstrated a significant main effect between measured EE and estimated EE (p < 0.01). There were no significant differences between the criterion method and the AC (r = 0.25, p > 0.05). The SW significantly underestimated EE when wheeling at 4.5 km·hr⁻¹, 5.5 km·hr⁻¹, and during self-paced sidewalk wheeling (+30 to 80%, p < 0.05). Hiremath and Ding SW equation on average improved in the EE prediction during low intensity activities, but error progressively increased during higher intensity activities (+27 to 43%).

CONCLUSION: Overall, the wrist-mounted AC can accurately estimate EE (r = 0.25) whereas the SW tends to overestimate EE during wheelchair locomotion. The wrist-mounted accelerometer is a viable option for physical activity assessment during wheelchair propulsion.
significantly different (P<0.005) except for level walking at 2.0 and 2.5 mph; household activities were overestimated whereas all walking was underestimated by the CPA. Using the absolute definition, all activities except level walking at 2.5 and 3.0 mph were significantly overestimated (P<0.0001). Using the ratio definition, only folding and sweeping were significantly different (P<0.005) however walking at a level grade was significantly underestimated (P<0.001).

CONCLUSION: Using either version of the CPA, the ratio definition significantly overestimates household activities and underestimates walking. The 2011 CPA minimizes the error associated with assessing energy expenditure; the CPA METs still provide a significantly different MET than what is measured in pregnant women.

2518 Board #193 MAY 31 3:30 PM - 5:00 PM
The Utility of a Simple Physical Activity Screener to Differentiate Cardiometabolic Risk in Latino Youth
Joon Young Kim, Justin R. Ryder, Rocio Ortega, Hillary Burks, Gabriel Q. Shalbiz, Arizona State University, Phoenix, AZ.

(Prior relationships reported)

PURPOSE: Latino youth are disproportionately impacted by obesity and type 2 diabetes, therefore early identification of high-risk youth is an essential step for closing the obesity-related health disparity gap. As researchers develop and implement sophisticated approaches to objectively quantify physical activity (PA), clinicians struggle to translate these approaches into real-world settings. The purpose of this study was to examine the utility of a simple PA screener for differentiating cardiometabolic risk in Latino youth.

METHODS: 151 non-diabetic Latino adolescents (age 16.6 ± 2.7 yrs, 70 male/81 female) were assessed for fasting triglycerides (TG), HDL-cholesterol (HDL), LDL-cholesterol (LDL), VLDL-cholesterol (VLDL), and plasma glucose and insulin. In addition, participants underwent a 2-hour Oral Glucose Tolerance Test to assess insulin sensitivity ( Matsuda index) and glucose tolerance. Prior to testing, participants completed a questionnaire which asked whether or not they engage in regular PA (yes or no).

RESULTS: 100 youth answered “yes” and 51 answered “no” to the single-question PA screener with a significantly greater proportion of males answering yes than females (84.3% vs. 50.6%, P<0.001). After adjusting for age and gender, those responding “yes” had significantly lower TG (92.3 ± 47.1 vs. 113.5 ± 59.6 mg/dL), VLDL (15.5 ± 7.9 vs. 19.0 ± 9.9 mg/dL), fasting and 2-hour glucose (90.7 ± 6.3 vs. 91.4 ± 7.0 mg/dL, 112.4 ± 24.3 vs. 122.5 ± 21.8 mg/dL, respectively). The three-dimensional accelerometer (GT3X+) produced approximately 20 more minutes of MVPA per day than the GT1M or StepWatch. Although average number of daily minutes of MVPA was similar for the GT3X and StepWatch, agreement between these monitors for categorizing participants as meeting or not meeting physical activity recommendations was only of moderate accuracy on day 2. The cut points used in this study for the GT3X+ monitor do not provide high levels of agreement with the other monitors studied for daily minutes of MVPA or for categorization for meeting or not meeting physical activity recommendations.

CONCLUSIONS: Participants found the ankle-worn StepWatch to be more agreeable to wear during the assessment process than the hip-worn ActiGraph monitor. These findings support future studies that explore individual perceptions of assessment tools to ensure maximum compliance.

2517 Board #192 MAY 31 3:30 PM - 5:00 PM
Perceptions of Objective and Self-Report Methods for Monitoring Sedentary and Physical Activity Behaviors
Lucas J. Carr, Mallory Peavler, Grace Anne Edwards, Nicholas Boerio, Matthew T. Mahar, FACSIM, East Carolina University, Greenville, NC.

(Prior relationships reported)

While many studies have examined the accuracy, validity, and reliability of physical activity measures, little is known about individual perceptions of the monitoring process. Such information could provide researchers insight to assist in reducing non-compliance when assessing physical activity.

PURPOSE: To identify participant perceptions of two objective (hip-worn ActiGraph accelerometer, ankle-worn StepWatch monitor) and two self-report methods (online 48 hour recall questionnaire, 48 hour activity log) of measuring sedentary and physical activity behaviors.

METHODS: A convenience sample of 53 college-aged students wore two objective monitors for 48 hours during all non-bathing hours including sleep time. Participants documented their sedentary/active time in 15 minute blocks using a 48 hour behavioral log. Participants completed a four-item, online 48 hour sedentary/activity recall survey. Participants rated the objective monitors (e.g., comfort during day, comfort while sleeping, ease of wear during exercise, awareness of monitor, intrusiveness, responsiveness to device for engaging in physical activity) and self-report surveys (e.g., difficulty to complete, perceived accuracy) using a five-point Likert Scale (strongly disagree=1; disagree=2; neutral=3; agree=4; strongly agree=5).

RESULTS: Participants rated the ankle-worn StepWatch significantly more comfortable to wear during the day (3.6 ±1.0 vs. 2.8±1.1; P =<0.001), more comfortable while sleeping (3.1±1.3 vs. 2.8±1.1; P = <0.001), easier to wear during exercise (3.6±1.1 vs. 2.8±1.1; P =<0.001) and less intrusive/interfering (2.2±0.8 vs. 2.8±1.0; P =<0.001) than the ActiGraph accelerometer. Participants also reported being more aware of the hip-worn ActiGraph than the StepWatch (3.1±1.0 vs. 2.9±1.1; P = 0.008). No differences were observed between the self-report assessment tools.

CONCLUSIONS: Participants found the ankle-worn StepWatch to be more agreeable to wear during the assessment process than the hip worn ActiGraph monitor. These findings support future studies that explore individual perceptions of assessment tools to ensure maximum compliance.

2516 Board #191 MAY 31 3:30 PM - 5:00 PM
Agreement of Hip and Ankle Worn Activity Monitors for Measurement of Physical Activity
Matthew T. Mahar, FACSIM, Mallory Peavler, Grace Anne Edwards, Nicholas A. Boerio, Lucas J. Carr, East Carolina University, Greenville, NC.

(Prior relationships reported)

PURPOSE: To examine agreement among three activity monitors for assessment of moderate and vigorous physical activity.

METHODS: Participants (N = 39) wore three activity monitors for 48 hours. The monitors included the ActiGraph GT1M accelerometer, the three-dimensional GT3X+ accelerometer, both worn at the hip, and the ankle-worn StepWatch activity monitor. Moderate-to-vigorous physical activity (MVPA) was calculated for the ActiGraph monitors using previously published cut points. MVPA was calculated from the StepWatch steps per minute output based upon previously published moderate intensity cut points relative to height. Average minutes of MVPA were compared with repeated measures ANOVA. Effect sizes (ES) were estimated with Cohens’s delta and Pearson correlations were calculated. Participants were then categorized as either meeting or not meeting the recommendation for 30 min of MVPA per day. Criterion-referenced agreement between different monitors was examined with proportion of agreement (Pa) and modified kappa (κp).

RESULTS: The GT3X+ produced significantly (p <.05) more daily minutes of MVPA (69.5 ± 42.9 min) than the GT1M (47.8 ± 35.8 min; ES = 0.55; r = .70) and StepWatch (46.4 ± 32.6 min; ES = 0.56; r = .75). The difference in mean daily minutes of MVPA between the GT3X and StepWatch was not significant (p = .09; ES = 0.02; r = .58). Criterion-referenced agreement was high between the GT1M and StepWatch on day 1 (Pa = .90, κp = .79), but lower on day 2 (Pa = .74, κp = .49). Agreement between the GT3X+ and GT1M was moderate (Pa = .77, κp = .54 [day 1], Pa = .79, κp = .59 [day 2]). Similar moderate levels of agreement were found between the GT3X+ and StepWatch (Pa = .77, κp = .54 [day 1], Pa = .74, κp = .49 [day 2]).

CONCLUSIONS: The three-dimensional accelerometer (GT3X+) produced approximately 20 more minutes of MVPA per day than the GT1M or StepWatch. Although average number of daily minutes of MVPA was similar for the GT3X and StepWatch, agreement between these monitors for categorizing participants as meeting or not meeting physical activity recommendations was only of moderate accuracy on day 2. The cut points used in this study for the GT3X+ monitor do not provide high levels of agreement with the other monitors studied for daily minutes of MVPA or for categorization for meeting or not meeting physical activity recommendations.

2519 Board #194 MAY 31 3:30 PM - 5:00 PM
Validity Of A Direct Observation Measure To Evaluate Group Exercise Classes
Megan P. Duesterhaus, Thomas L. McKenzie, FACSM, Simon J. Marshall, San Diego State University, San Diego, CA.

(Prior relationships reported)

Group exercise classes are a common physical activity modality but there is currently no validated objective measure to assess class content, instructor quality, or participant activity levels.

PURPOSE: To adapt and validate the System for Observing Fitness Instruction Time (SOFIT) for use in adult group exercise classes (SOFIT-X).
METHODS.  Three sequential studies were used to adapt and validate a new direct observation measure.  Study 1 used a nominal group technique with subject-matter experts to modify and content-validate the target behaviors of the SOFIT-X.  Study 2 used behavioral assessment experts to establish criterion codes across seven types of group-exercise classes through iterative cycles of pilot testing and measure revision.  Study 3 assessed variability of inter-rater reliability data collected by trained observers on 36 live group exercise classes.

RESULTS.  Seven subject-matter experts developed four coding categories (posture, intensity, class context, and instructor behavior).  Twenty sub codes (observable behaviors within each coding category) with definitions, and 23 instructor behavior criteria to yield a face- and content-valid version of the new measure.  Three trained observers then established criterion codes for 140 minutes of video-taped group exercise classes which were used subsequently for observer training.  Interobserver agreement (IOA) among any two of three observers was 97%, 100%, 99%, and 100% on posture, intensity, class context, and instructor behavior.  Agreement for all three observers ranged from 76% (intensity) to 87% (posture).  Data collected on 36 live classes using SOFIT-X revealed that participants were predominantly ambulatory (49.4%) at light intensity (43.1%), designed to promote cardiovascular fitness (39.2%).  Instructors mainly ‘promoted and demonstrated’ fitness (59.7%).  IOA during live observation was 91%, 76%, 92%, and 86% for posture, intensity, class context, and instructor behavior, respectively.

CONCLUSIONS.  SOFIT-X is a content- and criterion-valid measure that can be used to evaluate the quality of adult group exercise classes.  Further research should attempt to improve the validity of coding exercise intensity. Funded by a research grant (1R18DP0021380-01) from the Centers for Disease Control and Prevention.

2520  Board #195  MAY 31  3:30 PM - 5:00 PM
Validation Of New Sensewear Mini Armband Algorithms (version 5.2) In Children
Jung-Min Lee1, Young Won Kim1, Yang Bai1, Gregory J. Welk, FACSM1, Glenn A. Gaesser, FACSM2. 1Iowa State University, Ames, IA. 2Arizona State University, Phoenix, AZ. (Sponsor: Gregory J Welk, FACSM)

The SenseWear Mini Armband (SWM) has been shown to provide valid estimates of energy expenditure (EE) in adults and children.  A new set of pattern recognition algorithms version (v) 5.2 has recently been developed to further improve precision for accessing free-living activities, particularly for non-locomotor activities.

PURPOSE:  The purpose of the study was to evaluate the new v8.0 software (algorithm v5.2) compared to the previous v7.0 software (algorithm v2.2) in a sample of children performing a range of lifestyle activities ranging from sedentary to vigorous.

METHODS:  Forty five boys (n=24) and girls (n=11) ages 7 to 13 years performed 12 randomly assigned activities (out of a set of 24) while wearing a SWM with simultaneous indirect calorimetry monitoring using a portable metabolic analyzer (Oxycon Mobile, OM).  Each activity lasted 5 minutes with a 1 minute break in between.  Data from minute 3 and minute 4 were utilized to obtain steady-state EE values from both OM and SWM.  The SWM data were processed with both the v2.2 and v5.2 (pre-release version) algorithms.

RESULTS:  Pearson product-moment correlations (r) with OM were similar for both algorithms (v5.2: r = 0.91; v2.2: r = 0.90).  However, the absolute error rates (computed as average absolute value of the individual errors) were considerably lower for the new v5.2 algorithm (6.7%) compared with the v2.2 algorithm (30.1%).  The v5.2 algorithms yielded non-significant (p>0.05) differences in EE estimates for most of the walking related activities as well as for stationary cycling at moderate intensity (absolute error = 3.13%).  Significant differences were found for vigorous cycling (absolute error = 20.46%).

CONCLUSIONS:  The newly developed SenseWear v5.2 (pre-release) algorithms yielded more accurate estimates of EE than the v2.2 algorithms for monitoring lifestyle activities in children.  The result for moderate intensity cycling is particularly noteworthy since this activity has proven difficult to assess with traditional accelerometer-based monitors.
RESULTS: Actual steps taken and step counts registered by the activity monitors for all walking activities. Mean absolute percent error (MAPE) was also determined for all walking activities.

METHODS: Participants wore the StepWatch (SW) and the Actigraph with and without the LFE activated (GT3X-LFE and GT3X-N). They walked on a treadmill at five different speeds (40.2 m/min, 53.64 m/min, 67.2 m/min, and 67.2 m/min) for 5 minutes at each speed. Two trained observers counted steps using hand tally counters for all walking activities. Paired t-tests were used to assess significant differences between actual steps taken and step counts registered by the activity monitors for all walking activities.

RESULTS: Agreement between OBS and CRIT, as measured by mean percent (SD) of the CRIT, is displayed in Table 1.

CONCLUSIONS: The PAtracker provides a valid method by which to classify body positions and activity types. While the load and intensity categories do not appear to be valid measures, they may be improved upon with additional training or redefining the operational definitions.

Table 1. Mean Percent Agreement (MPA) between OBS and CRIT (SD).

<table>
<thead>
<tr>
<th>Body Position</th>
<th>MPA</th>
<th>PA Type</th>
<th>MPA</th>
<th>Load (lbs)</th>
<th>MPA</th>
<th>PA Intensity</th>
<th>MPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>0.1 (14°)</td>
<td>Calisthenics</td>
<td>0.1 (10)</td>
<td>0.10</td>
<td>0.10</td>
<td>Low</td>
<td>0.1 (20)</td>
</tr>
<tr>
<td>Jogging</td>
<td>0.1 (17°)</td>
<td>Calisthenics</td>
<td>0.1 (10)</td>
<td>0.10</td>
<td>0.10</td>
<td>Light</td>
<td>0.1 (50)</td>
</tr>
<tr>
<td>Lifting</td>
<td>0.1 (20°)</td>
<td>Calisthenics</td>
<td>0.1 (10)</td>
<td>0.10</td>
<td>0.10</td>
<td>Light</td>
<td>0.1 (50)</td>
</tr>
<tr>
<td>Standing</td>
<td>0.1 (30°)</td>
<td>Calisthenics</td>
<td>0.1 (10)</td>
<td>0.10</td>
<td>0.10</td>
<td>Light</td>
<td>0.1 (50)</td>
</tr>
</tbody>
</table>

*Indicates 80-120% acceptable level of agreement. If MPA = 100 then CRIT values = Observed Values. If MPA < 100 then Observed values underestimated CRIT values. If MPA > 100 then Observed values overestimated CRIT values.

2524 Board #199 MAY 31 3:30 PM - 5:00 PM
Evaluation Of The Actigraph’S ‘low Frequency Extension’ - A Pilot Study
Yuri Feito, Heather Garner. Barry University, Miami Shores, FL.
(No relationships reported)

The accuracy of the Actigraph accelerometer has been widely established. However, the effect of its 'low-frequency extension' (LFE) during treadmill walking and the free-living environment has not been studied.

PURPOSE: To determine the accuracy of the Actigraph’s LFE during treadmill walking and the free-living environment.

METHODS: Participants wore the StepWatch (SW) and the Actigraph with and without the LFE activated (GT3X-LFE and GT3X-N). They walked on a treadmill at five different speeds (1.5, 2.0, 2.5, 3.0, and 3.5 mph) and wore the devices in the free-living environment for an entire day. The hand-tally counter and the SW served as the criterion method for the treadmill and free-living environments, respectively.

RESULTS: Repeated measures ANOVA showed the GT3X-N significantly underestimating step counts at speeds less than 2.5 mph. During the free-living condition, significant differences (P < 0.001) were observed between the GT3X-LFE (overestimated), GT3X-N (underestimated) and the criterion method.

CONCLUSIONS: Repeated measures ANOVA showed the GT3X-N significantly underestimating step counts at speeds less than 2.5 mph. During the free-living condition, significant differences (P < 0.001) were observed between the GT3X-LFE (overestimated), GT3X-N (underestimated) and the criterion method.

2525 Board #200 MAY 31 3:30 PM - 5:00 PM
Validation of the Actical Step Count Function in Older Adults
Marguell J. Johnson, Amanda Shelton, Justina Malin, Amber Schulzetenberge, Alyssa Hopfensperger. University of Wisconsin - Eau Claire, Eau Claire, WI. (Sponsor: David R. Bassett, Jr., FACSM)
(No relationships reported)

PURPOSE: To assess the validity of the Actical accelerometer step count function in older adults.

METHODS: Twenty-nine participants aged 67.70 ± 6.07 participated in the study. Actical step counts were compared to actual steps taken and those recorded by three pedometers (Yamax, Omron, & Walk-4Life). Participants walked around a 200-m indoor track at a self-selected pace and performed treadmill walking at different speeds (40.2 m/min, 53.64 m/min, and 67.2 m/min) for 5 minutes at each speed. Two trained observers counted steps using hand tally counters for all walking activities. Paired t-tests were used to assess significant differences between actual steps taken and step counts registered by the activity monitors for all walking activities. Mean absolute percent error (MAPE) was also determined for all walking activities.

RESULTS: There was no statistical difference between Actical step counts and actual steps taken during self-paced walking (p = .50; MAPE = .4%). During treadmill walking at 40.2 m/min speed, the Actical step counts were significantly different from actual steps taken (p < .01; MAPE = 5%). During treadmill walking at 53.64 m/min, the Actical step counts were significantly different from actual steps taken (p < .01; MAPE = 17%). During treadmill walking at 67.2 m/min, the Actical step counts were significantly different from actual steps taken (p < .05) but had an acceptable MAPE value (1.5%). Overall, MAPE values were acceptable for all activity monitors during self-paced walking (< 3%). MAPE values were acceptable for the Omron and Walk-4Life pedometers during treadmill walking at 67.2 m/min speeds (< 3%).

CONCLUSIONS: The Actical step count function provides valid estimates of step counts during self-paced walking and walking at constant speeds of ≥67.2 m/min in older adults.

2526 Board #201 MAY 31 3:30 PM - 5:00 PM
Accuracy Of Sensewear® Pro Armband In Estimating Energy Expenditure During Steady-state And Non-steady-state Physical Activity
Dharini M. Bhammar, Brandon J. Sawyer, Siddhartha A. Angadi, Glenn A. Gaesser, FACSM. Arizona State University, Phoenix, AZ.
(No relationships reported)

The SenseWear® Pro Armband (SWA) estimates energy expenditure (EE) for facilitation of physical activity and weight goals.

PURPOSE: We compared EE estimates from the SWA to indirect calorimetry-derived EE during physical activity.

METHODS: 17 men ages 61 ± 16 years (BMI: 29.1 ± 4.6 kg/m2) and 28 women ages 48 ± 20 years (BMI: 26.5 ± 6.1 kg/m2) performed 90-min and 65-min physical activity routines on separate days. The 90-min routine (steady-state: SS) routine consisted of 8-min bouts of 8 different activities including rest, walking, cycling, arm cranking, and simulated activities of daily living (ADL), performed in a random order, with a 4-min rest period between each activity (only steady-state data during min 4-7 were analyzed). The 65-min routine (non-steady-state: Non-SS) consisted of 5-min bouts of 12 different randomly assigned activities performed in one continuous routine, after an initial 5-min rest period, and included walking, jogging, cycling, rowing,
simulated sports, and ADL (all 65 min were analyzed). EE was measured by indirect calorimetry using the OxyconTM Mobile (OM) and predicted using the SWA (Version 7.0). Pearson correlations, paired t-tests, intraclass correlation coefficients (ICC) and Bland-Altman plots were used for the analysis.

RESULTS: EE from SWA and OM were moderately correlated for both SS and Non-SS routines (r = 0.75 and 0.63 respectively, p < 0.01). SWA overestimated total EE (TEE) compared to OM for SS (337 ± 80 kcal vs 252 ± 59 kcal, p < 0.01) and Non-SS (293 ± 80 kcal vs 212 ± 62 kcal, p < 0.01) routines. For TEE, Bland-Altman analysis showed wide limits of agreement for SS (85 kcal, 95% CI: -14 to 181 kcal) and Non-SS (86 kcal, 95% CI: -3 to 175 kcal) routines. In the SS routine, strong ICC values were observed for walking at 4 mph (0.95) and jogging at 5 mph (0.95), and moderate ICCs were observed for rest and walking at 2.0 and 2.5 mph (0.75 to 0.77). Lower ICCs were obtained for the remaining activities, ranging from 0.35 (cycling) to 0.58 (walking at 3 mph). ICCs for each activity in the Non-SS routine ranged from 0.21 (arm cranking) to 0.85 (jogging at 5.5 mph).

CONCLUSIONS: Our results indicate that the SWA overestimates EE across a variety of low- and moderate-intensity activities, but produces better estimates of EE during high-intensity activities.

Supported by NIH grant R01 HL091006

2527 Board #202 MAY 31 3:30 PM - 5:00 PM
Physical Activity Scale for Elderly (PASE): A Cross-validation study for Chinese Older Adults Hongjun Yu1, Weimo Zhu, FACSM2, Jun Qiu1, Chenggang Zhang1, Tsinghua University, Beijing, China. 1University of Illinois at Urbana-Champaign, Champaign, IL.

PERSPECTIVE: To cross-validate PASE, a valid and reliable physical activity questionnaire, for the Chinese older adults.

METHODS: 66 (41 males & 25 females; aged 70.0 ±7.1, Height = 165.6±9.4 cm, Weight = 65.1±16.0 kg, BMI = 23.5±4.22) Chinese older adults’ 7-day energy expenditures (EE) were collected using Armband Pro 3. They were then asked to recall their PA using PASE before and after the Armband data collection. Total EE, average METS, steps, Measured EE, Measured Active EE by Armband Pro 3 were computed and compared from PASE and test-retest reliability was computed also for PASE.

RESULTS: 77% of the subjects wore the armband for 24 hr. a day. The correlation between the Armband Measured Active EE and that reported by PASE is 0.58, which moderately supports the validity of PASE when applying it to the Chinese sample. The test-retest reliability coefficient of PASE is 0.87. In average, the Chinese older adults’ daily PA are: Total EE = 2088.92±539.86 (METs), Average METs = 1.62±0.55, Measured EE = 1751.58 ±507.21 METs, Measured Active EE 502.52±288.26 METs, according to the Armband.

CONCLUSIONS: PASE’s validity and reliability was confirmed for the Chinese older adult sample and the Chinese older adults spent most of their time at low and light PA.

2528 Board #203 MAY 31 3:30 PM - 5:00 PM
Validation Of The Mywellness Key In Walking And Running Speed Marco Bargamin1, Andrea Ermolao1, John C. Sieverdes2, Marco Zaccaria1, Silvano Zannuso1, University of Padova, Padova, Italy. 1University of South Carolina, Columbia, SC. 2University of Greenwich, London, United Kingdom.

PERSPECTIVE: This study was performed to assess the validity of the MyWellness Key (MWK) accelerometer during a treadmill-based protocol. The identification of different exercise intensities is imperative to objectively measure time spent at a specified exercise intensity.

METHODS: Thirty subjects (age = 24.5 ±2.6 years, 62% men) participated in a treadmill protocol using three different walking velocities (3, 4.5, and 6 km/h) and running (8 km/h) while outfitted with a MWK. Exercise intensity was measured by indirect calorimetry (ICVO2).

RESULTS: The relationship between exercise intensity predicted from MWK (MWKVO2) and oxygen consumption (VO2), yielded a high and significant correlation (r = 0.944; P < .001) with standard error of estimate = 2.24 ml/kg·min−1. The average differences between the two methods (MWKVO2-ICVO2) were -0.79 (-8.0%), -0.02 (-0.02%), 0.51 (3.26%) and -0.74 (-2.7%) ml·kg−1·min−1 at 3, 4.5, 6, and 8 km·h−1 respectively. Only the 3 km·h−1 speed showed a difference when compared to the criterion measure (p < .001). Bland and Altman analysis revealed less than a 1 MET difference in the mean at each point estimate and relatively tight distribution with the standard errors, especially with the 2 moderate walking speeds.

CONCLUSIONS: We found a high correlation between oxygen utilization and the MWK with low standard errors estimates. This indicates that this accelerometer can be used to accurately identify exercise intensities that are related to walking and running.

2529 Board #204 MAY 31 3:30 PM - 5:00 PM
Validating GPS Data With The PALMS System To Detect Different Active Transportation Modes Jacqueline Kerr, Gregory Norman, Suneeeta Godbole, Frederick Raab, Barry Demchak, Kevin Patrick. UCSD, San Diego, CA.

PERSPECTIVE: To test the validity of web-based GPS processing software to detect transportation mode.

METHODS: A total of 714 protocolized travel trips were made by trained researchers. They carried 2 GPS models set to collect data every 30 seconds. Trips across four transportation modes (bus, car, walk, cycle) were made in open space locations or downtown corridors (with more signal interference from buildings) with either continuous transitions across modes or with planned pauses. Start and end times of the journeys were noted to provide an annotated ‘truth’ file to match to the processed GPS data. The GPS data were processed in the Personal Activity Location Measurement Software (PALMS). Sensitivity and specificity were tested and algorithm classification was considered correct if transportation mode was correct for 85% of the trip.

RESULTS: There were no significant differences by device model. Across conditions sensitivity ranged from .38-.64 and specificity ranged from .44-.59. Under the best conditions (i.e., pause between trips and space location) sensitivity ranged from .73-1.0 and specificity ranged from .12-.25 for both device models.

CONCLUSIONS: Validation studies using field based trials of naturally occurring travel modes have not been reported before. Validation studies to date have not tested different conditions for algorithm specificity and sensitivity. Under optimal conditions the algorithm demonstrated good sensitivity but poor specificity, suggesting that further algorithm refinement is needed to improve accuracy of transportation classification. Our validation and processing protocols are available for researchers to use to test the conditions under which GPS may function best in their region.

2530 Board #205 MAY 31 3:30 PM - 5:00 PM
Validity of the Bouchard Activity Record in Free-Living Older Adults Nora E. Miller1, Ann M. Swartz2, Teresa L. Hart1, John M. Hawkins, Jr.1, Scott J. Strath1. 1University of Wisconsin - Milwaukee, Milwaukee, WI. 2Arizona State University, Phoenix, AZ.

PERSPECTIVE: To assess the validity of the BAR against accelerometer in an older adult population in a free-living environment.

METHODS: Forty-nine healthy participants (33 females, 65.6±7.8 yrs, 25.6±4.3 kg/m²; 16 males, 68.6±8.1 yrs, 26.7±3.0 kg/m²) completed a 1-day BAR while wearing the...
RESULTS. Data from this study show that older adults self-reported 17.53 hours sedentary, 3.18 hours standing, and 3.27 hours walking on the BAR, compared with 17.28 hours, 3.94 hours, and 2.70 hours, recorded via activPAL™, for sedentary, standing, and walking respectively. Significant and moderately strong correlations were found between BAR and activPAL™ for time spent in sedentary (r = 0.44, p = 0.002) and walking (r = 0.50, p < 0.001) behavior. There were no significant mean differences reported between BAR and activPAL™ for time spent in sedentary, standing, or walking behaviors.

CONCLUSION. The BAR and activPAL™ provide similar results for sedentary behavior and PA time in this older adult sample with reported sedentary, standing, and walking time differing from objective measurement by 1%, 19%, and 21%, respectively over a 24-hour period of time. The BAR, therefore, represents a viable pen-and-paper option for those interested in assessing sedentary behavior and PA profiles in an older adult free-living population.

This work was supported by funding sources K01-A0025962 and UWM Research Growth Initiative.
METHODS: 45 clinic staff wore an accelerometer (accel) for 7 days and then self-reported days they acquired ≥ 30 bout-mins of moderate to vigorous PA (MVPA). 11 of these 45 staff repeated this procedure 18 months later. Both accelerometer and self-reported PA were recorded as number of days with ≥ 30 min MVPA. The LoA method was applied by estimating the mean difference of days with ≥30 mins MVPA between measures, and the standard deviation (SD) of differences about the mean, i.e. 95% LoA. 95% LoA were estimated by within- and between-subject variances from ANOVA, with the subject as the factor. A 95% repeatability coefficient for each method was estimated by 1.96 t*- within-subject SD between RM.

RESULTS: Staff (38.3 ± 9.6 yr) were mostly female (91%) and Caucasian. The self-report PA measure overestimated days ≥ 30 mins MVPA by a mean of 1.86 days. 95% of the differences in days ≥ 30 mins MVPA between RM of accelerometer and self-report PA were between -1.22 and 4.95 days (see Figure). The repeatability coefficient of the self-report PA was 71% greater than the coefficient of accelerometer.

CONCLUSIONS: Agreement of self-report PA with a criterion measure is most useful when self-report PA also agrees with itself - that is, it’s repeatable. This small sample had poor agreement with one repeated measure of self-report PA, with 95% LoA between -1.22 and 4.95 days.

Funded in part by DHHS Office on Women’s Health (ASTWH07006-01-00); University of Utah Department of Family and Preventive Medicine.

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**Board #210**  MAY 31  3:30 PM - 5:00 PM

**The Influence of Body Mass Index on Physical Activity Level and Recall Accuracy**

Katrina D. DuRose, FACSM, Brooke Graves, Thomas D. Raedeke, Lucas Carr, Lesley Lutes. East Carolina University, Greenville, NC.

(No relationships reported)

PURPOSE: To evaluate whether normal weight and overweight/obese college students differ on physical activity level and self-reported physical activity recall accuracy,

METHODS: On day one, 52 college students (18.7 ± 0.85 years) had height and weight measured and received an Actigraph GT1M accelerometer to wear for 7 consecutive days. After wearing the GT1M, participants completed self-reported physical activity questions on the Behavior Risk Factor Surveillance Survey (BRFSS) and the International Physical Activity Questionnaire (IPAQ). Body mass index (BMI) was calculated as either normal weight ≤25.0 kg/m² (n=30; 21.08 ± 2.01 kg/m²) or overweight/obese: ≥ 25.0 kg/m² (n=22; 29.57 ± 4.76 kg/m²).

Recall accuracy was calculated by self-reported minutes in moderate and vigorous physical activity minus minutes in moderate and vigorous physical activity measured by the GT1M. Independent t-tests compared the time spent in moderate and vigorous physical activity on the BRFSS, IPAQ, and GT1M accelerometer.

RESULTS: There were no significant differences found between normal and overweight/obese participants on the average minutes per day spent in moderate and vigorous physical activity based on the BRFSS, IPAQ, and Actigraph GT1M (p>0.05). Recall accuracy was similar between the normal weight and overweight/obese groups on the BRFSS (Moderate: normal=104.29 ± 116.9 min/d, overweight/obese=108.56 ± 116.9 min/d; Vigorous: normal=42.43 ± 25.28 min/d, overweight/obese=44.28 ± 47.33 min/d) and IPAQ questionnaires (Moderate: normal=108.14 ± 139.26 min/d, overweight/obese=89.42 ± 116.81 min/d; Vigorous: normal=34.15 ± 40.08 min/d, overweight/obese=38.09 ± 46.03 min/d).

CONCLUSIONS: These results suggest that in college students physical activity levels and recall accuracy are similar regardless of BMI.

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**Board #211**  MAY 31  3:30 PM - 5:00 PM

**Validity Of Actigraphs Uniaxial And Triaxial Accelerometers For Assessment Of Physical Activity In Adults**


(No relationships reported)

PURPOSE: To assess the validity of the uniaxial GT1M and the triaxial GT3X Actigraph accelerometers against oxygen consumption

METHODS: Thirty-four participants aged 18 to 30 years performed three 6-minute bouts of exercise on a treadmill at 4.8, 6.4, and 9.7 km.h⁻¹. Oxygen consumption was measured minute-by-minute using a metabolic system.

RESULTS: The GT3X had significant higher counts at all speeds as compared with the GT1M accelerometer (p<0.001). Mean error for the GT1M at 4.8 km.h⁻¹ was +2862 cpm (limits of agreement +1907 to +3828), at 6.4 km.h⁻¹ was +4852 cpm (limits of agreement +3616 to +6088), and at 9.7 km.h⁻¹ was +9369 cpm (limits of agreement +6589 to +12148). Whereas, mean error for the GT3X at 4.8 km.h⁻¹ was +5716 cpm (limits of agreement +3589 to +7843), at 6.4 km.h⁻¹ was +13142 cpm (limits of agreement +8329 to +17954), and at 9.7 km.h⁻¹ was +8580 cpm (limits of agreement +5846 to +11314).

CONCLUSIONS: These data suggest that the uniaxial GT1M and the triaxial GT3X Actigraph accelerometers are valid tools for measuring treadmill walking and jogging.

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**Board #212**  MAY 31  3:30 PM - 5:00 PM

**Distributional Characteristics of Athletic Performance**

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(No relationships reported)

INTRODUCTION: It is difficult to characterize the distribution shape for an athletic performance variable, due largely to unavailable data. On the rare occasions when an adequate data set is available, distribution typically focuses on measures of location and dispersion and ignores skewness of the data and elongation (or heaviness) of the tails.

PURPOSE: This study characterizes the skewness and elongation parameters for an athletic performance variable (swim times) and assesses the effects of age and sex on these distribution parameters.

METHODS: Data for this project was provided by USA Swimming (USAS) and consisted of the best 50-yard Freestyle performance for all USAS registered male and female swimmers from 6-19 years of age that competed in the event from 2005-2010 (N = 1,193,362). First, the distribution skewness and elongation parameters were assessed using methods previously described (Hoaglin, 2006). Then, MANOVA was conducted to test for differences in the parameters for age, sex, and competition year.

RESULTS: MANOVA revealed a highly significant effect of age on both the skewness and elongation parameters (V = 1.59, F(26, 130) = 19.27, p < .001), a result that was confirmed by separate univariate ANOVAs. There was significantly greater positive skew (0.44-0.49) for the middle ages (9-15 years) as compared to the skewness (0.37-0.42) for the youngest and oldest ages (6-7 and 16-18 years). The elongation parameter was positively correlated with age with the smallest value (0.02) occurring for 6 year old swimmers and the greatest values (0.10-0.11) occurring for the oldest swimmers (17-19 years).

CONCLUSIONS: Positive skewness was confirmed for all combinations of age, sex, and competition year. The degree of skewness appears to be influenced by the number of swimmers of a given age. The positive correlation between age and elongation is a novel finding. Whether or not a similar relationship exists for variables such as height and muscle mass is unclear and could aid in a better understanding of the elongation parameter for this particular athletic performance variable.
To date, no study has examined the validity of the Actitrainer tri-axial accelerometer (AT) (Actigraph, Florida, USA) in combination with heart rate (HR) for prediction of energy expenditure (EE) during walking in overweight and obese adults.

**PURPOSE:** To examine the validity of existing regression equations (Freedson and vector magnitude equations (VM)) based on accelerometer counts (AC) from the AT for predicting EE in overweight and obese adults during treadmill and outdoor walking. Further, to examine whether novel gender-specific equations combining AC, HR and body mass (BM) can enhance the accuracy of the EE prediction.

**METHODS:** Twenty overweight or obese adults (eight males and twelve females, age 43 ± 11 years, BMI 30.5 ± 4.9 kg/m²) completed a 30 min incremental walking protocol on a treadmill in a laboratory setting (4.65 km·h⁻¹). VO₂ and VCO₂ were measured throughout via breath-by-breath indirect calorimetry (IC) and EE for each stage was calculated using the Weir equation. AC and HR were continuously measured using the AT and Polar HR monitor. Novel gender-specific EE prediction equations were generated by multiple linear regression using AC, HR and BM. In a separate study, ten overweight and obese adults (five males and five females, age 44 ± 13 years, BMI 30.4 ± 4.0 kg/m²) conducted a self-paced three kilometre external walk during which EE, AC and HR were measured as before. EE was estimated using existing and novel prediction equations for both treadmill and external walks and compared to IC.

**RESULTS:** The Freedson equation overestimated EE (7.9 ± 1.3 kcal·min⁻¹ vs. IC: 5.5 ± 1.1 kcal·min⁻¹, P<0.01) during treadmill walking as did the VM equation (7.1 ± 1.1 kcal·min⁻¹, P<0.01). There was no difference between EE estimated using the novel gender specific prediction equations and EE measured by IC during either treadmill (P=0.993, standard error of estimate (SEE) 0.17 kcal·min⁻¹) or outdoor walking (P=0.114, SEE 0.77 kcal·min⁻¹).

**CONCLUSIONS:** The Freedson and VM equation significantly overestimated EE in overweight and obese adults during walking exercise. However, novel gender specific prediction equations based on VM, HR and BM appear to provide valid estimates of EE in this population during both treadmill and self-paced external walking.

**RESULTS:**

**Objectively Measured Physical Activity, Sedentary Behavior and Academic Performance in Finnish School-Aged Children**

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The school environment offers opportunities for children to be active, particularly during recess. Yet the influence of the playground on levels of daily physical activity (PA) has not been well described.

**PURPOSE:** To determine the role of renovated (Learning Landscapes, LL) vs. non-renovated playgrounds on levels of recess, school day and after school PA in elementary school children. Data collected serve as baseline for the Intervention of Physical Activity in Youth (IPLAY) Study.

**METHODS:** We measured 5-6 days of free-living PA via wrist-mounted Actical accelerometers in 277 low socioeconomic status elementary school children in metropolitan Denver, CO. We applied age specific cutpoints to the data to determine minutes and percent time spent in moderate-vigorous PA (MVPA). Univariate ANOVA was conducted to determine between-subject effects of weight status, presence of LL and sex on recess, school day and, after school (end of school day-5PM) PA, and likelihood of meeting the PA guideline.

**RESULTS:** During recess (see figure) and the school day, but not after school, children in LL accumulated more PA than their non-LL counterparts (school day mins MVPA: 35.7 (LL) vs. 25.5 (non-LL)). Boys were significantly more active than girls at all time points. Normal weight children were more active than overweight children over the course of the school day. Children in LL were no more likely than their non-LL counterparts to meet the guideline for daily MVPA.

**CONCLUSIONS:** In LL schools, normal weight girls and all boys participate in greater levels of recess PA compared to non-LL. However, overweight girls’ levels of PA are not different between playground conditions, signifying the need for additional approaches to encourage them to be more active.
METHODS: 278 children from five schools in the Jyväskylä school district in Finland (59% of the 475 eligible students; their mean age was 12.2 years; 55% were girls) participated in the study in the spring of 2011. Self-reported physical activity and screen time were evaluated by questions used in the WHO Health Behavior in School-aged Children (HBSC) study. Children’s physical activity and sedentary time were determined objectively by using an ActiGraph GT1M/ GT3X accelerometer for seven consecutive days. A cut-off value of 2,000 counts per minute was used for moderate to vigorous physical activity (MVPA) and 100 counts per minute for sedentary time. Schools’ grade averages were provided by the education services of the city of Jyväskylä. Cross-tabling and the analysis of variance were used to analyze the relationships between physical activity, sedentary behavior and academic performance.

RESULTS: Based on objective measurements, 59% of the children met the recommended level of 60 minutes of MVPA per day. Children were sedentary 59% of their waking hours. Children’s self-reported screen time was 3.6 hours per day on average. Objectively measured physical activity (p=0.595) and sedentary time (p=0.551) were not associated with the schools’ grade average. However, high levels of self-reported physical activity (p=0.001) and low levels of self-reported screen time (p=0.001) were associated with the high average of school grades.

CONCLUSIONS: The level of physical activity and sedentary behavior of Finnish school-aged children is comparable with that reported in international results. In this study, self-reported physical activity was directly, and screen time inversely, associated with academic performance. Objectively measured physical activity and sedentary time were not associated with academic performance. Objective and subjective measures may reflect different constructs and contexts of physical activity and sedentary behavior in association with academic outcomes.

CONCLUSION: Physical environment plays a critical role in whether children use active transport such as walking or biking to get to school.
Impact of Physical Activity Breaks on Healthy Activity Children Policy (HSP-5-000) Adherence in Middle Schools
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In North Carolina, a statewide policy mandates that schools provide at least 30 minutes of daily PA for children in grades K-8, over and above PE requirements (HSP-5-000). To assist middle schools with policy adherence we provided 16 middle schools in suburban NC with a 5-minute classroom-based PA break, available on CD or DVD.

PURPOSE: This study evaluated the impact of IR in middle schools in Winston-Salem Forsyth County Schools (WS/FCS).

METHODS: The WS/FCS Superintendent implemented a requirement for middle school students to engage in at least one IR break daily. Students staff trained middle school staff on IR use. School staff determined when IR would be implemented. IR videos were loaded on a central server that could be accessed through a networked computer in each classroom. Schools implemented IR 6 weeks in Spring 2011. Students completed a pre-post online survey to assess health-related behaviors and attitudes toward IR. Teachers maintained a daily log of IR use. After 4 weeks, trained volunteers and staff conducted direct classroom observations of IR, on/off task behavior of students, and teacher engagement. Teachers and students also provided qualitative feedback about IR.

RESULTS: Pre-post online surveys were completed by 1,553 middle school students (26.3% 6th graders, 37.4% 7th graders, and 35.4% 8th graders; 43% white, 25% black, and 32% other). Seventy-seven percent of students reported participating in an IR at any time during the evaluation period and 56% of students reported doing IR daily. Most students (73%) reported that they preferred alternative types of activities and to have activity breaks at different times during the school day.

CONCLUSION: Policies for daily activity breaks can facilitate increased school day PA. Student and staff input is critical when developing and implementing policies and programs to increase school day PA. Further research is needed to confirm these findings.

Gross motor coordination (GMC) and physical fitness (PF) are related, in part, to growth status during childhood. GMC and PF influence physical activity (PA) and can also be influenced by PA.

PURPOSE: to describe antecedents of growth, GMC, PA and health- and performance-related PF of children at 6 years of age relative to level of PA at 10 years of age.

METHODS: 285 primary school children (142 girls, 143 boys) from the Azores islands, Portugal, were measured annually (in the Fall) from 6 to 10 years. PA was assessed with personal interview using the Godin and Shephard questionnaire. tertiles for PA (sedentary, moderate, very active) at 10 years of age were calculated. Then, growth status, health and performance-related PF (Fitnessgram and AAIHPERD) and GMC of the children in each tertile at 10 years were tracked back to 6 years of age. ANOVA models were computed with SPSS 18.

RESULTS: Sedentary and high active girls at 10 years of age differed in GMC (F=4.23, p=0.016) and had poorer performances in the curl-up (F=3.57, p=0.028), push-up (F=1.14, p<0.001) and 50 yard dash (F=9.40, p=0.003) at 6 years; sedentary girls had poorer scores on all variables. Sedentary and moderately active girls at 10 years differed only in 50 yard dash test (F=9.40, p=0.003) at 6 years, while moderately and very active girls at 10 years differed only in push up test (F=1.14, p<0.001) at 6 years. Sedentary boys at 10 years of age had a higher fatness (F=3.28, p=0.038) and lower GMC (F=3.35, p=0.035) and did not perform as well in push-ups (F=3.44, p<0.001) compared to high active boys at 6 years. Sedentary and moderately active boys, and moderately and very active boys at 10 years differed only in push-ups (F=3.44, p<0.001 and F=3.44, p<0.001, respectively) at 6 years.

CONCLUSIONS: Children with high level of PA at 10 years tended to have a better profile of GMC and health and performance-related PF at 6 years of age compared to those with low PA. The findings highlight a need to incorporate GMC into PA intervention programs.

Study funded by the Fundação para a Ciência e a Tecnologia (FCT). Contract PTDC/DME/67569/2006 FCOMP-01-0124-FEDER-09608.

Physical Activity And Clustered Metabolic Risk Score In Young Children: A Cross-sectional Study (the IDEFICS Study)
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The relevance of physical activity (PA) as the main therapeutic tool for combating cardiovascula risk and metabolic syndrome in children has been highlighted.

PURPOSE: To study the association between objectively measured PA intensities and clustered metabolic risk score (MRS) in a large sample of European children aged 2≤10 years.

METHODS: We conducted a cross sectional study (the IDEFICS) which comprised 5548 children (2863 boys; 2<10 years) from eight European countries with complete measurements. Triglycerides, total cholesterol (TC), high-density lipoprotein cholesterol (HDL-c), glucose, insulin, systolic blood pressure, sum of two skinfold thickness and cardiorespiratory fitness were measured. The ratio TC/HDL-c and the homestasis model assessment were calculated. Z-scores were calculated for each risk factor variable by age group and sex, and then all individual Z-scores were summed to create a continuous score clustering metabolic risk factors. Since cardiorespiratory fitness was only available in children older than 6 years old, a second clustered metabolic risk score was obtained only for older children. Physical activity (PA) was assessed by accelerometry and minutes spent at the follow intensities were calculated; low PA, moderate PA, vigorous PA and average physical PA. The odds ratio for having high MRS in the least active quintile compared with the most active quintile of average PA was 2.79 (1.23 - 6.32). Odds ratios, in pre-school girls, compared with the most active quintile were raised in the second and least active quintiles for vigorous PA (4.55 and 5.34, respectively) and in the second quintile for moderate PA (2.87). The logistic regression analysis were repeated for the MRS including cardiorespiratory fitness only available for older children (6 < 10 yrs), and the results show that the strongest associations were found with moderate PA, where the least active quintiles had an odds ratios of MRS around 5 compared with the most active quintile in both sexes.

CONCLUSIONS: Our results suggest that those children who are less active have a higher risk score compared to those who are in the highest quintile of PA in both sexes aged from 2 to 10 years. Special focus on moderate and vigorous PA and to start at earlier age (2 years) should be provided.
Family Child Care Homes (FCCs) are among the providers of non-relative care for young children in the U.S. However, little is known about physical activity (PA) levels of children attending FCCs. The available, limited evidence suggests these children spend most of their time engaging in sedentary behavior, and the factors which influence children’s PA in this setting are unknown.

**PURPOSE:** To determine the relationship between FCC characteristics and practices and objectively measured PA in 2- to 5-year old children attending FCCs.

**METHODS:** FCC practices and characteristics were assessed in 45 FCCs using the Nutrition and Physical Activity Self-Assessment for Child Care Instrument (NAP SACC-SA). Within the 45 FCCs, 136 children (ages 2 to 5 yrs) wore an accelerometer during childcare attendance over one-week. Time spent in light, moderate, and vigorous PA per hour was calculated using intensity-related cut-points. For each NAP SACC-SA item, FCCs were divided into two groups: Promoting PA (PPA) or not promoting PA (Non-PPA). Mixed model analysis of variance was used to evaluate differences in total activity between groups. Models included FCC as a random effect to control for the clustering of children within FCCs. Age, sex, and BMI z-score were included as child-level covariates.

**RESULTS:** FCC characteristics and practices associated with higher levels of PA (min/hr; p<0.05) included provision of sufficient outdoor active play (32.2 ± 1.0 vs. 28.6 ± 1.3), active play using portable play equipment (31.7 ± 1.0 vs. 29.3 ± 1.4), the presence of a variety of fixed play equipment (32.2 ± 1.0 vs. 28.9 ± 1.3), suitable indoor play space (32.2 ± 1.0 vs. 28.6 ± 1.3), engaging in active play with children (32.1 ± 1.1 vs. 29.6 ± 1.2), and receiving activity-related training (33.1 ± 1.2 vs. 30.3 ± 1.1). Children were most active in FCCs with ≥ 4 significant PPA characteristics/practices compared to children in FCCs with < 4 significant PPA characteristics/practices.

**CONCLUSIONS:** This is the first study to identify specific practices and characteristics of FCCs that influence children’s PA. These data should be considered when developing programs and policies to promote PA in FCCs.

Supported by USDA-NIFA Grant 2008-04423
METHODS: High school students enrolled in drill team (n=33), band (n=33) (both are approved substitutes for physical education credits), and physical education (n=36) were recruited for participation in this study. Participants completed a brief survey, physical measurements, and wore an ActiTrainer Accelerometer, which is a valid and objective method of continuously recording physical activity, for a seven-day period. The groups were compared in two areas: 1) total time spent in moderate to vigorous physical activity (MVPA) and 2) time spent in MVPA during class (in minutes).

RESULTS: The drill team group (180.64 ± 87.77) participated in a significantly (P<0.01) greater amount of MVPA during class than both the band (95.30 ± 56.41) and PE groups (71.28 ± 39.06) which were not significantly different from each other. The overall weekly MVPA for the band group (743.64 ± 304.25) was significantly greater than the PE group (533.67 ± 242.00) while neither were significantly different from the drill team group (677.39 ± 265.99).

CONCLUSION: These findings suggest that a significantly greater amount of moderate to vigorous physical activity occurs in the drill team classes compared to the physical education and band classes that were examined in this study. The findings of this study suggest that approved substitutes for physical education that result in increases in physical activity should be encouraged as options for students to enroll in as a means of combating the prevalence of sedentary behavior in high school students. Further research is needed to examine other extracurricular activities' impact on physical activity in students.

2552 Board #227 MAY 31  3:30 PM - 5:00 PM
Evaluation of an After School Physical Activity Program for Disadvantaged Youth
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(Purpose: To evaluate the effectiveness of “Keep It Moving” (KIM), an after-school physical activity program in Colorado Springs, CO designed to encourage healthy movement outside of the formal school setting.

METHODS: Children at four disadvantaged elementary schools (87-93% free and reduced lunches) were assessed using an accelerometer along with the SOFIT observation method at two different time points during spring 2011. Standard data reduction processes for accelerometer and SOFIT data were used to determine time spent participating in physical activity. KIM facilitators were also observed using SOFIT to evaluate their interaction with participants during the program.

RESULTS: Among the entire sample (N=119) an average of 20.8 ± 9.5 minutes of moderate physical activity and 2.9 ± 3.9 minutes of vigorous physical activity was accumulated during the 45 minute KIM sessions, resulting in a combined 23.7 ± 11.3 minutes of moderate to vigorous physical activity (MVPA). Data from the SOFIT observation demonstrated that participants in the KIM program spent 12.3% of the session being “very active” (i.e. MVPA), with the majority of time spent “standing” (40.3%) and “walking” (36.0%). Only a small portion of the KIM sessions were devoted to sitting (10.5%) or lying down (6.8%). SOFIT data for facilitators indicated the majority of time was spent “managing” (40.6%), “observing” (33.5%), “promoting fitness” (10.1%) and in “general instruction” (9.2%), while lesser time was spent “demonstrating fitness” (2.6%) and on non-codefiable tasks (4.3%).

CONCLUSIONS: The KIM after school program succeeded at engaging participants in approximately 24 minutes of MVPA per session. The SOFIT observation results also suggest that participants spent a large portion of each KIM session being physically active. In addition to other activity accumulated throughout the day, the program could potentially assist children in reaching the recommended levels of PA, thus aiding them in achieving the benefits of a healthy lifestyle.

2553 Board #228 MAY 31  3:30 PM - 5:00 PM
Is Maintained Pattern of Physical Activity from Adolescence to Adulthood Associated with Reduced CVD-risk? HUNT-Study,Norway
Vegar Rangul1, Turid Linguaas Holmen1, Kristian Midtphjell1, Adrian Bauman3. 1Nord-Trøndelag University College, Levanger, Norway. 3HUNT Research Centre, Faculty of Medicine, Norwegian University of Science and Technology, Levanger, Norway. 5Prevention Research Collaboration, School of Public Health, University of Sydney, Sydney, Australia.

Little is known about the effect of adolescent physical activity on later health status, and few studies have examined physical activity patterns from adolescence to young adulthood as predictors of subsequent risk of cardiovascular disease (CVD).

METHODS: In a prospective longitudinal design we examined how different physical activity patterns from adolescence to young adulthood associated with CVD risk factors in young adulthood.

RESULTS: Data were from the Nord-Trøndelag Health Study (HUNT2, 1995-97 and HUNT3, 2006-08), Norway. In the present 10-year longitudinal study we included 1869 individuals (males n=838) who participated in both the youth part of HUNT2, aged 13-19 years old (baseline) and the follow-up HUNT3, aged 23-31. Measurements included self-reported physical activity, body mass index (BMI), waist circumference (WC), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), glucose, triglycerides, resting heart rate (HR), and blood pressure. We used separate linear regressions models to investigate associations between physical activity patterns and each CVD risk factor. Physical active maintainers (physical active defined as ≥2-3 days/week) were compared to inactive maintainers (IM). Adopters (those who were inactive (<2 days/week) as adolescents (baseline) and physical active as young adults, follow-up) were compared to IMs and to those who discontinued activity (relappers).

RESULTS: AMs had significantly lower HR, compared to all other PA patterns. Men who were AMs had significantly lower WC than relappers and IMs. In unadjusted analyses, AMs had significantly lower WC, BMI, HR, diastolic blood pressure, TC, triglycerides and higher HDL-C compared to IMs. When adjusted for age and gender, WC BMI, HR, diastolic blood pressure and HDL-C remained significant. When comparing IMs against adopters, only HR was significant lower. In gender specific analysis, male adopters had no different CVD risk compared to inactive maintainers. Among females, adoption was associated with lower HR and TC compared to IMs.

CONCLUSIONS: Active maintainers had the best profile, with significantly lower CVD risks compared to inactive maintainers. Adopting physical activity between adolescence and young adulthood may not confer a lowered CVD risk, compared to inactive maintainers.

2554 Board #229 MAY 31  3:30 PM - 5:00 PM
Physical Activity And Its Association With Academic Performance In Korean Adolescents
Jung-woo Oh, Hyun-jin Kwon, Yeon-soo Kim. Seoul National University, Seoul, Korea, Republic of.

PURPOSE: The purpose of this study was to investigate the association between PA and AP, as well as between media time (MT) an AP.

METHODS: This study used cross-sectional data included 75,066 (39,612 male students, 35,454 female students) middle and high school students from Korea Youth Risk Behavior Web-based Survey (KYRBIWS, 2009). Logistic regression performed to analyze the association between PA, MT, and AP.

RESULTS: From an analysis of Odds Ratio (OR), male students who achieved lower AP showed a significant decline in PA participatory rate compared to those who reported higher AP. For the high AP groups’ PA participatory rate, the reference value was 1. The middle AP group showed an OR value of 0.88 (CI 0.84-0.93) and the low group showed an OR value of 0.81 (CI 0.77-0.86). In the case of female students, OR values were 0.89 (CI 0.84-0.95). When comparing IMs against adopters, only HR was significant lower. In gender specific analysis, male adopters had no different CVD risk compared to inactive maintainers. Among females, adoption was associated with lower HR and TC compared to IMs.

CONCLUSIONS: Active maintainers had the best profile, with significantly lower CVD risks compared to inactive maintainers. Adopting physical activity between adolescence and young adulthood may not confer a lowered CVD risk, compared to inactive maintainers.
**Board #230**  MAY 31  3:30 PM - 5:00 PM

**Examining Girls’ Physical Activity Levels in Organized Sports**

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(Sponsor: Karen Croteau, FACSM)

(No relationships reported)

Many children do not meet recommended levels of physical activity (PA). This is particularly evident for girls in adolescence, when PA declines sharply. Organized sports (OS) may have potential to increase girls’ likelihood of meeting PA recommendations, but little research has focused on girls’ PA within OS.

**PURPOSE:** The purpose of this study was to describe the amount of PA that girls accumulate during games and practices within three OS, and to compare the levels between games and practices.

**METHODS:** A cross-sectional design was used. Participants were 94 girls, aged 10 to 17 yr, mean (± SD) = 13.4 ± 2.2 yr, recruited from 10 teams in three OS (netball, basketball, soccer) in Sydney’s Western Suburbs. Each participant wore one ActiGraph GT3X monitor, placed on the right hip via elastic belt, for the duration of one practice and one game. Accelerometers were initialized to record counts and steps, using 5 s epochs. Freedson’s cut-points were used to determine PA intensity.

**RESULTS:** Across OS, the mean (± SD) for percent time in moderate-to-vigorous PA (MVPA) during games (30.1 ± 10.2%) was significantly lower ($t = -5.27, P < 0.001$) than during practices (36.4 ± 8.3%). In games (mean duration = 90.8 ± 13.7 min), OS featured similar proportions of MVPA (netball = 30.9 ± 9.1%; basketball = 29.9 ± 8.5%; soccer = 29.1 ± 8.5%). In OS practices (mean duration = 82.6 ± 22.6 min), MVPA was more heterogeneous (netball = 39.4 ± 4.7%; basketball = 35.5 ± 8.1%; soccer = 32.6 ± 11.2%). Overall, step/h for games (OS = 2,702 ± 960; netball = 2,543 ± 699; basketball = 2,349 ± 660; soccer = 3,340 ± 1,267) was significantly lower ($t = -5.05, P < 0.001$) than during practices (OS = 3,234 ± 743; netball = 3,430 ± 423; basketball = 2,753 ± 767; soccer = 3,602 ± 916).

**CONCLUSION:** Our observations of the three sports showed that participants achieved significantly higher levels of MVPA and steps during OS practices, compared to OS games. Girls spent 21.8 min/h in MVPA during practices and 18.1 min/h in MVPA during games. For this population, OS appears to make a substantial contribution to the PA of participating girls. OS alone, however, does not provide amounts of PA sufficient to meet daily recommendations for girls. This information on OS can be used as a platform from which to inform policies, and to develop strategies to increase adolescent girls’ PA levels through sport.

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**Board #231**  MAY 31  3:30 PM - 5:00 PM

**Physical Activity Tracking in Iowa Bone Development Study Youth: Alignment by Biological versus Chronological Age**

Shelby L. Francis, Joanna L. Morrissey, Elena M. Letuchi, Steven M. Levy, Kathleen F. Janz, FACSM. University of Iowa, Iowa City, IA.

(No relationships reported)

**PURPOSE:** To compare the tracking of childhood and adolescent objectively-measured physical activity (PA) using peak height velocity (PHV) as a predicted measure of biological age (BA) versus chronological age (CA, yr). To investigate whether known gender differences in PA trajectories were altered after aligning by BA instead of CA.

**METHODS:** The Iowa Bone Development Study has collected longitudinal ActiGraph data at ages 5, 9, 11, 13, and 15 yr. To be included in this analysis, participants had to have worn an accelerometer at least two measurement periods (N = 112 girls; N = 96 boys). Spearman correlation coefficients were used to determine two-year intervals of tracking of moderate to vigorous PA (MVPA) before and after maturity (PHV). Gender-specific MVPA trajectories were compared using mixed models with autoregressive residual covariance.

**RESULTS:** Moderate two-year tracking associations were present, except the -1 yr PHV to +1 yr PHV in boys. The mixed models indicate MVPA was highest at age 5 and then declined in girls. Boys’ MVPA increased until 9 yr and then decreased at a faster rate than girls. A significant interaction between age and gender confirmed the different trajectories. By 2.5 to 3 yr post PHV girls and boys had similar levels of MVPA.

**CONCLUSIONS:** Exploring opportunity, availability, and support of MVPA in boys and girls may help explain why levels are decreasing with age. Further research into the immediate time period surrounding PHV appears warranted in boys.

Supported by the National Institute of Dental and Craniofacial Research (R01-DE12101, R01-DE09551); General Clinical Research Centers Program (M01-RR00059); National Center for Research Resources (UL1 RR024979).

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**Board #232**  MAY 31  3:30 PM - 5:00 PM

**Comparison Of Adolescents Risk Factors Prevalence To Chronic Disease Development In Urban Regions In Brazil**

raquel sapone ceschini, Fabio Luís Ceschini, Aylton Figueira Júnior. São Judas Tadeu University - São Paulo – Brazil, São Paulo, Brazil.

(No relationships reported)

**PURPOSE:** This paper compared both sex adolescents’ risk factors to chronic diseases development living at four distinct areas in developing country. Sample: We evaluated 1.442 adolescents [710 (49.2%) girls and 732 (50.8%) boys] from 14 to 19 years of age living in São Paulo State-Brazil. We selected three regions in countryside and one in central area. The sample distribution was at countryside regions: North (n=355) and East (n=366) side in Sao Paulo State. Both cities presented as main activity the rural profile (rural-non-urban cities) while in the West area (n=379) are a presented urban profile (central-urban city).

**METHODS:** Adolescents were surveyed by cross sectional evaluation answering the Youth Behavior Risk Questionnaire and the International Physical Activity Questionnaire (IPAQ-short version). Four behavioral risks were assessed: 1) physical inactivity (PI); adolescents that reported less than 300 minutes/week of moderate-vigorous physical activity in the previous evaluation week; 2) alcohol intake (AI): drink at least one dose of any kind of alcohol beverage in the previous evaluation week; 3) cigarette smoking (CS): smoke at least once in the previous evaluation week; 4) overweight indicator (OW): present at least 21.66 (Kg/m2) body mass index value. Data Analysis: Qui-Square test (p<0.05 as significance level).

**RESULTS:** Data analysis evidenced significant differences in risk factors prevalence by gender. Boys presented higher behavior risk for AI as well CS than girls. On the other hand, female group presented higher prevalence value for PI and OW. In general, more than 2 risks factors were higher in girls than boys. The analysis by regions, showed different physical inactivity prevalence. Rural non-urban cities (North= 56.7% and East = 64.6%) presented more active adolescents than rural-urban city (West = 39.2%) and central-urban city (Central = 35.4%). Similar trend was found for AI and OW by regions.

**CONCLUSION:** This paper allow us to conclude that: 1- distinct regional development may influence the amount behavior risk prevalence in adolescents; 2- prevalence of risk factors were different in boys and girls; 3- the comparison among the four studied risk factors, PI presented the highest prevalence.
PAQ-C questionnaire and PA general scores (PAgS) estimated according to Crocker et al. (1997). Sedentary behavior, consumption of processed foods and sugary drinks (Wilson et al., 2008) were assessed by self-report.

RESULTS: The prevalence of MetS was 3.5%. Significant differences were found between participants w/MetS and with MetS in PAgS (2.56±0.71 vs 2.1±0.67, respectively), and participants with MetS had a significantly lower mean score (p=0.012). Regarding the risk factors for MetS (HDL, LDL, WC, blood pressure and triglycerides), significant differences were found between subjects with AOb and without AOb (w/AOb) (2.43±0.64 vs. 2.66±0.70, respectively). Those with AOb also had lower scores in PAgS (p<0.001). There were no differences between subjects with MetS and w/MetS for sedentary behaviors (1.77±0.69 vs. 1.7±0.30 hrs/wk, respectively), and scores of processed foods and sugary drinks consumption (5.56±3.78 vs. 5.73±5.23).

CONCLUSION: A physically active lifestyle may prevent the diagnosis of metabolic syndrome in adolescents.

Sponsored by the Research Center of Sport, Health and Human Development (CIDESD) and the Department of Education in Madeira Autonomous Region

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**Board #254**

**MAY 31 3:30 PM - 5:00 PM**

**Physical Activity Levels of Elementary School Students during Physical Education and Recess.**

Kerry L. McIver, Russell R. Pate, FACSM. University of South Carolina, Columbia, SC.

(No relationships reported)

Physical education class (PE) and recess are the two main opportunities that children have to be physically active during the school day. However, no study has directly observed the exact time spent, by children, in these settings, while using accelerometry for the purpose of quantifying physical activity in these settings.

PURPOSE: The purpose of this study was to precisely document time spent in PE and recess and to describe the physical activity levels of elementary school children in those settings.

METHODS: One-hundred and forty-one 1st and 5th graders, attending 10 elementary schools, participated in the study. Participants wore Actigraph accelerometers for one-week, and during that period the precise times spent in PE and recess each day were documented for each participant. Accelerometer counts per 30-seconds were categorized as sedentary, light, moderate-to-vigorous (MVPA) and vigorous physical activity (VPA). Minutes spent in these categories were calculated for PE and recess periods for each day and across the week.

RESULTS: Participants attended PE once per week for an average of 48 minutes. Percent of time spent in MVPA during PE was approximately 30%, except for 5th grade girls, who spent 23% of PE class in MVPA. First graders spent significantly more time in recess compared to 5th graders (24 minutes per day vs. 17 minutes per day), and more of that time was spent in MVPA (65% vs. 48%).

CONCLUSION: The results suggest lower than recommended levels of MVPA during PE for both grades. Proportion of time spent in MVPA during recess was higher than PE. Physical activity during PE and recess, as determined by close observation of times spent in these settings, was variable based on grade and gender. PE, as an active opportunity for children, warrants continued examination. While activity levels were higher in recess, modifications of active opportunities may be necessary especially for older girls.

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**Board #255**

**MAY 31 3:30 PM - 5:00 PM**

**Breaks in Sedentary Time during Childhood and Adolescence: Iowa Bone Development Study.**

Kathleen F. Janz, FACSM, Suyang Kwon1, Trudy L. Burns1, Steven M. Levy1. University of Iowa, Iowa City, IA. 2Consortium to Lower Obesity in Chicago Children, Chicago, IL.

(No relationships reported)

PURPOSE: The frequency of interruptions in sedentary time (sedentary breaks) is an aspect of sedentary behaviors which may be associated with metabolic health outcomes. The aim of this study was to describe the change in the frequency of sedentary breaks over a 10-year period from ages 5 to 15 yr.

METHODS: The longitudinal Iowa Bone Development Study has collected accelerometer data at approximately 5, 8, 11, 13, and 15 years of age. Data from participants who wore an accelerometer at least 10 hours per day and three days per data collection episode were used (423 children at age 5, 550 at age 8, 520 at age 11, 454 at age 13, and 344 at age 15). The frequency of sedentary breaks was determined based on accelerometer data and compared by weekday/weekend, time period during the day, gender, and data collection episode.

RESULTS: The frequency of sedentary breaks decreased by >200 times/day over a 10-year period from ages 5 to 15. Linear regression models estimated a 1.8 times/hour decrease per year for boys and a 2.0 times/hour decrease per year for girls (P < 0.0001). Both boys and girls showed significantly fewer breaks on weekdays from morning to 3:00 PM than on weekends from morning to 3:00 PM (Ps < 0.0001). The frequency of sedentary breaks was slightly higher among boys than girls (gender difference ≤ 2 times/hour; Ps < 0.01 at ages 11, 13, and 15).

CONCLUSIONS: Breaks in sedentary time notably decrease during childhood and adolescence. During school hours, boys and girls have fewer breaks in sedentary time than during any other time period of weekday or weekend day. If health effects of sedentary breaks are proven, schools may be a potential intervention setting for increasing the frequency of sedentary breaks. School policy interventions such as increasing recess time and activity breaks during class time may have an impact on students’ sedentary break behaviors.

Supported by the National Institute of Dental and Craniofacial Research (R01-DE12101, R01-DE09551); General Clinical Research Centers Program (M01-RR024979).

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**Board #256**

**MAY 31 3:30 PM - 5:00 PM**

**Is Physical Activity Set in Stone? Tracking of Accelerometer-measured Activity in Early Childhood**

Nicholas M. Edwards1, Philip R. Khoury2, Heidi J. Kalkwarf3, Randal P. Claytor4, Stephen R. Daniels,4, Cincinnati Children’s Hospital Medical Center & University of Cincinnati, Cincinnati, OH. 5Cincinnati Children’s Hospital Medical Center, Cincinnati, OH. 6Miami University, Oxford, OH. 7University of Colorado School of Medicine & Children’s Hospital Colorado, Aurora, CO. (Sponsor: Gregory D. Myer, FACSM)

(No relationships reported)

PURPOSE: To determine whether relative physical activity (PA) levels at age 3 years are sustained in subsequent years during early childhood.

METHODS: This study enrolled 372 children. Objective measures of PA (RT3, triaxial accelerometer) were collected for 3 days every 4 mo from age 3 to age 7 y. Non-wear time was defined as 60 min with consecutive zero vector magnitudes per min (vpm) allowing up to 3 min with vector magnitudes ≤ 100. Valid days were defined as 8 to 18 h wear time. PA for each year of age (e.g., 3.0-3.99 y) was calculated as mean daily vpm averaged across valid days (vpm). Spearman rank correlation coefficients between PA at age 3 y and ages 4 through 7 y were calculated. Participants were categorized into gender-specific tertiles of PA at each age. Differences in PA throughout the study between sexes and between the High PA tertile and Middle/Low PA tertile at age 3 y were tested using t-tests.

RESULTS: At age 3, PA was 613 ± 201 vpm (mean ± SD) in boys and 564 ± 199 vpm in girls; boys’ PA remained higher at each age (P < 0.01). PA at age 3 y was significantly correlated with PA levels at ages 4 through 7 y (P < 0.015; Table). Participants in the highest tertile of PA at age 3 y were approximately twice as likely to remain in the highest tertile in subsequent years compared with those not in the highest tertile at age 3 (50% vs. 26%; P < 0.001).

CONCLUSIONS: Boys are more active than girls at ages 3 through 7 y. Children who are relatively more physically active at age 3 y have a significantly greater likelihood of maintaining higher PA levels from age 4 to 7 y than their peers. These findings highlight the importance of establishing healthy PA levels early in life.

Supported in part by grants: NIH NHLBI R01HL064022, NCRR KL2RR026315, USPHS ULI RR026314, and CCHMC HIRC.
CONCLUSION:
Regular participation in formal sport activities is an important factor in increasing the likelihood of being physically fit. The total amount of physical activity practice and the practice of non-organized physical activity during the week were not significant correlates of physical fitness on a regular basis (boys: OR=1.86, 95% CI: 1.31-2.64, p=0.001; girls: OR=1.66, 95% CI: 1.20-2.29, p=0.002) were more likely to have a better performance on Pacer test in both genders. On the other hand, body mass index for boys (OR=0.728, 95% CI: 0.62-0.86, p<0.001), and age for girls (OR=0.60, 95% CI: 0.46-0.78, p<0.001) were negatively associated with being considered physically fit.

RESULTS:
A cross-sectional school-based study of 799 adolescents (446 girls) aged 15-18 years from Azorean Islands was conducted. PA measured by pedometers was compared between the tertiles of BMI and PA based on PA questionnaires. The correlation coefficient between BMI and PA was 0.09. The PA questionnaire was a reliable measurement with an interclass correlation of 0.76. The final model included age and gender in PA prediction.

PURPOSE:
To determine the PA amount of Azorean adolescents using pedometers and assess the impact of individual and psychosocial correlates.

METHODS:
A cross-sectional school-based study - The Azorean Physical Activity and Health Study II, of 799 adolescents (446 girls) aged 15-18 years from Azorean Islands was conducted. PA was assessed by pedometer for 7 consecutive days. Psychosocial correlates, enjoyment and self-efficacy, were determined by established questionnaires. The final model included age and BMI on steps/day. The final model included the effect in steps/day of gender β=80.45 (p<0.001), self-efficacy β=73.38 (p<0.035) and enjoyment β=355.57 (p<0.036).

CONCLUSION: Results are consistent with other objective assessments of youth PA indicating that males are typically more active than females. Psychosocial correlates, such as self-efficacy and enjoyment are significant factors in adolescents PA.

KEYWORDS: Adolescents, Pedometers, Psychosocial correlates
Pedro Silva is supported by FCT SFRH/BPD/71332/2010

<table>
<thead>
<tr>
<th>Physical activity at ages 3 through 7 years.</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
<th>Age 7</th>
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<tbody>
<tr>
<td>(N=342)</td>
<td>(N=339)</td>
<td>(N=329)</td>
<td>(N=311)</td>
<td>(N=260)</td>
<td></td>
</tr>
<tr>
<td>PA, mean vpm (SD)</td>
<td>589 (201)</td>
<td>604 (219)</td>
<td>601 (214)</td>
<td>581 (205)</td>
<td>555 (206)</td>
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<tr>
<td>Correlation with PA at age 3*</td>
<td>1.00</td>
<td>1.37</td>
<td>0.35</td>
<td>1.24</td>
<td>1.16</td>
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</tbody>
</table>

Proportion in High PA tertile during subsequent years:

- High PA at age 3: 100% 52% 53% 49% 39%
- Middle/Low PA at age 3: 9% 23% 27% 27% 29%

*P < 0.015 for all correlations.
RESULTS: The univariate ANOVA revealed highly significant differences in levels of PA of youth across the three cities (p < .001). Youth from Al-Ahsa were less active than youth in Birmingham and Coventry (1495, 3627 & 3949 METs-min/wk respectively). Using Chi-square analysis, frequency data revealed a significant difference in PA levels between youth in Birmingham, Coventry and Al-Ahsa (χ² = 653.85, p < 0.001), with 72.3%, 77.2% and 26% of youth being ‘active’ respectively. Also, ANOVA revealed highly significant differences (p < .001) in the proportions of overweight/obese participants based on IOTF BMI classification, with males and females from Al-Ahsa exhibiting a higher prevalence of overweight/obesity (36.4% and 36.6%, respectively).

CONCLUSIONS: Youth from Birmingham and Coventry are more physically active than their counterparts living in Al-Ahsa. Males are generally more physically active than females. Additionally, youth with higher BMI reported lower levels of physical activity and higher amounts of sedentary time.

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<th>Board #240</th>
<th>MAY 31</th>
<th>3:30 PM - 5:00 PM</th>
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<tr>
<td><strong>Longitudinal Investigation Of Daily And Yearly Physical Activity In Australian Children</strong></td>
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<tr>
<td>Rohan M. Telford¹, Richard D. Telford, FACSM,² Ross B. Cunningham¹, Rachel C. Davey¹, Gordon Waddington¹, Thomas Cochrane¹, ³Canberra University, Canberra, Australia. ²Canberra Hospital, Canberra, Australia. ³Australian National University, Canberra, Australia. (No relationships reported)</td>
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Longitudinal studies of the daily and yearly physical activity (PA) patterns in young children may provide valuable information for intervention strategies aiming to promote and increase PA in youth.

PURPOSE: To contribute to our understanding of the patterns of PA which may exist on a yearly and daily basis within a cohort of boys and girls as they progress through elementary school.

METHODS: Participants were initially 775 children (394 boys and 381 girls, mean age 8.0 ± 0.3) recruited from 29 elementary schools in suburbs where the household income was similar to the Australian average. Pedometers were worn annually for a 7 day period over five consecutive years and step counts were converted to a physical activity index (PAI, approximately the square root of steps) to satisfy requirements for statistical analysis. In the final two years accelerometers were worn to assess PA intensity.

RESULTS: Overall, the PAI of boys was higher than girls, the respective means and standard errors being 102.5, 0.76 versus 93.5, 0.77 (p<0.001). Boys spent more time per day (values expressed as the means of the sqrt of minutes and standard errors) in moderate (5.71, 0.10 v 4.7, 0.11, p<0.001) and vigorous (2.8, 0.09 v 2.4, 0.09, p<0.001) intensity activity, while girls spent more time in sedentary classified activities (20.4, 0.12 v 19.9, 0.12, p=0.01). There were changes in the average daily step count from year to year (p<0.001), but these changes fluctuated, providing little evidence of any systematic changes in total PA between the ages of 8 and 12 years. On the other hand, a systematic pattern of step counts did emerge according to day of the week (p<0.001). This was characterized by a gradual build up of daily steps from Monday to Friday followed by a decline over the weekend, with Sunday being the least active day. This pattern persisted from year to year in both genders and a corresponding pattern was found for time spent in moderate, vigorous and light intensity activity.

CONCLUSION: Whilst there was little evidence of any systematic changes in step-counts within this cohort over the final four years of elementary school, there were systematic day by day changes during the week which persisted from year to year. These data suggest that strategies to increase PA in elementary school children might benefit from targeting specific days of the week.

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<th>Board #241</th>
<th>MAY 31</th>
<th>3:30 PM - 5:00 PM</th>
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<tr>
<td><strong>Physical Activity and Motor Skill Development in Young Children</strong></td>
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<tr>
<td>Jennifer I. Flynn, Dawn P. Coe, Jeffrey T. Fairbrother, R. Sean Durham. The University of Tennessee, Knoxville, TN. (Sponsor: Dixie Lee Thompson, FACSM) (No relationships reported)</td>
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Young children should accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) daily. Physical activity (PA) contributes to motor skill development, particularly for tasks requiring complex movement patterns thought to underlie skill-related activity and PA later in life (e.g., sport and dance).

PURPOSE: To assess the association between MVPA and motor development in young children.

METHODS: Participants were 40 children (4.8 ± 0.8 years) enrolled in a university research laboratory school. MVPA was assessed using an accelerometer (Actigraph GT3X) set to collect data at 15 s epochs. These data were used to calculate average daily time (min) spent in MVPA for one week (Pate et al., 2006). The Tests of Gross Motor Development-2 (TGMD2) was used to assess 8 gross motor skills that were considered to represent complex skills (CS). CS tests were TGMD2 subtests that show the lowest percentage of mastery for 3-5 year old children. The CS tests were 4 locomotor (galloping, unipedal hopping, leaping, and horizontal jumping) and 4 object control (stationary basketball dribble, catching, kicking, and underhand rolling) skills. Relationships between MVPA and CS scores were examined using Pearson correlations.

RESULTS: There were significant correlations between MVPA and galloping (r=0.372; P=0.028), hopping (r=0.471; P=0.004), dribbling (r=0.393; P=0.020), and catching (r=0.337; P=0.048).

CONCLUSIONS: These correlations indicate that further research is warranted to determine a causal link between MVPA and CS competency. It is important to determine if PA drives CS competency or if CS competency supports PA efforts. This relationship is important given the recognition that motor skill development and CS competency are critical to success in lifetime PA. This study was funded by a grant from the University of Tennessee Korn Learning, Assessment, and Social Skills (KLASS) Center.

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<th>Board #242</th>
<th>MAY 31</th>
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<tr>
<td><strong>Types of Physical Activities Among High School Students - United States, 2010</strong></td>
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<tr>
<td>MinKyoung Song, Dianna D. Carroll, Sarah M. Lee, Janet E. Fulton, FACSM. Centers for Disease Control and Prevention, Atlanta, GA. (No relationships reported)</td>
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There are no recent nationally-representative studies on participation in types of physical activity among U.S. high school students.

PURPOSE: Describe the most frequently reported types of leisure-time physical activities among U.S. high school students overall, and by sex and body mass index (BMI).

METHODS: We analyzed data from the 2010 National Youth Physical Activity and Nutrition Survey among 8,895 U.S. high school students in grades 9-12 who completed a self-administered questionnaire. A total of 35 different physical activities were listed in the questionnaire. Students were classified as participating in a specified activity if they reported that activity ≥ 1 days/week. Weighted prevalence estimates and 95% confidence interval (CI)s were compared by sex and BMI (normal, overweight, obese).

RESULTS: Overall, walking was the most frequently reported physical activity among U.S. high school students (80.4%, 95% CI [79.1, 81.6]) followed by running/jogging (70.0%, [68.0, 71.9]), weight-lifting (44.1%, [41.8, 46.5]), basketball (43.5%, [41.5, 45.6]), and active video-games (39.8%, [37.7, 42.0]). Four of the top five reported activities were the same between boys and girls (Table). Stratified by sex and BMI, four of the top five activities in each sex group were also reported the top five in all BMI categories for that sex.

CONCLUSIONS: Walking and running/jogging were the most frequently reported activities among U.S. high school students for all sex and BMI groups. Knowledge of the types of activities in which youth engage may inform public health professionals to develop targeted strategies to improve participation in physical activities among U.S. youth.

<table>
<thead>
<tr>
<th>TABLE. Top Five Physical Activities Among U.S. High School Students during the past 7 days by Sex, 2010</th>
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<tbody>
<tr>
<td><strong>Male</strong></td>
</tr>
<tr>
<td>Activity</td>
</tr>
<tr>
<td>Walking</td>
</tr>
<tr>
<td>Running/jogging</td>
</tr>
<tr>
<td>Weight-lifting</td>
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<tr>
<td>Basketball</td>
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<tr>
<td>Active video-games</td>
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</tbody>
</table>

658 Copyright © 2012 by the American College of Sports Medicine. Unauthorized reproduction of this article is prohibited.
Although 60 minutes of physical activity (PA) per day are recommended for children and adolescents, many schools have physical education (PE) class 1 to 2 times per week for 30 minutes to 1 hour per class. It is unknown whether, despite the lack of opportunity for PA in PE, students from a multi-ethnic, low income, urban setting meet the recommendations for PA through participation in outside of school activities, and in what types of PA students most often engage.

**RESULTS:**

Methods: The Physical Activity Checklist Interview (PACI) was administered to students (n=1332; age 9-15 years; grades 4-8) in the school setting. Students were instructed to include only activities in which they had participated for at least 15 minutes. Students could indicate as many activities as appropriate and report additional activities that were not included on the form (PA and sedentary activities (SA)).

Results: Ninety-two percent of students reported participating in ≥1 PA with an overall average 2.8 activities before or after school. The most common out of school activities reported were walking (55% of students), running/jogging (30%), dance (29%), basketball (26%), and football (23%). However, 95% of students also reported participating in ≥1 SA. The majority of SA (46% of students) reported were technology based (screen time) such as TV, non-active video games, and computer use. Twenty-two percent of students also reported participating in other SA which included activities such as reading, doing homework, and talking on the phone.

**CONCLUSION:** Although they indicated a range of PA types, the majority of students were not participating in the recommended amount of PA. Because PA has a beneficial effect on physical and mental health, and patterns of health-related behaviors are often established in childhood, strategies to increase PA outside of school are needed. Additionally, because PA levels begin to decline during adolescence, health care providers, school personnel, community leaders and families should work to develop PA programs appropriate to students’ interests.
CONCLUSIONS: 100% of the children do daily physical activity, foods high in energy content will increase. There are significant differences in SM variables except abdominal circumference and triglycerides in children only qualified for metabolic syndrome.

2572  Board #247  MAY 31  3:30 PM - 5:00 PM
Eating Behaviors And Fitness Scores Differ By Socio-economic Status In Elementary School Students
Mariane M. Fuhlman, FACSM1, Heather L. Hall1. 1Wayne State University, Detroit, MI. 2Elmhurst College, Detroit, MI.
(No relationships reported)

There is a clear disparity in health in the United States such that groups of lower socioeconomic status (SES) (L) are more likely to suffer from morbidity and mortality related to chronic disease than those of higher SES (H). While chronic disease does not manifest itself until late in life, the health behaviors that contribute to it begin in childhood and have a cumulative effect. Thus, direct intervention strategies aimed at high risk populations are appropriate.

PURPOSE: To determine if treatment levels and eating behaviors differ by SES as early as elementary school.

METHODS: The study population consisted of 1064 elementary school students from urban and suburban schools in the Midwest. Students completed the Fitnessgram® fitness test which measured aerobic fitness, abdominal and upper body muscular endurance, back and hamstring flexibility, and body mass index (BMI); and the Eating Behavior Survey which measured intake of fruits, vegetables, meats, grains and non-nutritious foods. Comparisons between SES were conducted using analysis of variance with a Tukey post hoc.

RESULTS: Significant differences between H SES and L SES students were found on the following dependent variables in both males and females: (p<0.05). Sample data for females: BMI (L = 20.1 ± 1.2; H = 18.5 ± 0.5); mile run times in seconds (L = 834 ± 30.7; H = 626 ± 18.5); curl-ups (L = 20.8 ± 3.3; H = 35.0 ± 2.7); and push-ups (L = 8.7 ± 3.3; H = 15.1 ± 0.7). Eating behaviors showed similar trends. Fruits (L = 0.8 ± 0.3; H = 3.0 ± 0.7); vegetables (L = 0.9 ± 1.6; H = 2.9 ± 1.5); grains (L = 4.8 ± 2.3; H = 6.3 ± 3.7); and non-nutritious foods (L = 9.2 ± 7.3; H = 4.5 ± 2.5).

CONCLUSIONS: L SES students have lower fitness scores and poorer eating behaviors than H SES students. Recent research indicates that improvements in fitness reduce the risk of becoming overweight across puberty. Targeting these students for interventions at an early age may decrease their risk of obesity related disorders in adulthood.

2573  Board #248  MAY 31  3:30 PM - 5:00 PM
Change in School Choice Policy and Active Commuting to Elementary School
John R. Sirard1, J. Michael Oakes2, Kelsey McDonald2. 1University of Virginia, Charlottesville, VA. 2University of Minnesota, Minneapolis, MN.
(No relationships reported)

The strongest and most consistent correlate of whether a child will walk to school is the commute distance. In existing urban areas, restricting school choice, which forces more children to attend their neighborhood school, may reduce this distance barrier to actively commuting to school.

PURPOSE: The purposes of this study were to assess the effect of a new, more restrictive school choice policy, which separated the city into three geographical transportation zones, on changes in 1) travel distance to school for students in Minneapolis K-5 and K-8 schools and 2) prevalence of active commuting to Minneapolis K-5 and K-8 schools. We hypothesized that travel distance to school would decrease and the proportion of students actively commuting would increase.

METHODS: Baseline data were collected in spring 2010 and follow-up data in fall 2010 after the policy went into effect. School district transportation data were used to determine distance to school for the approximately 20,500 enrolled students across 39 schools. Direct observations of student travel modes (i.e., walking, bicycling, auto) during morning and afternoon commute times were used to assess changes in active and automobile commuting for school. Each school was observed by trained research staff on 2 morning and 2 afternoon commutes at each time point. A transportation survey was conducted by the transportation coordinator at each school to control for any new active commuting programs or infrastructure projects.

RESULTS: Across all schools, distance to school significantly decreased from spring to fall 2010 (1.83±0.48 miles vs. 1.74±0.46 miles; p=0.002). From spring to fall, there was a statistically significant 1% increase in the proportion of students actively commuting (about 205 students; ps 0.024) that was seen for the morning (p=0.033) and afternoon commuting times (p=0.018).

CONCLUSIONS: We observed a significant increase in active commuting to and from school after implementation of a restricted school choice policy, which was similar across the transportation zones. These findings indicate that reducing school choice options may decrease travel distance and increase active commuting to school.

Supported by a grant from Active Living Research #67295.

2574  Board #249  MAY 31  3:30 PM - 5:00 PM
A Survey of Sports Health and Nutrition in Urban High School Athletes
Brian Y. Kim1, David Knues2. 1University of California Los Angeles, Santa Monica, CA. 2University of California Irvine, Irvine, CA.
(No relationships reported)

PURPOSE: To survey the baseline knowledge of sports health and nutrition in urban high school athletes and identify areas that can be targeted for education.

METHODS: Student-athletes enrolled in grades 9-12 at an urban, Title I-funded, public high school were asked to submit self-reported age, height, and weight, and complete a 23-item multiple-choice questionnaire covering various topics in sports nutrition and health. CDC criteria were used to determine BMI %ile, underweight, overweight, and obesity. Comparisons of means and proportions were made using two-tailed t-tests and confidence intervals, respectively.

RESULTS: 424 students (304 M, 120 F) completed the survey. Mean age was 16 y (M 15.8 y; F 15.9 y; p=0.76). Mean BMI Sd. was 6.9 (M 60.9, F 66.1; p=0.15). 32% were overweight (M 34%; F 24%; CI 0.003-0.2) and 15% were obese (M 19%, F 4%; CI 0.09-0.21). 1 boy and 1 girl were underweight. Overall, 44% were happy with their bodies (M 47%, F 38%; CI -0.02-0.19). Girls more frequently reported a desire to lose weight (M 37%; F 67%; CI 0.2-0.4) and endorsed planned to lose weight (M 14%, F 25%; CI 0.20-0.19). Boys were more likely to be desire gaining weight (M 32%, F 7%; CI 0.18-0.32). 9% of athletes reported current dieting to lose weight (M 9%, F 11%; CI -0.09-0.04) and 15% admitted to dieting to lose weight in the past (M 14%, F 18%; CI -0.12-0.04) with no significant differences between sexes. 76% identified carbohydrates (CHO) as an important source of fuel during exercise, but only 48% and 58% correctly identified cereals and fruit, respectively, as good sources of CHO. Girls were more likely to consider nuts a good source of CHO (M 55%, F 69%; CI 0.05-0.28), whereas boys were more likely to consider steak a good source of CHO (M 36%, F 26%; CI 0.01-0.25). 9% of athletes considered a high protein diet the ideal diet for teenage athletes and 56% considered protein an important source of fuel during exercise. 60% believed that all athletes should be taking a daily multivitamin. Boys were more likely to agree with the statement that B vitamins improve exercise performance (M 14.5%, F 5.8%; CI 0.14-0.03). 57% of girls were able to identify the female athlete triad.

CONCLUSIONS: High school athletes display deficits in several areas of knowledge related to sports health and nutrition, and may benefit from targeted education addressing these topics.

2575  Board #250  MAY 31  3:30 PM - 5:00 PM
The Relationship Between Active Travel to School, Sports Participation and Obesity in Young People
(No relationships reported)

Informal physical activity (PA) such as active travel to school (ATS) is an important source of physical activity for children and adolescents. However, more research is needed for better understanding the relationship between ATS and parameters of health-related fitness.

PURPOSE: The purpose of this study is to investigate the relationship between ATS and, % body fat (%BF) and estimates of VO2max.

METHODS: Participants in this study were 1329 adolescents (603 boys and 699 girls), between 10 and 17 years of age (x=11.7±1.6 yrs), from 4 schools in Madeira Island, Portugal. Participants completed the PAQ-C questionnaire (Crocker et al., 1997), and answered questions about transport to and from school as well as sport participation. Measures for height, weight, waist circumference, triiceps and calf skinfolds were taken. % BF was estimated according to Slaughter et al. (1988), and participants classified in health risk categories (Lohman, 1987).

RESULTS: Of all participants, only 10% walked daily to and from school, with a duration of at least 20 minutes. About 53.1% of participants did not participate in any organized activities.
apart from PE classes, and 41% had a high or very high % BF. Results showed significant differences between boys and girls (p<0.05), with boys reporting higher mean levels in the PA score (2.73±0.71 vs. 2.23±0.51 for boys and girls, respectively), with a significant decrease in the PA score, as age increased. Students who went to school by car or bus (non-ATS) had a significantly higher % BF (p<0.05), compared to those who use ATS (26.7% vs. 22.2%, respectively). Three predictors for high or very high % BF were identified: being younger (OR=1.136; 95%IC: 1.036-1.246), using non-ATS (OR=1.002; 95%IC: 1.000-1.005), and not participating in organized sports and activities (OR = 1.212; 95%IC: 1.034-1.421).

CONCLUSION: Strategies to promote PA in youth should target active travel to school, younger ages and opportunities for participating in organized physical activities.

Supported by an Icebreaker grant

2576  Board #251  MAY 31  3:30 PM - 5:00 PM
Screening for Risk of the Female Athlete Triad Among High School Athletes
Katie N. Brown1, Heidi J. Wengreen1, Katherine A. Beals, FACSM2, 1Utah State University, Logan, UT. 2University of Utah, Salt Lake City, UT.
(No relationships reported)

Screening to identify high school athletes at risk for the Female Athlete Triad (Triad) would allow for intervention to prevent deleterious effects of the Triad. Currently there are no screening tools that are brief and easy to administer to large numbers of athletes in a high school setting.

PURPOSE: To develop and explore the use of a brief survey to assess knowledge and prevalence of Triad risk factors among female high school athletes so as to guide the development of future screening and intervention programs.

METHODS: Female high school athletes (n=163) representing a variety of sports completed a brief questionnaire that assessed knowledge of the components of the Triad as well as Triad risk factors including eating behaviors, body weight beliefs, menstrual history and history of stress fracture. Triad knowledge questions were piloted among 52 athletes, and formally assessed in the remaining 91. Descriptive statistics were calculated and differences between athlete groups were examined using analysis of variance and chi squared distributions.

RESULTS: None of the athletes had heard of the Triad and few answered the Triad knowledge questions correctly. Only 31% knew that skipping a period during training was not normal; 30% knew that not eating enough could influence menstrual dysfunction; 13% knew that stress fractures occurred more frequently in girls who skip their period; and 23% knew that skipping periods could cause their bones to become weak. Cheerleaders had more correct answers (53%) than the other athlete groups (p=.006). Nineteen percent of athletes reported having suffered a stress fracture, although this was more common among drill team members (59%, p<0.001). A history of amenorrhea was reported by 24% of athletes. Seventeen percent of the athletes had a BMI <18.5 kg/m2; 59% had a BMI between 18.5 kg/m2 and 25 kg/m2, and 4% had a BMI greater than 25 kg/m2. The average desired weight change was -4.0 lbs. Of the 46 athletes (28%) who reported wanting to lose more than 10 lbs, 92% had a BMI less than 25 kg/m2. Fifty-nine percent of the athletes reported feeling pressure to be a certain weight; for most (80%) the pressure was self-imposed.

CONCLUSIONS: Knowledge of the Triad among this group of female high school athletes was poor and many were demonstrating behaviors and attitudes that placed them at risk for the Triad.

2577  Board #252  MAY 31  3:30 PM - 5:00 PM
Physical Activity In Adolescents In An Olympic Borough Prior To The London 2012 Olympic Games
Zoe Hudson, Stephanie JC Taylor, Eoin McNamara. Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, United Kingdom.
(No relationships reported)

Overweight and obesity continues to escalate in children. Tower Hamlets (TH) is multi ethnic, socio-economically deprived and one of the five Olympic boroughs for the Olympic Games in London 2012.

PURPOSE: To evaluate current pedometer determined physical activity and body composition in 11-12 yr olds in TH.

METHODS: All secondary schools were invited to participate. A scaled pedometer was worn for 7 days. Internationally recognised mean daily step count cut-offs (boys = 15000, girls = 12000) were used to define activity level. BMI, BIA-determined % body fat (BF) and waist circumference (WC) were all measured. Children were classified as normal weight, overweight or obese according to international cut-off points. A questionnaire was also administered to establish socio-economic status and ethnicity.

RESULTS: 452 boys and 229 girls took part, 69 and 62% were South Asian, respectively. Boys were more active than girls (mean daily steps 11,580 ± 3560 vs 10,062 ± 3239) (p <0.001). Activity was greater during the week compared to the weekend (mean step counts of 11,297 and 10,080, respectively). There was no significant difference by ethnicity or socioeconomic status.

Overweight/obesity ranged from 33.5%, 53.2% and 61.5% for BMI, % BF and WC, respectively (Table 1). BMI cut-offs may under-estimate overweight/obesity in a South Asian population.

Table 1. Percentage body composition according to 3 different measures

<table>
<thead>
<tr>
<th></th>
<th>BMI</th>
<th>WC</th>
<th>% BF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>46.0</td>
<td>46.8</td>
<td>45.5</td>
</tr>
<tr>
<td>Overweight</td>
<td>20.5</td>
<td>38.6</td>
<td>65.5</td>
</tr>
<tr>
<td>Obese</td>
<td>35.5</td>
<td>29.4</td>
<td>60.0</td>
</tr>
</tbody>
</table>

There was no significant interaction between activity and body composition in this cohort.

CONCLUSION: Over 50% were overweight or obese according to % BF and WC. Only 16.6 % of boys and 27.9 % of girls achieved the minimum recommended daily step counts. Intervention strategies are required.

Supported by an Icebreaker grant
CONCLUSION: BMI percentile, but not MVPA minutes, was directly associated with CRP and systolic BP in a nationally representative sample of U.S. children and adolescents. No combined association was seen between PA and BMI percentile when examining BP or CRP. Our data suggest that a public health focus should be reducing fatness in children and adolescents with elevated BP and CRP.

2579 Board #254  MAY 31  3:30 PM - 5:00 PM

Validity of Accelerometry During Free-Living Activity In Children
Scott E. Crouter, FACSM1, Magdalene Horton1, David R. Bassett, Jr, FACSM1, 2.University of Massachusetts Boston, Boston, MA. 2The University of Tennessee Knoxville, Knoxville, TN.

(Accepted relationships reported)

Accelerometers are commonly used to assess free-living physical activity (PA). Most validation studies with accelerometers focus on structured activities; however it has not been determined how well they work under free-living conditions.

PURPOSE: The primary purpose of this study was to examine the validity of the Crouter vector magnitude 2-regression model (Cvm2RM) and the Crouter vertical axis 2RM (Cva2RM) for children, to estimate energy expenditure (EE) and time spent in sedentary behaviors (SB), light PA (LPA), moderate PA (MPA), and vigorous PA (VPA) during a 2-hr free-living measurement. A secondary purpose was to examine single linear regression equations for children under the same conditions.

METHODS: Twenty-seven boys and 15 girls (mean±SD; age, 12±0.8 yrs; BMI percenttile, 73.1±28.4%) were monitored for 2-hrs of free-living activity. Activity data was collected using an Actigraph GT3X+, positioned on the right hip, and measured EE (METs) was obtained using a Cosmed K4b2. Actigraph prediction equations for children (Cvm2RM, Cva2RM, Freedson, Treuth, Trost, and Puyau) were compared against the Cosmed for mean METs and time spent in LPA, MPA, and VPA. Measured METs were calculated as measured activity VO2 divided by measured resting VO2. For comparability all prediction equations were converted to METs using measured resting VO2.

RESULTS: On average, participants were monitored for 95.0±36.5 minutes. The Puyau equation was within 0.1±1.8 METs of measured METs; all other methods significantly underestimated measured METs (P<0.05). For SB, the Cvm2RM, Treuth and Trost equations were all within 7-min of measured values (P>0.05), the other equations overestimated measured SB time (P<0.05). Measured time spent in LPA and MPA was underestimated by the Cvm2RM (11.0 min) and Puyau (25.2 min) equations, respectively (P<0.05). All prediction equations significantly underestimated measured time spent in VPA. The Cvm2RM and Cva2RM had 95% prediction intervals that were -20 to -50% lower than the other equations for time spent in SB, LPA, and MPA.

CONCLUSION: Compared to the Cosmed, all prediction equations were significantly different from at least one PA intensity category, however the use of a 2RM in children reduced the individual errors compared to other equations.

Study supported by NIH grant 5R21HL093407-02

2580 Board #255  MAY 31  3:30 PM - 5:00 PM

Actigraph Cut-Points for Sedentary Behaviour and Moderate-to-Vigorous Intensity Physical Activity in 2-3 Year Old Children
Silvia S. N. Costa1, Stacy A. Clemes1, Sally Barber2, Paula Griffiths1, Noel Cameron1, 2Loughborough University, Loughborough, United Kingdom. 2Bradford Institute for Health Research, Bradford, United Kingdom.

(Accepted relationships reported)

Whilst accelerometers have become the preferred instruments for objectively measuring physical activity (PA), the short/variable nature of young children’s PA patterns requires the use of short (<15 seconds) sampling periods (epochs). There are currently no accepted cut-points for determining time spent in sedentary behaviour and time spent in moderate-to-vigorous intensity PA (MVPA) in toddlers, for epochs shorter than 15 seconds.

PURPOSE: To determine Actigraph cut-points for defining sedentary behaviour and MVPA in 2-3 year old children, for 5 and 10 second epochs.

METHODS: Twenty-two toddlers (age: 2.92 ± 0.55 years) were video recorded during a 25 minute structured activity session, whilst wearing an Actigraph GT3X+ accelerometer positioned on the right hip with an elastic belt. Children’s PA was coded second-by-second using the Children’s Activity Rating Scale (CARS). Receiver Operating Characteristic curve analysis was used to determine the sedentary behaviour and MVPA cut-points for accelerometer counts derived from the vertical axis at 5 and 10 second epochs, using the average CARS score per epoch. Epochs with an average CARS score ≤2 were classified as sedentary behaviour, whilst epochs with an average CARS score ≥4 were classified as MVPA.

RESULTS: The sedentary behaviour and MVPA cut-points for 5 second epochs are ≥85 counts/epoch (Se: 82.1%; Sp: 84.0%; Area under the curve (AUC): 0.914) and ≥178 counts/epoch (Se: 86.4%; Sp: 85.3%; AUC: 0.926), respectively. For 10 second epochs, the sedentary behaviour and MVPA cut-points are ≥85 counts/epoch (Se: 81.9%; Sp: 82.2%; AUC: 0.894) and ≥365 counts/epoch (Se: 84.6%; Sp: 82.6%; AUC: 0.917), respectively.

CONCLUSIONS: To our knowledge, this is the first study to develop cut-points at shorter epochs for use in toddlers, using the new Actigraph GT3X+. The proposed cut-points show high Se and Sp, and can be used to estimate time spent in sedentary behaviour, light and MVPA in 2-3 year old children, for the Actigraph GT3X+.

2581 Board #256  MAY 31  3:30 PM - 5:00 PM

Active Commuting to School Predicts One-year Changes in Children’s Physical Activity
Stephen H. Wong, FACSM, Wendy Y. Huang, Gang He. The Chinese University of Hong Kong, Hong Kong, China.

(Accepted relationships reported)

It has been suggested that children who actively commute to school tend to be more physically active than passive commuters. However, the longitudinal association of active commuting with overall physical activity (PA) has not been well established.

PURPOSE: To determine the one-year PA changes among 6-10 years old Chinese children and to examine whether PA levels in active commuters at baseline were less likely to decline than those in passive commuters.

METHODS: Participants were a subsample of a cohort in a longitudinal study Understanding Children’s Activity and Nutrition (UCAN). PA was assessed by Actigraph accelerometers for 8 consecutive days at baseline and one year follow up. Time spent in moderate-to-vigorous PA (MVPA) was estimated based on the age- and gender-specific cut-off points. Children’s usual travel mode to/from school was reported by their parents at baseline. Children were then categorized on the number of active commuting trips to and from school per week, i.e. active, ≥5; passive, 0-5. Changes in PA between baseline and one-year later were assessed using paired t test. The association between active commuting on changes in PA was determined using a generalized estimating equations adjusting for gender, age, parental education and baseline body mass index (BMI).

RESULTS: A final sample of 166 children (42.2% boys; 7.6 ± 1.0 yr) recorded sufficient Actigraph data for both assessments, i.e. 10 hours per day during at least 3 weekdays, whilst their parents provided the complete information on the frequency of travel mode to school. MVPA on weekdays decreased at follow-up among 54% of the girls and 60% of the boys. On average, the girls reduced MVPA by 11.8 minutes (95%CI: -10.3, 18.1, NS) while the boys reduced by 3.9 minutes (95%CI: -10.3, 18.1). The active commuters at baseline were more likely to increase their PA participation at follow up compared with the passive commuters (B=19.5, 95%CI: 1.5, 37.4, P<0.05) after adjusting for gender, age, parental education, and baseline BMI.

CONCLUSIONS: PA participation decreased over a one year period among Chinese girls. Children who actively commuted to school at baseline were less likely to decrease the PA participation compared with the passive commuters.
CONCLUSION:

The estimated minutes of MVPA from SMA (48.4±7.8min) were nearly identical to those from OM (48.7±9.1min). In contrast, the 6 Actigraph cut-points all underestimated the OM values to underestimate the actual activity levels of children in simulated free living conditions.

RESULTS:

No significant differences in ICCday values were found between HAM and WAM for any variable (i.e., overlapping CIs), however distinct trends were observed. Excluding Ti measured by the WAM, ICCday values for all variables decreased as BD increased from 1- to 10-min. The number of monitoring days necessary to reliably measure AEE, AEEint, AEE, and Tday was greater for HAM versus WAM across BD, ranging from 2-26 versus 2-10 days, respectively. Conversely, the number of monitoring days to reliably measure Ti was lower for HAM (4-5 days) versus WAM (6-8 days).

CONCLUSION: Reliability of PA variables changed with BD and AM location, and was generally higher for WAM. Practically, the results of the study suggest that a monitoring period of 7 consecutive days allows for WAM to reliably measure a variety of free-living PA variables in adolescents.

PURPOSE:

The purpose of this study was to compare the accuracy of SMA and Actigraph in classifying youth MVPA in relation to a criterion measure.

METHODS:

A total of 42 youth ages 7 - 13 (male: 31, female: 11) performed a set of 12 different free living activities while wearing the SMA, an Actigraph and while being monitored with an Oxycon Mobile (OM) metabolic analyzer. The 12 activities (randomly selected from a set of 25) were of varying intensity (i.e. sedentary, light, moderate and vigorous) and were completed in a random order to simulate real world conditions. Each activity lasted 5 minutes, with 1 minute between activities. Six different Actigraph cut-points were applied to estimate MVPA from the Actigraph activity counts (Freedson/Trost (FT), Puyau (PU), Vanhelst (VH), Treuth (TH), Evenson (EV), Mattocks (MT)). The SMA data were processed using the latest software (version 8.0, pre-released algorithm 5.2e). A metabolic equivalent (MET) of 4 was used to differentiate MVPA from non-MVPA for the OM and SMA. Weighted Cohen’s kappa coefficient (κ), sensitivity (Se) and specificity (Sp) were used to determine classification accuracy compared to the OM. The total recorded minutes of MVPA from OM, SMA and the Actigraph cut-points were also directly compared to one another.

RESULTS:

SMA showed substantially better classification agreement (κ = 0.64) than the various Actigraph cut-points (FT = 0.34; PU = 0.18; VH = 0.34; TH = 0.20; EV = 0.28; MT = 0.16). The Se for OM (0.69) was greater than the 6 sets of Actigraph cut-points (range from 0.24 - 0.49). The Sp for OM (0.75) was smaller than the Actigraph values (range from 0.97 - 0.99) but still acceptable. The estimated minutes of MVPA from SMA (48.4±7.8min) were nearly identical to those from OM (48.7±9.1min). In contrast, the 6 Actigraph cut-points all underestimated the OM values (FT = 23.5±8.0min; PU = 13.3±5.9min; VH = 23.5±6.8m in; TH = 14.3±6.1min; EV = 19.7±6.7min; MT = 11.6±5.5min).

CONCLUSION: The SenseWear Mini Armband yielded better classification agreement for monitoring youth physical activity. The high specificity of the various Actigraph cut-points appears to underestimate the actual activity levels of children in simulated free living conditions.

PURPOSE:

Objective physical activity assessment is novel in rural Africa, little is known regarding volume or intensity of physical activity in this population and no studies have compared accelerometer cut-points.

METHODS:

The study took place within the Africa Centre for Health and Population Studies surveillance area in rural KwaZulu-Natal, South Africa. 150 participants;50 from each school

PURPOSE:

To compare accelerometer cut-points for assessing physical activity levels in South African children/adolescents.

METHODS:

The study took place within the Africa Centre for Health and Population Studies surveillance area in rural KwaZulu-Natal, South Africa. 150 participants;50 from each school
Evidence on the harmful effect of sedentary behaviour on health is emerging. Further, sedentary behaviour in children and youth is a concern as it tracks from childhood into adulthood. Previous studies of sedentary behaviour have often relied on self-reported measures of the behavior, such as time spent watching TV. More studies using objective methods to measure sedentary behavior are needed to further explore the association between sedentary behavior and health indicators, such as body mass index (BMI).

**PURPOSE:** To determine how many days of accelerometry are necessary to reliably estimate sedentary behavior in preschool children, and to study the association between time spent in sedentary behaviour and BMI in a population based sample of 9- and 15-year-olds.

**METHODS:** This is a part of the Physical Activity among Norwegian Children Study (PANCS). A total of 2299 9- and 15-year-olds participated in the study, giving a participation rate of 82%. Sedentary behaviour was measured using the Actigraph accelerometer. The sum of minutes at ≤100 cpm was used to define time spent at sedentary behavior. Differences between groups were analysed using independent-sample T-test.

**RESULTS:** Nine-year-old boys and girls spent 6.9 h/day and 7.1 h/day, respectively, in sedentary behaviour. The corresponding numbers in 15-year-old boys and girls were 8.8 h/day and 9.0 h/day, respectively. In both age groups, girls spent more time in sedentary behaviour than boys (p<0.026), and 15-year-olds spent 2h more per day in sedentary behaviour than 9-year-olds (p<0.001). There was no association between time spent in sedentary behaviour and BMI, with the exception of 9-year-old boys was a weak correlation was observed (r=0.1, p=0.04).

**CONCLUSIONS:** Both 9- and 15-year olds spend a large proportion of the day being sedentary. Girls were more sedentary than boys, and time spent in sedentary behaviour increased with increasing age. The latter suggest that early intervention may be needed to prevent this increase. An association was found between sedentary behaviour in 9-year-old boys only, suggesting that more research is needed.

**2588** Board #263  MAY 31  3:30 PM - 5:00 PM

**How Many Days of Accelerometry Monitoring Predict Sedentary Behavior in Preschool Children?**

Wonwoo Byun, Steven N. Blair, FACSM, Michael W. Beets, Marsha Dowda, FACSM, Russell R. Pate, FACSM. U of South Carolina, Columbia, SC.

(Accepted for presentation October 14, 2011)

**Accelerometry monitoring is emerging as the objective measure of habitual activity in children. However, little research has been conducted to understand the reliability of accelerometry in measuring sedentary behavior in preschool children.**

**PURPOSE:** To determine: (1) how many days of accelerometry monitoring are necessary to reliably estimate sedentary behavior in preschool children, and (2) whether the number of days necessary to reliably estimate sedentary behavior differs by application of different cutpoints.

**METHODS:** The participants of this study were preschool children who were enrolled in the Children’s Activity and Movement in Preschool Study. We included a total of 212 children who had ≥ 4 days of in-school accelerometer data and 150 children who had ≥ 6 days (including weekend) of total day data. Sedentary behavior was measured using ActiGraph accelerometers. Accelerometry data were summarized as time spent in sedentary behavior (min/hr of observation) using three different cutpoints developed specifically for 3- to 5-year old children (< 37.5 cts/15s, <200 cts/15s, and <373 cts/15s). PROC MIXED procedure was used to determine if the amount of time spent in sedentary behavior is different across days of the week. The ICCs and levels of engagement in MVPA were low in this sample.
RESULTS: On average, the children wore the accelerometers for a total of 12.1 hrs/day and 8.4 hrs/day while in school. Preschool children spent less time in sedentary behavior on weekend days compared to weekdays (P < .05). Across different cutpoints, the ICCs ranged from 0.75 to 0.81 for total sedentary behavior, and from 0.81 to 0.92 for in-school sedentary behavior, respectively. To achieve the ICC of ≥ 0.8, between 6.4 and 8.6 days, and between 1.8 and 4.4 days of monitoring was needed for total sedentary behavior, and in-school sedentary behavior, respectively.

CONCLUSIONS: The greatest reliability, and hence the lowest number of days needed for the ICC of ≥ 0.8, was obtained using the cutpoints of <373 cts/15s for total daily sedentary behavior (6.4 days), and ≤200 cts/15s for in-school sedentary behavior (1.8 days) respectively.

2589  Board #264  MAY 31  3:30 PM - 5:00 PM
Do Physically Active Young Children Maintain Their Activity Levels After The Preschool Day?
Jennifer R. O'Neill, Marsha Dowda, FACSM1, Karin A. Pfeiffer, FACSM2, Russell R. Pate, FACSM1. 1University of South Carolina, Columbia, SC. 2Michigan State University, East Lansing, MI.

Increasing attention on young children’s low levels of physical activity (PA) from expert panels and policy makers has highlighted the need to understand young children’s PA, both in school and out of school.

PURPOSE: To determine if the most active children during the preschool day are the most active children outside of preschool.

METHODS: Participants were 351 children, mean age 4.6 ± 0.3 years (50% male, 49% African American), from 16 preschools in central South Carolina. Children wore accelerometers for 5 consecutive weekdays. School day was defined by each preschool as the period of instruction. In-school and out-of-school min·hr⁻¹ of moderate to vigorous physical activity (MVPA) were calculated. Children in the highest quartile of low physical activity (PA) from expert panels and policy makers has highlighted the need to understand young children’s PA, both in school and out of school.

RESULTS: Children wore accelerometers for an average of 6.0 and 6.5 hr·d⁻¹ in school and out-of-school, respectively. Children engaged in MVPA for 6.9 ± 2.6 min·hr⁻¹ in school and 8.7 ± 3.3 min·hr⁻¹ out-of-school. Boys were more active than females during preschool (7.4 ± 2.6 vs. 6.3 ± 2.5 min·hr⁻¹; p < .05) and outside preschool (9.0 ± 3.3 vs. 8.3 ± 3.2 min·hr⁻¹; p < .05). High Active males obtained more in-school MVPA (10.5 ± 0.5 min·hr⁻¹) than Low Active males (6.1 ± 0.3 min·hr⁻¹; p < .05). For out-of-school MVPA, there was no difference between High Active males (9.6 ± 0.5 min·hr⁻¹) and Low Active males (8.7 ± 0.3 min·hr⁻¹; p = .06). High Active females accumulated more in-school MVPA (9.5 ± 0.4 min·hr⁻¹) than Low Active females (5.3 ± 0.3 min·hr⁻¹; p < .05). High Active females obtained more out-of-school MVPA (9.5 ± 0.4 min·hr⁻¹) than Low Active females (8.5 ± 0.3 min·hr⁻¹; p < .05).

CONCLUSIONS: The most active males in preschool had similar out-of-school MVPA compared to the least active males in preschool. The most active females during the preschool day were the most active females outside of preschool.

Supported by NIH Grant R01 HD055451.

2590  Board #265  MAY 31  3:30 PM - 5:00 PM
Parental Perception of Neighborhood Environments and Children’s Physical Activity in Hong Kong
Gang He, Wendy Y. Huang, Stephen H. Wong, FACSM. The Chinese University of Hong Kong, Hong Kong, China.

PURPOSE: Examining neighborhood environments is important to explain and promote physical activity (PA) of children, but it is under-investigated among Chinese population. Therefore, the purpose of this study was to investigate the association between parental perception of neighborhood environments and PA in Hong Kong children.

METHODS: 280 children (143 boys) aged 6-10 years and their parents were recruited from 14 local schools. Children were instructed to wear an ActiGraph GT3X accelerometer for 8 consecutive days to determine their PA level. Average time (minutes/day) spent on moderate to vigorous PA (MVPA) was calculated based on Freedson’s age-specific cut-off counts. Parental perceived neighborhood environments, namely supervision, safety, facilities and climate, were determined by a valid questionnaire. Data were collected as part of a longitudinal study; Understanding Children’s Activity and Nutrition (UCAN). Gender differences in MVPA minutes were determined using independent samples T test. Association between neighborhood environmental variables and PA was determined by Pearson correlations. Variables with significant associations were further examined using multiple regression analyses adjusting for age and parental education.

RESULTS: Boys were more physically active than girls (MVPA: 142 ± 47 vs. 112 ± 41 minutes/day, P<0.05). No associations were found in any neighborhood environmental variables with boys’ MVPA. For girls, supervision, facilities and climate were significantly related to PA level (P<0.05). Multiple regression analyses revealed that after controlling for age and parental education, supervision (b=0.10;12; 95%CI=0.1 to 16.73) and climate (b=0.38; 95%CI=1.73 to 18.1) were associated with girls’ MVPA (P<0.05).

CONCLUSIONS: Parental perception of supervision and climates might influence PA participation amongst girls in Hong Kong.

2591  Board #266  MAY 31  3:30 PM - 5:00 PM
Establishing Wrist-based Cutpoints For The Geneactiv Accelerometer In Elementary School Aged Children
Raymond C. Browning, FACSM, Christine A. Schaefer, Heidi J. Nace, Paige E. Kyle. Colorado State University, Fort Collins, CO.

PURPOSE: To establish wrist-based intensity cutpoints for the GeneActiv ACC in children performing typical activities.

METHODS: Metabolic and ACC data was collected in 6-11 year olds (n=18, mean age (SD), 9.33 (1.0) years, 67% female) while they performed 9 activities for 6 minutes each. Metabolic rates were measured using indirect calorimetry, and the ACC was used to determine activity intensity cutpoints for children performing typical activities. The cutpoints were established at 1.5, 3, 6 and 11 METs for sedentary (sed), light, moderate (mod) and vigorous (vig) activity, respectively.

RESULTS: AA and NG yielded R² values of 0.73 and 0.88, respectively (P=0.001). Cutpoints for sed, light, mod and vig activity using AA were 5.2, 20.9, 52.4 and 52.4, respectively. Cutpoints for sed, light, mod and vig for NG were 2.1, 17.4, 48.1 and ≥48.1, respectively.

CONCLUSION: Active gaming involving significant wrist movement decreases the strength of the relationship between SVM and METs using LR. This highlights the need for activity specific intensity classification, particularly for activities involving wrist movement.

2592  Board #267  MAY 31  3:30 PM - 5:00 PM
Relationship between Moderate-to-Vigorous Physical Activity and Daily Step Counts in Elementary School Children
Chiaki Tanaka1, Mak Takanaka2, Shigeho Tanaka1. 1J. F. Oberlin University, Tokyo, Japan. 2Kyoto Seibou College, Kyoto, Japan. 3National Institute of Health and Nutrition, Tokyo, Japan.

PURPOSE: Establishing Wrist-based Cutpoints For The Geneactiv Accelerometer In Elementary School Aged Children
Raymond C. Browning, FACSM, Christine A. Schaefer, Heidi J. Nace, Paige E. Kyle. Colorado State University, Fort Collins, CO.

(Please refer to the actual document for the provided text, as the text above is a template and not the original content.)
CONCLUSION:

Spearman correlations were used to assess the relationships between HRQoL and physical activity (separately for pedometer and survey question), screen time and BMI. Quality of life was assessed using the Pediatric Quality of Life (PedsQL) inventory. Mann Whitney U tests were used to assess differences between sexes and/or weight status for HRQoL, PA, and BMI. Spearman correlations were used to assess the relationships between HRQoL and physical activity (separately for pedometer and survey question), screen time and BMI.

RESULTS:

A strong and significant correlation was observed between minutes of moderate-to-vigorous physical activity and step counts (r=0.83, p<0.001). The daily step counts corresponding to 60 min, 100 min, and 120 min of moderate-to-vigorous physical activity were 11,843, 15,362, and 17,121 steps/day, respectively. This study was funded by the Crim Fitness Foundation.

CONCLUSIONS:

These results suggest that approximately 12,000 steps/day are required for elementary school children to engage in 60 min of moderate-to-vigorous physical activity. Supported by Health Sciences Research Grants (Research on Health Science) from the Ministry of Health, Labor and Welfare (to C. Tanaka) and a grant from Sumitomo Life Health Foundation in 2010 (to C. Tanaka).

2593 Board #268
MAY 31
3:30 PM - 5:00 PM
Associations between After-School Settings with Physical Activity and Sedentary Behavior in 5th Grade Children
Sharon Ross1, Marsha Dowda, FACSM1, Natalie Colabianchi2, Ruth Saunders1, Russell Pate, FACSM1. 1University of South Carolina, Columbia, SC. 2University of Michigan, Ann Arbor, MI. (No relationships reported)

PURPOSE: To assess the concurrent validity of a brief caregiver proxy report instrument designed to measure PA in 2- to 5-year old children attending Family Day Care.

METHODS: FDCPs (N=39) completed a modification of the Burdette et al. (2004) parental proxy report. For each child under their care, FDCPs recalled the usual duration of outdoor play time from arrival to lunchtime and from lunchtime to departure. Responses were recorded on a 5-point scale consisting of 0 = 0 min, 1 = 1-15 min, 2 = 16-30 min, 3 = 31-60 min, and 4 = over 60 min. A single PA score was calculated by averaging the responses. 107 children (53.2% male) between the ages of 2 and 5 y (mean age = 3.4 ± 1.2 yrs) wore the ActiGraph GT3X accelerometer for the duration of child care attendance during a single week. Time spent in moderate-to-vigorous PA (MVPA), and light- moderate-vigorous PA (LMVPA) was calculated using the intensity-related cut-points developed by Pate et al. (2006). Associations between FDCP-reported PA and objectively measured MVPA and LMVPA were assessed using Pearson product moment correlations. Additionally, one-way ANOVA was used to evaluate differences in objectively measured PA across levels of FDCP-reported PA.

RESULTS: Significant positive correlations were observed between FDCP-reported PA and objectively measured MVPA (r = 0.31, p < 0.01) and LMVPA (r = 0.33, p < 0.01). Across levels of FDCP-reported PA, both LMVPA (F(2, 104) = 7.82, p = 0.009) and MVPA (F(2, 104) = 8.71, p = 0.0003) increased significantly in a linear dose-response fashion.

CONCLUSIONS: Proxy PA reports completed by FDCPs were significantly correlated with objectively measured PA, and may be a valid assessment option in studies where more burdensome objective measures are not feasible.

2594 Board #269
MAY 31
3:30 PM - 5:00 PM
Validity of Family Day Care Providers’ Proxy Reports on Children’s Physical Activity
Kelly R. Rice, Kathy Guenter, Stewart Trost, FACSM. Oregon State University, Corvallis, OR. (No relationships reported)

Interventions to promote physical activity (PA) in children attending Family Day Care require valid, yet practical measurement tools. Among preschool-aged children, PA is typically measured using direct observation or motion sensors; however, the cost and participant burden associated with these methods make them difficult to implement in large surveillance studies and/or community-level program evaluations. For these scenarios, proxy-reports completed by Family Day Care Providers (FDCPs) may be a viable option; however, the validity of this approach has not been evaluated.

PURPOSE: To assess the concurrent validity of a brief caregiver proxy report instrument designed to measure PA in 2- to 5-year old children attending Family Day Care.

METHODS: FDCPs (N=39) completed a modification of the Burdette et al. (2004) parental proxy report. For each child under their care, FDCPs recalled the usual duration of outdoor play time from arrival to lunchtime and from lunchtime to departure. Responses were recorded on a 5-point scale consisting of 0 = 0 min, 1 = 1-15 min, 2 = 16-30 min, 3 = 31-60 min, and 4 = over 60 min. A single PA score was calculated by averaging the responses. 107 children (53.2% male) between the ages of 2 and 5 y (mean age = 3.4 ± 1.2 yrs) wore the ActiGraph GT3X accelerometer for the duration of child care attendance during a single week. Time spent in moderate-to-vigorous PA (MVPA), and light- moderate-vigorous PA (LMVPA) was calculated using the intensity-related cut-points developed by Pate et al. (2006). Associations between FDCP-reported PA and objectively measured MVPA and LMVPA were assessed using Pearson product moment correlations. Additionally, one-way ANOVA was used to evaluate differences in objectively measured PA across levels of FDCP-reported PA.

RESULTS: Significant positive correlations were observed between FDCP-reported PA and objectively measured LMVPA (r = 0.31, p < 0.01) and MVPA (r = 0.33, p < 0.01). Across levels of FDCP-reported PA, both LMVPA (F(2, 104) = 7.82, p = 0.009) and MVPA (F(2, 104) = 8.71, p = 0.0003) increased significantly in a linear dose-response fashion.

CONCLUSIONS: Proxy PA reports completed by FDCPs were significantly correlated with objectively measured PA, and may be a valid assessment option in studies where more burdensome objective measures are not feasible.

2595 Board #270
MAY 31
3:30 PM - 5:00 PM
Associations Of Physical Activity, Screen Time, And Bmi With Quality Of Life In Urban Children
Joseph T. Warning1, Karin A. Pfeiffer, FACSM1, Joey C. Eisenmann2, James M. Pivarnik, FACSM1, Joseph J. Carlson3, Kimberly S. Maier1, Erin Lamb1, 1Michigan State University, East Lansing, MI. 2Helen DeVos Children’s Hospital, Grand Rapids, MI. 3Crim Fitness Foundation, Flint, MI. (No relationships reported)

Health-related quality of life (HRQoL) measures include measures of physical health, emotional functioning, and social functioning. Previous studies have shown that overweight children have lower quality of life scores when compared to their healthy-weight children. However, limited research is available regarding the potential associations of HRQoL with physical activity (PA) and screen time (ST) in low socioeconomic status children.

PURPOSE: The purpose of this study was to examine the associations of physical activity, screen time, and BMI with HRQoL in children from a racially diverse, low socioeconomic status area.

METHODS: Participants were 197 children (50% males, 64% African American) from four elementary schools (~80% eligible to receive free/reduced lunch) in/near Flint, Michigan. PA was assessed using pedometers (New Lifestyles, SW-200) and a survey question. ST was assessed using children’s self-report for viewing television, playing video games, and online computer use.

RESULTS: Approximately 27% and 5% met guidelines for PA and ST, respectively. Approximately 33% of children were overweight or obese. No significant associations were found between HRQoL and physical activity (separately for pedometer and survey question), screen time and BMI.

CONCLUSION: There were no associations between quality of life scores with physical activity, screen time, or BMI. Results also did not show differences between overweight and normal weight children in HRQoL, which was contrary to existing literature (Williams et al., 2005; Riazi et al., 2010). It is likely that variables aside from PA, ST and BMI are more relevant to minority/low-SES populations with regard to HRQoL.

This study was funded by the Crim Fitness Foundation.
Association Between Serum Sex Hormone and Obesity Status in Pubertal Chinese Boys

Liang Li1, Minhao Xie2, Yi Yao2, Stephen H. Wong, FACSM1, 1The Chinese University of Hong Kong, Hong Kong, China. 2Beijing Sport University, Beijing, China. (No relationships reported)

Over the past decades, the prevalence of obesity in children and adolescents has increased dramatically. However, it is not clear whether sex hormone profiles are associated with obesity status in pubertal Chinese boys.

PURPOSE: To evaluate the association between sex hormone profiles and obesity status in pubertal Chinese boys.

METHODS: A total of 30 pubertal Chinese boys aged 13-15 years were recruited in this study, including 15 obese boys (obese group, BMI: 29.8 ± 2.4 kg/m², age: 14.2 ± 0.8 years), and 15 normal weight boys (control group, BMI: 19.4 ± 2.0 kg/m², age: 14.7 ± 1.0 years). Venous blood samples were collected in the morning after an overnight fast. Body fat (BF) and weight were measured using a body composition instrument (Model InBody 230, Biospace, Korea). Height was measured to the nearest 0.1 cm using a stadiometer. Serum sex hormones, i.e., testosterone (T) and estradiol (E₂) were assessed through chemiluminescence immunnoassay method.

RESULTS: The obese group had a higher BF than control group (30.4 ± 4.6 % vs. 15.6 ± 5.4 %, p<0.01). The serum T level was lower in the obese group compared with that in control group (2.8 ± 1.1 vs. 4.2 ± 1.8 ng/ml, p<0.05). There was no statistical difference between the two groups in E₂ level (obese group vs. control group: 26.5 ± 13.4 vs. 20.3 ± 9.4 pg/ml, NS). However, a higher ratio of E₂/T was found in obese group compared with control group (9.7 ± 3.7 vs. 5.2 ± 2.3, p<0.01). BF was negatively associated with T level (r = -0.386, p<0.05), and positively associated with E₂ level (r = 0.439, p<0.05).

CONCLUSIONS: The results suggest that the 13-15 years old obese Chinese boys expressed lower serum T level and higher E₂/T ratio compared with normal weight boys. The amount of adipose tissue may correlate with sex hormone metabolisms in Chinese boys. Future studies are needed to illustrate the possible mechanisms behind this.

Supported by National Natural Science Foundation of China, NO.: 30800541.

Comparison of Peer and Instructor Assessment in a Physical Education Teacher Education Program

Melissa M. Snyder, Beth J. Patton. Ashland University, Ashland, OH. (Sponsor: Randall F. Gearhart Jr., FACSM) (No relationships reported)

Peer assessment (PA) occurs in many higher education programs. However, there is no known research examining PA in physical education teacher education (PETE) in regards to student teaching experiences. PA may be a method to better prepare PETE students to assess their future students.

PURPOSE: The current observational investigation compared PETE students’ assessment of a peer teaching to the instructor’s assessment using a 13 item written tool.

METHODS: Subjects included nine sophomore PETE students completing their first field experience, five male and four female. The subjects were assigned in groups of two or three to a school. Subjects assessed one another teaching a physical education skill to various age groups. Two sessions for each subject were also assessed by the university instructor using the same 5-point Likert-type scale (excellent, very good, good, satisfactory, needs improvement, unacceptable). Each assessment consisted of 13 items. Frequencies of each assessment were compared for the student and university supervisor assessment.

RESULTS: There were a total of 468 items assessed over both teaching sessions (234 by the subjects, 234 by the instructor). Subjects were much more likely to assess a student as excellent (n = 93, 39.74%) or very good (n = 98, 41.88%) than the university instructor (n = 3, 1.28% and n = 89, 38.03%, respectively). The subjects infrequently assessed the student teacher as needing improvement (n = 1, 0.43%) as compared to the instructor (n = 5, 2.14%).

CONCLUSIONS: Subjects tended to assess their peers performance higher than the instructor. Further research is needed to determine how peer assessment can be improved. Factors such as training, previous experiences and interpersonal issues can affect the assessments peers provide. Teacher education students are required to learn numerous skills during their educational preparation and will be required to assess their students as a professional. Assessing others as a student may better prepare them to evaluate their students in the future. This, in turn, may help the students to become more competent teachers and benefit society.

Youth Soccer Participation History in NCAA Division 1 Athletes

Aaron Gray1, John DiFlorio, FACSM2, Ryan Baker2. 1University of Missouri, Columbia, MO. 2University of California - Los Angeles, Los Angeles, CA. (No relationships reported)

PURPOSE: To investigate the youth soccer participation history of intercollegiate athletes across all sports at the University of California - Los Angeles.

METHODS: Observational survey of NCAA Division 1 intercollegiate athletes listed on the 2010-12 rosters. Data collected included sport participation history for subjects, levels of participation, and reasons for sport discontinuation.

RESULTS: 296 subjects (162 women, 134 men) from 12 different sports completed surveys. Included within this group were 26 athletes (9 women, 17 men) participating in collegiate soccer. Excluding those collegiate soccer athletes, 41.8% of females and 54.7% of males played soccer from the ages of 6 to 9. From the ages of 10 to 11, 35.9% of these women and 33.3% of the men participated in soccer. When evaluating those currently competing in individual sports (golf, gymnastics, tennis, swimming) compared to team sports (baseball, basketball, football, rowing, softball, volleyball, water polo), 36% of those competing in individual sports played soccer from the ages of 6 to 9 compared to 56.4% of those in team sports. Within the group of those competing in collegiate soccer, 34.4% of the women and 41.2% of the men did not participate on a travel/club soccer team prior to the age of 10.

CONCLUSIONS: 47% of non-collegiate soccer athletes participated in soccer as a child with 35% continuing until the ages of 10 to 11. Those currently participating in team sports were more likely to have been involved with youth soccer compared to those currently competing in individual sports. Over 40% of NCAA Division 1 soccer players surveyed were not involved in travel/club soccer until the age of 10.

Landscape: Learning About The Needs And Desires Of A School And Community-based Activity Program Evaluation

Kishu Virgil, Mary de Groot, Stephanie Greer, Sarah Herrera, Nicole Keith, FACSM. IU/PUUI, Indianapolis, IN. (Sponsor: Randall F. Gearhart Jr., FACSM) (No relationships reported)

Physical inactivity disproportionately affects low-income and ethnic minority urban residents. PARCS is a 9-year-old community-based exercise partnership between IUPUI and Indianapolis Public Schools (IPS) that strives to increase regular physical activity in urban residents at a membership price of $20/year. Costs remain low by employing university exercise science and fitness studies majors as faculty staff for academic credit. This model could be duplicated with other community and academic partners across the US.

PURPOSE: To characterize program participants, LANDSCAPE describes adult PARCS members who have enrolled in this study. Data describe the sociodemographic, health, attitudinal, quality of life and physical attributes of the LANDSCAPE sample.

METHODS: Our study sample consists of 154 adult PARCS members of Black or White race. Four questionnaires were completed by study participants. Anthropometric measures were collected as well as resting heart rate (RHR) and resting blood pressure (BP).

RESULTS: Data show that 68% of the study participants were Black, 48% had a household income of $40,000 per year, 48% found it financially difficult to make ends meet, while 43% reported making ends meet to be “not hard, not easy.” 41% of the respondents owned a home and 56% worked outside of the home. Forty percent reported having hypertension, 19% diabetes, 18% physically inactive, and 15% smoked. Measured mean resting SBP and DBP were 125 ± 13 mmHg and 77 ± 8 mmHg, respectively. Mean RHR was 76 ± 12 BPM and the average BMI was 34.6. Resting SBP and BMI in study participants were higher than national recommendations of <120 mmHg and <25, respectively, while, resting DBP and RHR of study participants fell within recommended ranges of <80 mmHg and 60-100 BPM, respectively.

CONCLUSIONS: Results show that LANDSCAPE participants have limited discretionary income and several risk factors and/or comorbidities that could be managed by participating in

667
Active video gaming (AVG) has been suggested as an alternative for increasing total daily energy expenditure among adolescents. One of the challenges of using AVG to promote a physically active lifestyle is the selection of appropriate AVG with moderate-intensity level (3.0-5.9 METs) that produces sufficient energy cost for obtaining health-related benefits. There are many AVGs available in the market but their energy cost demand varies widely. However, very few studies have identified the factors contributing to this variation.

**PURPOSE:** To examine the association between total energy expenditure and body kinematics while playing the selected AVG.

**METHODS:** Sixty Hong Kong Chinese adolescents aged 15 to 17 years old, without physical and psychological illness, enrolled in the present within-subject study. Participants attended three AVG experimental sessions in a randomized fashion to perform AVG using: i) lower limb movement (soccer) ii) upper limb movement (table tennis) and iii) whole body movement (adventure), respectively. During the AVG sessions, participant’s in-game metabolic energy expenditure (kcal/min) was measured using portable indirect calorimetry, and mechanical energy expenditure and in-game 3D motion were measured using a 14-camera motion capture system. Repeated measures ANOVA was used to examine the differences between the selected AVGs in terms of energy expenditure. Multiple regression analysis was conducted to examine the contribution of the movement of different body segments in predicting energy expenditure after adjusting for gender, age and maturation status.

**RESULTS:** The findings of the present study will provide empirical data concerning the contribution of the movement of different body segments (head, sacrum, foot, shoulder and wrist) to the variation in energy expenditure among the selected AVGs.

**CONCLUSIONS:** These results will be able to inform the choice on AVGs to meet the desired intensity for future AVG intervention studies.
PURPOSE: This study therefore aimed at assessing the prevalence of overweight and obesity in German primary school children on the basis of BMI as well as WHR (central obesity). Furthermore, the prevalence of central obesity in active vs. less active children is determined.

METHODS: 157 classes took part in the evaluation of the school-based health promotion programme "Join the Healthy Boat" in south-west Germany. Written, parental consent for examination and data collection was obtained of 1968 children. Body weight and height, as well as waist circumference of 1892 children (7.1 ± 0.6 yrs; 50.3% male) were measured. In a subsample of 294 children physical activity was measured for 4 consecutive days using accelerometer combined with heart rate (Actiheart; CamNtech, UK).

RESULTS: An average BMI of 16.0 ± 2.2 kg/m² and a mean WHR of 0.45 ± 0.04 could be observed. On basis of German BMI classifications (Kromeyer-Hauschild et al, 2001) 7.8% of the examined children were underweight, 82.3% normal weight, 5.5% overweight and a further 4.4% obese. Central obesity (WHR > 0.5) was established at 9.5% of children. Also, 2.8% of normal weight children (based on BMI) showed a WHR > 0.5, as well as 55.8% of overweight and 94.0% of obese children. In the subsample 10.5% are central obese. Of the 109 children achieving the guideline of 60 min moderately to vigorously physical activity (MVPA) only 6,4% are central obese compared to 13% of those not achieving the guideline.

CONCLUSIONS: These baseline data show an unusual high percentage of obese children within an otherwise rather small portion of overweight children compared to other German studies (9.9% including obesity). Nearly all obese children are affected by central obesity, which applies to just about half of overweight children and at least a small proportion of normal weight children. Moderate to vigorously active children show a slightly smaller prevalence of central obesity.

**2604 Board #279**  
**Prevalence of Biomarkers of Vascular Disease in Young Adults**  
Matt Feigenbaum, PhD, FACS, Andy O’Neill, Vincent Marsh. *Furman University, Greenville, SC.*  
(No relationships reported)

**BACKGROUND:** Atherosclerotic vascular disease remains the leading cause of morbidity and mortality in the U.S. and is largely influenced by lifestyle choices. Detection and treatment of controllable risk factors (RFs) can prevent or deter the progression of vascular disease.

**PURPOSE:** To determine the prevalence of biomarkers and RFs of vascular disease in young adults.

**METHODS:** Biomarkers and RFs of vascular disease were assessed in undergraduates (N=416; age=19.3±0.9 yrs; Caucasian=95.1%) enrolled in a required Wellness Concepts course. Students were risk stratified as low (0-2 RFs), moderate (3-5 RFs), or high risk (6+ RFs) according to AHA Guidelines (2009).

**RESULTS:** Data indicated that 93.7% and 6.3% are Low and Moderate Risk, respectively. Only 5.4% of the students have elevated LDL-C, 1.2% have hypertension, 1.3% have type 2 diabetes, and 2.6% indicate tobacco use. Gender differences exist (p<0.01) in CRP levels (mg/L) (acute phase protein associated with vascular inflammation) between underweight (0.04±0.59), healthy weight (0.96±1.18), overweight (1.17±0.79), and obese students (2.88±2.30).

**CONCLUSION:** While few young adults in the population studied are at increased risk for vascular disease, they should be acquainted in BMI are accompanied by increases in biomarkers of vascular inflammation known to contribute to atherosclerotic lesions.

**2605 Board #280**  
**7-day Physical Activity And Self-efficacy Toward Physical Activity Of Children With Developmental Coordination Disorder**  
Sheng K. Wu1, Tsung-Yi Wu1, Hsien-Hui Lin1, Fu-Chen Chen1. 1National Taiwan College of Physical Education, Taichung, Taiwan. 2University of Minnesota, Minneapolis, MN.  
(No relationships reported)

**PURPOSE:** To analyze the motor coordination and physical activity of school-aged children with and without developmental coordination disorder (DCD) in Taiwan.

**METHODS:** Participants including 34 children without DCD and 20 children with DCD aged 9-11 years old, were examined by the Movement Assessment Battery for Children (MABC) test, and measured and recorded their total physical activities within 7-day by the RT3 accelerometer. Children’s Self-Perception of Adequacy in and Prediction for Physical Activity Scale (CSAPPA scale) was used to measure the generalized self-efficacy toward physical activity of children.

**RESULTS:** Children with DCD scored higher in MABC test than children without DCD (18.5 vs. 7.0, p<0.001). The amounts of total physical activity and moderate to vigorous physical activities (MVPA) in 7-day were higher in the non-DCD group than the DCD group (p<0.05). Children with DCD had significantly lower scores in CSAPPA scale than children without DCD (47.9 vs. 56.2, p<0.01).

**CONCLUSIONS:** This study confirmed that children without DCD participated in more physical activities in 7 days and had higher MVPA and generalized self-efficacy to toward physical activity than children with DCD in Taiwan. Comparing to children without DCD, it is essential to encourage children with DCD to participate in more physical activities and MVPA and concern their physical fitness and health.

**D-30 Free Communication/Poster - Resistance Exercise II**  
MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

**2606 Board #281**  
**Acute Physiological Effects of Different Circuit Training Protocols in Young Adults**  
Myoositi Massiidda, Alessandra Caria, Lucia Cugusi, Carla M. Calò. *University of Cagliari, Cagliari, Italy.*  
(No relationships reported)

Circuit training (CT) effectively reduces the time devoted to strength training. Nonetheless, few studies have focused on the differences in the acute physiological strain produced by free weight CT and weight CT compounded with aerobic exercise.

**PURPOSE:** The purpose of this study was to perform a comparison of 3 different training protocols (TP): Circuit Weight Training (CWT), Compounded Circuit Weight Training (weight CT and cycling) (CCWT) and Compounded Circuit Free Weight Training. (free weight CT and running) (CCFWT) in order to determine which of the 3 programs provides the best acute physiological responses in a young adult population.

**METHODS:** The sample consisted of 21 healthy sedentary individuals, 12 males and 9 females (age range 20-30 years). We have developed 3 CT Protocols. Sixty seconds (sec) sets of resistance exercises (30% of 1RM) for CWT have been established. Whereas in the CCWT, the subjects spent 30 sec on the same resistance exercises and 30 sec cycling on a bike (60%HRmax). Finally in the CCFWT, the subjects spent 30 sec on the free weight exercises and 30 sec running on a treadmill (60%HRmax). Each TP were on 3 separate days at least 48 hours apart. The rest intervals between the sets lasted 20 sec and the exercises rhythm were fixed at 60 beats per minute (bpm).

**RESULTS:** The CCFWT elicited a higher average HR response than CWT and CCWT for both genders (F=9.88; P<0.001). However, when males and females performed the CCFWT they spent a greater percent of training time within a high HR training zones (70-79% and 80-89% of HRmax) than CWT and CCWT (F=5.58; P<0.001). Similarly, the CCFWT required a greater training load than CWT and CCWT for both sexes (F=7.33; P<0.001). Moreover, the CCWT elicited a lower average HR response and training load than CWT and CCWT for both genders (F=0.001). Regarding inter-gender comparison, we did not find any significant differences (P>0.05) in energy expenditure, blood lactate concentration and cardiac response between males and females for all the TP.

**CONCLUSIONS:** CFWT produces measures that provided a significantly greater benefit of exercise for the 3 programs of interest and seems adequate to produce good training load and cardiovascular improvements for both genders, while CCWT seems not to produce sufficient responses for cardiovascular fitness improvement in both sexes.
Improving body composition and fitness is important in reducing the increased risk of obesity and associated diseases. Body weight resistance training (BWRT) may constitute a convenient, economical, and effective method to improve body composition and fitness for those who do not have access to traditional resistance training equipment.

PURPOSE: To examine the effects of a 10-week BWRT program with caloric restriction on body weight and composition.

METHODS: Twenty-six sedentary adults were assigned to one of two groups: exercise (n=14, 9 women, 5 men) or control (n=12, 8 women, 4 men). Exercising subjects were on average 34±4 years of age, weighed 91.3±22.0 kg, with a mean BMI of 32.1±6.9. Control subjects were 36±7 years of age, weighed 92.3±16.1 kg, with a mean BMI of 33.2±6.1. The exercise group completed 3 training sessions per week using the TotalGym XLS while reducing caloric intake by 500 kcal/day for 10 weeks. The training sessions followed a progression protocol to maintain appropriate intensities. The control group maintained a sedentary lifestyle with no change in caloric intake. Baseline and post-intervention anthropometric measurements and body composition were assessed. Body composition was evaluated in each subject by bioelectrical impedance using the InBody 520 (Biospace Co. Ltd, Los Angeles, CA). Data was analyzed using the Statistical Package for Social Sciences (SPSS 16.0 Inc.).

RESULTS: Significant decreases in body weight (-3.4±1.4 kg, P<0.013) and BMI (-1.2 index points, P=0.013) were observed in the exercise group, while the control group demonstrated no changes from baseline (P=0.05). Participants had a mean reduction of 472 kcal per day. Neck, waist, hip, relaxed biceps (arm), and flexed biceps (elbow flexed) circumference significantly decreased in the exercise group (P=0.003) while neck, waist, relaxed biceps, and flexed biceps circumference significantly increased in the control group (P=0.02). Between-group analyses revealed that decreases in the exercise group were significantly larger than the increases in the control group (P=0.01).

CONCLUSION: 10 weeks of body weight resistance training with the commercially available home use Total Gym XLS, in combination with reduced caloric intake may promote weight loss and improve body composition.

It is not well understood if localized changes in subcutaneous (SC) fat occur due to resistance training (RT). It is also not known if different methods of RT have differing effects on localized SC fat loss.

PURPOSE: To compare the effects of 12-weeks of compound supersets (CS) RT to traditional strength (TS) RT on body composition (BC) and localized SC fat.

METHODS: 20 untrained women (20.8±2.69 y) were randomly placed into two groups: TS RT or CS RT. All subjects were pre- and post-tested for SC fat via ultrasound (US), SC fat via skinfold (SF) calipers for the triceps (TRI), supra iliac (SI), and thigh (TH), percent body fat (FAT) via SF, fat mass (FM), lean body mass (LBM), total body mass (TBM), and body mass index (BMI). The CS and TS groups performed back squats (SQ) and leg press (LP) at matched intensities, volumes and cumulative rest time per session. The CS group’s SQ were followed by LP and then rest. The TS group performed SQ with 1 min rest between sets, and then LP with 1 min rest between sets. Comparisons of all variables were made using repeated measures mixed model ANOVAs.

RESULTS: 2x2 mixed model ANOVAs showed no significant interactions or main effects for FM, TBM, FAT; TRI SF or SI SF. A main effect for BMI and LBM showed a significant (P<0.05) increase due to training (mean±SE) (BMI: 22.764±0.807 vs. 23.128±0.477 kg/m² and LBM: 44.126±1.021 vs. 45.617±1.021 kg) but no difference between groups. There was a significant interaction for TH SF, which was further analyzed via paired t-test for both groups, showing a significant (P=0.05) decrease in the TS group (mean±SD) (29.958±2.0927 mm pre vs 24.4167±1.54826 mm post), but not the CS group. A (2 group) x (2 site) x (2 time) ANOVA was used to compare the US SC fat thickness, which was measured at 2 sites on the thigh. There were no significant 3-way or 2-way interactions, and the only significant main effect was a significant (P<0.05) difference between the 2 measured sites (0.721±0.057 vs 1.043±0.078 cm).

CONCLUSION: There is little evidence to support a 12-week lower body RT effect on percent body fat or localized SC fat with the possible exception of the TH SF when using traditional strength training. The change in LBM demonstrates any body composition changes due to 12-week RT may be due to increases in muscle mass, not fat loss.

Improving muscular strength and endurance promotes vitality and may protect against functional decline in late adulthood. However, research concerning the effects of resistance training has been limited despite the prevalence of type 2 diabetes (T2D) in the US has rapidly increased in recent decades, with an estimated 26 million Americans being diagnosed. Recent evidence suggests that sex hormone-binding globulin (SHBG) independently predicts risk of T2D. Previously we demonstrated that a 12-week periodized resistance training (RT) program results in improvements in body composition, independent of weight loss in overweight, sedentary young adult men. In this randomized controlled trial, we investigated the effects of RT on SHBG, testosterone, cortisol and glucose tolerance.

RESULTS: In the RT group, SHBG increased by ~ 25% (16.09±1.38 vs. 20.28±1.74, P<0.001). Levels of free testosterone (125.5±6.5 vs. 106.0±3.5 pg/mL, P<0.001) decreased in the RT group, while serum total testosterone (488±21 vs. 468±26 ng/dL, P=0.35) and cortisol (15.42±1.08 vs. 13.78±0.87 μg/dL, P=0.17) did not change. Additionally, the RT group exhibited a significant decrease in 2-hr glucose area under the curve (AUC) (2490.58±427.35 vs. 3042.19±394.65 mg/dL/min, P<0.01) and mean insulin (57.50±5.86 vs. 49.87±5.21 μU/mL, P<0.05) during the OGTT. Apart from serum cortisol levels, which increased by ~ 20% (15.06±1.38 vs. 17.92±0.88 μg/dL, P<0.05) none of the above mentioned variables changed in the C group.

CONCLUSION: Chronic RT increases SHBG in overweight, sedentary young men in concert with improved glucose tolerance. The improvement in whole body glucose tolerance by RT may be mediated, in part, by an increase in SHBG. Whether RT may decrease risk for T2D via increased SHBG requires further study.
group completed 3 training sessions per week using the TotalGym XLS while reducing caloric intake by 500 kcal per day for 10 weeks. Subjects performed two sets of 15 repetitions for each of the 18 exercises with 30 seconds of rest between sets. The Borg Rating of Perceived Exertion (RPE) scale was used to monitor and adjust resistance settings, ensuring continuous progression over the entire training period. Baseline and post-intervention maximal strength and muscular endurance were assessed via 1-RM testing and maximum repetitions to fatigue at 60% of 1-RM, respectively.

**RESULTS:** Exercising subjects demonstrated significant increases in maximal voluntary strength for the chest press (8.9±13.8%, p=0.014), leg flexion (11.5±11.7%, p=0.003), and latissimus dorsi pull-down exercises (10.1±2.5%, p<0.002). The exercise group also demonstrated substantial increases in muscular endurance for the chest press (57.4±33.6%, p<0.001), leg flexion (25.1±9.3%, p<0.001), and latissimus dorsi pull-down exercises (47.2±24.9%, p<0.001). No significant changes were detected in the control group.

**CONCLUSIONS:** Body weight resistance training with the Total Gym XLS combined with a 500 kcal per day restrictive diet may enhance muscular strength and endurance.

Supported by the USC Clinical Exercise Research Center.

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**2611 Board #286 MAY 31 2:00 PM - 3:30 PM**

**Effect Of Free-weight And Machine-weight Training On Upper Body Strength Gains In Low- And High-strength College Women**

Thomas J. Pujol, FACSM1, Jerry L. Mayhew2, William F. Brechue3, Paul Reneau1. 1Southeast Missouri State University, Cape Girardeau, MO; 2Truman State University, Kirksville, MO; 3United States Military Academy, West Point, NY; 4Fairmont State University, Fairmont, WV.

(No relationships reported)

Anecdotal evidence suggests that women prefer to perform resistance exercises using machine weights as opposed to free weights. However, few studies have compared free weights and machine weights for women. Furthermore, little evidence is available relative to the effect of initial strength level on strength gain in women.

**PURPOSE:** To compare the effect of training modes on upper body strength development in low- and high-strength women.

**METHODS:** Untrained women (n = 217, age = 19.2 ± 1.0 y, body mass = 64.6 ± 15.6 kg, %fat = 23.0 ± 5.5%) were selected from a larger cohort based on initial 1RM bench press performance on either free weights (FW, n = 69), seated horizontal press machine (SHP, n = 81), and supine vertical press machine (SVP, n = 67). Body fat (%fat) and lean body mass (LBM) were estimated from skinfolds using a generalized equation. Subjects were matched for low-strength (LS; n = 106; IRM = 27.8 ± 2.1 kg) and high-strength (HS; n = 111; IRM = 45.6 ± 6.1 kg) on their specific training mode. Each subject completed a 12-wk linear periodization resistance training program (WK 1-5: 3 x 10-12-RM; WK 6-9: 3 x 6-8-RM; WK 10-12: 3 x 3-5-RM) using either free weights or mode-specific weights.

**RESULTS:** Pre-training mode x strength level ANOVA indicated that HS had significantly greater body mass (72.8 ± 17.9 kg), LBM (54.0 ± 10.0 kg), and %fat (24.9 ± 5.8%) than LS (56.7 ± 6.7 kg, 44.7 ± 4.5 kg, and 21.1 ± 3.8%, respectively). Following training, mode x strength level ANOVA on strength gain (Post 1RM - Pre 1RM) indicated SVP (10.1 ± 4.2 kg) was significantly greater than SVP (6.5 ± 4.2 kg; p<0.001) which was greater than FW (4.5 ± 4.3 kg; p<0.001). There was no significant difference (p>0.99) in strength gain between strength groups (LS = 7.2 ± 4.3; HS = 7.2 ± 5.3 kg); however, the LS groups made a significantly greater percent gain (25.9 ± 5.6%) compared to the HS groups (16.0 ± 11.3%). None of the body composition parameters made significant changes following training.

**CONCLUSIONS:** Changes in muscular strength following resistance training in college women is likely to be greater for machine weights than for free weights and may differ between machine weight types. However, absolute strength gains will be similar between low- and high-strength women regardless of training mode.

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**2612 Board #287 MAY 31 2:00 PM - 3:30 PM**

**The Effects Of Four Weeks Home-based Isometric Exercise Training On Resting Blood Pressure**

Natalie Goldring, Jonathan D. Wiles, Damian A. Coleman. Canterbury Christ Church University, Canterbury, United Kingdom.

(No relationships reported)

Research demonstrates that isometric exercise training can reduce resting blood pressure (BP). However, most training studies involve the use of expensive laboratory-based equipment to complete the training, which is ultimately neither cost nor time effective as a treatment method for hypertension. A home-based isometric exercise program would be cheaper and simpler to perform, and could potentially make this form of exercise more accessible to the general population.

**PURPOSE:** To evaluate the effects of a simple, home-based, isometric wall squat exercise (IWSE) training program for reducing resting BP.

**METHODS:** Thirty healthy normotensive males were examined using a crossover study design. Participants were initially randomly assigned to either an IWSE training group or a control group for a 4 week period. After a 4 week ‘washout’ period, participants then changed to the other condition. The IWSE training consisted of 3 exercise sessions per week performing 4 x 2 minute wall squat exercises in each session. Before training, participants performed a continuous incremental IWSE test to determine training intensity (equivalent to 95% peak heart rate (HR)). The control period required participants to maintain a normal daily routine for the 4 week period. BP and HR were measured 48 hours pre- and post- both conditions. Resting BP was measured using a non-invasive hemodynamic monitor and HR was measured via ECG using a bipolar lead II configuration.

**RESULTS:** During training, participants exercised at a HR of 121.2 ± 24.5 beats·min

-1

(±SD). After 4 weeks of IWSE training, significant reductions in resting BP 3.5 ± 3.7, DBP -4.0 ± 2.7 and MAP -3.8 ± 2.7 mmHg were demonstrated (P<0.05) compared to the control period (SBP 0.7 ± 1.1, DBP 0.7 ± 1.8 and MAP 0.7 ± 1.3 mmHg). Resting HR also reduced significantly (P<0.05) with training (-5.9 ± 6.7 beats·min

-1

) compared to the control period (-0.1 ± 6.0 beats·min

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**CONCLUSION:** 4 weeks of home-based IWSE training can decrease resting BP in a simple, cost and time effective way, allowing an individual to exercise privately, in familiar surroundings and at their own convenience. This novel method of exercise prescription should be investigated further with borderline hypertensive participants.

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**2613 Board #288 MAY 31 2:00 PM - 3:30 PM**

**Unilateral Strength Training With Maximal Velocity Improves Lower Body Power Outcome And Movement Velocity**

Johan Petersson1, Kenneth Riggberger2, Sofia Brorsson1, M. Charlotte Olsson1. 1School of Business and Engineering, Halmstad University, Sweden; 2Malmo Sports Academy, Stadionkontoret, Malmo, Sweden.

(No relationships reported)

In many sports development of power is considered to be one of the most important physiological qualities for success. Despite many studies in the area, research investigating unilateral power training methods for elite athletes is lacking.

**PURPOSE:** The purpose of this study was to examine the effects of unilateral explosive strength training on lower body power output and movement velocity after six weeks of training.

**METHODS:** 17 elite male handball players (age 22±4), experienced in resistance training, participated in a six week intervention study. The players were divided into a training group (TR) n=11, and control group (CTL) n=6. The TR group performed 15 supervised training sessions during six weeks, involving ballistic weightlifting exercises performed unilateral with heavy loads (>80% 1RM) and maximal intended movement velocity in both the concentric and eccentric phases of the lift. The CTL group performed bilateral strength training with heavy loads without movement velocity consideration. Loaded vertical squats jumps with absolute loads of 20, 40, 60, 80 and 100 kg were made before and after the training period. A linear encoder attached to the barbell measured average concentric power (ACP), average eccentric power (AEP), peak velocity and time to peak velocity (tpV) to evaluate power output and movement velocity. To keep results brief but clear, average load was calculated as the mean change of all five loads from pre- to post intervention. T-tests were used to analyze differences between the two groups.

**RESULTS:** The unilateral power training improved ACP (p<0.05) on average with 3±1 W/kg (18%) in TR vs. -1±2 W/kg (-3%) in CTL. Similarly, for AEP, average load increased significantly (p<0.05) in TR 3±2 W/kg (36%) compared to -1±1 W/kg (-1%) in CTL. Moreover, TR decreased their tpV with -0.18±0.08 ms (-40%) compared to CTL 0.01±0.06 ms (2%; p<0.05).

**CONCLUSION:** The TR group showed improvements after only a short period of structured unilateral maximal velocity training which indicates that unilateral training principles could be effective for improving lower body power output in elite athletes involved in sports where unilateral movements predominate. Longer studies are needed to evaluate further potential benefits of unilateral strength training.

Funding: BLESS, Halmstad University, Sweden

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2614  Board #289  MAY 31  2:00 PM - 3:30 PM  
Comparison of Shoulder Training Techniques for Strength Improvements in Collegiate Volleyball Players  
Anthony Clapp1, Emilee Traxler2, John L. Walker, FACSM2. 1Augsburg College, Minneapolis, MN. 2Texas State University, San Marcos, TX.  
(No relationships reported)  
Shoulder strength is frequently touted as a key factor for volleyball performance. Although resistance bands are often employed in rehabilitating athletes, their use for the purpose of making significant strength gains is viewed as tributary compared to that of weight training.  
PURPOSE: The purpose of this study was to compare the level of strength gains in the female collegiate volleyball player employing either a resistance training protocol with free weights or resistance bands, to determine which training technique would be most beneficial for shoulder strength.  
METHODS: Eight intercollegiate athletes from a NCAA Division III Women’s Volleyball team (Age=19.3 ± 1.3 yrs, Ht = 177.0±8.8 cm, Wt=71.8 ± 9.0 Kg) were matched by position and then randomly assigned to either a resistance band strength training group (RB, n=4) or a free weight strength training group (FW, n=4). The participants’ shoulder strength was measured with a Chattanooga Hydraulic Push-Pull Dynamometer with a digital gauge, in four different shoulder positions: flexion, extension, abduction, and adduction. After the completion of the measurements, the athletes completed a six week training program consisting of four different training exercises: flexion, extension, abduction, and adduction. All athletes performed these exercises 20 min/day, three times a week. Following six weeks of training, the participants’ shoulder strength was measured again.  
RESULTS: All of the athletes improved their shoulder strength over the length of the exercise program. Mean(s) strength was calculated from the four measurements and the average strength score for the FW group improved from 14.55 ± 2.3 lb. to 18.33 ± 1.9 lb. The average strength score for the RB improved from 15.18 ± 2.9 lb. to 18.67 ± 2.4 lb. Both groups were significantly stronger than the initial measurements (p < 0.05). There were no differences between the groups.  
CONCLUSIONS: This study revealed that participation in a shoulder strengthening program, using either elastic bands or free weights, can significantly improve the athlete’s shoulder strength. Ultimately, this should lead to an increase in performance and a decrease in the risk of injury to the shoulder.

2615  Board #290  MAY 31  2:00 PM - 3:30 PM  
Effects of Magnesium-Creatine Chelate and Protein Supplementation on Strength and Power Measures in Recreationally Trained Individuals  
David N. Suprak, Rory Callahan, Lorrie R. Brilla, FACSM. Western Washington University, Bellingham, WA.  
(No relationships reported)  
Creatine is the most effective supplement available for increasing high-intensity exercise capacity and muscle mass, and is often “stacked” with protein supplementation. Magnesium enhances creatine absorption into muscle. The efficacy of these supplements in combination has not been established.  
PURPOSE: To compare the effects of supplementation with magnesium-creatine chelate (C), C with whey protein stack (W), and placebo (P), combined with resistance training (RT), on measures of strength, power and acceleration.  
METHODS: Twenty-three healthy, recreationally active participants completed the study. Strength and power testing was conducted before and after an 8-week RT and supplementation program. Strength testing consisted of 1-repetition maximum (1RM) bench press (BP) and back squat (BS). Power testing included the standing broad jump (SBJ), vertical jump (VJ), and seated medicine ball (MB) chest throw. Acceleration was tested via a 10-m sprint. Participants were randomly assigned to one of three supplementation groups, in a double-blind format. The C group was given 5-g creatine chelate equivalent and 400-mg magnesium equivalent per day. The W group received 35 g of whey protein per day, in addition to that given to the C group. The P group received dextan. The eight-week RT was designed to progressively increase strength and power in the major muscle groups involved in movements being tested in a linearly periodized fashion. The effects of time and group were assessed with a two-way repeated measures ANOVA for each outcome measure.  
RESULTS: There were no group by time interactions or group effects for any outcome measure (p > .05 for each). Across groups, the following changes were observed. 1RM BS increased by 13.64 kg, while BP increased by 5.74 kg (p < .001 for each) over time. MB throw increased by 21 m, while SBJ increased by 0.11 m (p < .001 for each). 10-m sprint time decreased by .04 s (p = .005), while VJ did not change (p = .828).  
CONCLUSION: In healthy, recreationally active individuals, participation in periodized RT to improve strength and power of major muscle groups has a greater effect on improving strength, power, and acceleration than does supplementation with either C or W.

2616  Board #291  MAY 31  2:00 PM - 3:30 PM  
Timed Protein Supplementation Following Resistance Training in Young Women  
Heather C. Heidebrecht, Jessica Stallings, Jennifer L. Caputo, Richard S. Farley, Don W. Morgan, FACSM. Middle Tennessee State University, Murfreesboro, TN.  
(No relationships reported)  
The combination of resistance training (RT) and appropriately-timed protein supplementation yields additional gains in lean body mass, muscular strength, and muscular endurance in adult males compared to RT alone. However, limited research is available concerning the effects of timed protein supplementation among young adult females who engage in RT.  
PURPOSE: To determine the effects of timed protein supplementation immediately post-RT and 1-hour post-RT on lean body mass and muscle strength in young adult women.  
METHODS: Females (N = 29; age = 21.6 ± 2.1 yrs; body mass = 63.5 ± 7.4 kg; protein intake = 1.10 ± 0.23 g/kg) participated in a 10-week RT program featuring exercises targeting upper- and lower-body muscle groups. Participants were randomly assigned to one of three groups: immediate post-RT supplementation (IMPRT), 1-hour post-RT supplementation (1HPRT), or a control group (RT only; CTLRT). RT was conducted three days per week in a supervised environment. Lean body mass (LBM) was assessed using dual-energy x-ray absorptiometry (DEXA) and muscle strength was assessed using a 1-repetition maximum bench press (1RMBP) and leg press (1RMLP). Intake of dietary protein was assessed through 24-hour diet recall. The IMPRT group consumed the protein supplement immediately post-RT, the 1HPRT group returned one hour after RT to consume the protein supplement, and the CTLRT group consumed water immediately following RT. Participants in the IMPRT and 1HPRT groups were given 24 grams of whey isolate protein mixed with water, irrespective of body mass.  
RESULTS: When participant data from the three RT groups were combined, significant (p < .05) increases in LBM (2.3%) and 1RMBP and 1RMLP (21% and 20%, respectively) were observed following RT. However, no group-by-time interaction was detected for LBM, 1RMBP, or 1RMLP.  
CONCLUSION: Ten weeks of resistance training increases lean body mass and upper- and lower-body muscle strength in women, regardless of whether a protein supplement is ingested within one hour following RT workouts.

2617  Board #292  MAY 31  2:00 PM - 3:30 PM  
The Effects of Protein and Carbohydrate Supplementation on Resistance Training Induced Gains in Fat Free Mass and Strength  
Robert S. Santana, Ralph E. Graham, Michael P. Godard, FACSM, Timothy J. Piper, Loran D. Erdmann. Western Illinois University, Macomb, IL.  
(No relationships reported)  
PURPOSE: The purpose of this study was to compare the gains in strength and fat-free mass achieved by novice weight lifters who participated in a 9-week resistance training program, and who consumed either a protein and carbohydrate supplement drink or a non-caloric placebo drink immediately after each resistance training bout.  
METHODS: Twenty-one participants (Supplement: 12, Placebo: 9) completed the 9-week resistance-training program. Body fat percentage (BF%) and fat-free mass (FFM) were assessed via air displacement Hydraulic Push-Pull Dynamometer at baseline and again at the end of the 9-week training period. Pre- and post-training strength was also assessed via 1-repetition maximum tests on three different lifts.  
RESULTS: Food diaries collected and analyzed at 3 time points during the study indicated that the protein intake (without post-exercise supplementation) of the subjects in both groups exceeded the RDA for protein of 0.8 g/kg. Both groups exhibited significant increases in FFM and strength over the 9-week training period (FFM increased from 66.0 kg to 67.9 kg and from 62.8 kg to 64.4 kg, and total 1-rep max increased from 359.1 kg to 455.3 kg and from 356.3 kg to 458.1 kg in the Supplement and Placebo groups, respectively). However, no significant between-group differences in FFM or strength gains were observed.

672
CONCLUSIONS: The results of this study suggest that if protein intake is already adequate to meet daily protein requirements, post-exercise protein supplementation may not be associated with additional training-induced improvements in FFM and strength in novice lifters participating in a relatively short-term program of resistance training.

(The whey protein and dextrose used in this study were provided by Bioplex Nutrition and NOW Foods respectively.)

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**2618 Board #293 MAY 31 2:00 PM - 3:30 PM**

**Effects Of Strength Training On Parameters Of The Power-Duration Relationship Using Linear And Non-linear Models**

Brandon J. Sawyers, David G. Stokes, R Hugh Morton, Arthur Weltman, FACSM,1 Glenn A. Gaesser, FACSM.2 Arizona State University, Phoenix, AZ. University of Virginia, Charlottesville, VA. Massey University, Palmerston North, New Zealand.

(No relationships reported)

**PURPOSE:** Strength training has been shown to improve the capacity for high-intensity exercise, but it is uncertain whether it can improve critical power (CP). The purpose of this study was to determine the effects of strength training on CP and the curvature constant (W', or Anaerobic Work Capacity) of the hyperbolic power-duration relationship using linear and non-linear models.

**METHODS:** Before and after 8 weeks of whole-body strength training, 14 males (age 20.6 ± 2.0 years; weight: 78.2 ± 15.9 kg) performed an incremental exercise test on a cycle ergometer for determination of VO2peak and lactate threshold. In addition, on separate days each subject performed 4 randomly assigned constant-power exercise bouts (P1-P4, lowest to highest) to exhaustion on a cycle ergometer. CP and W' were estimated using nonlinear 2-parameter [t = W'/P(CP)] and 3-parameter [t = W/(P(CP) + k)] models, and two linear models (Work (W): W=W' + CP; Power (P): P= W' + (WCP)).

**RESULTS:** Significant (p < 0.05) improvements were found for upper and lower body strength (mean increase = 20%), power output at peak lactate (218 ± 23 W, p < 0.05), and time to exhaustion (TTE) during all 4 constant-power tests (P1: 17.9 ± 21.0 min; P2: 91.1 ± 3.4 min; P3: 5.4 ± 6.1 min; P4: 5.9 ± 2.8 min). Parameter estimates for CP and W' could not be obtained with the 3-parameter model. W' significantly (p < 0.001) improved with the other 3 models (2-parameter nonlinear: 20.1 ± 32.5 kJ; W: 16.7 ± 24.0 kJ; P: 13.8 ± 19.3 kJ). By contrast, CP showed a significant decrease with the 2-parameter nonlinear model (162 ± 157 W, p = 0.023) and no change (p > 0.05) with the 2 linear models (W: 167 ± 166 W; P: 175 ± 175 W).

**CONCLUSIONS:** The improvement in W' is consistent with previous findings of increased capacity for high-intensity exercise after strength training. However, CP was not improved, and paradoxically decreased as estimated from the nonlinear 2-parameter model. These results suggest that strength training alters the power-duration hyperbola such that W' is enhanced at the (apparent) expense of CP. Because significant increases in exercise tolerance within the severe exercise intensity domain were observed, our results suggest that current models of the power-duration hyperbola cannot reliably estimate changes in CP after strength training.

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**2619 Board #294 MAY 31 2:00 PM - 3:30 PM**

**Effect Of Core Strength and Endurance Training On Performance In College Students: Randomized Pilot Study**

Jim Schilling, Jeff Murphy, John Bonney, Jacob Thich. University of Southern Maine, Gorham, ME. (Sponsor: Karen Croteau, FACSM)

(No relationships reported)

The evidence is inconsistent regarding benefits in performance acquired through core muscle training. Few investigators have considered utilizing nonathletes and none have compared the effects of core strength training with core endurance training and their influence on various functional measures.

**PURPOSE:** To examine the effectiveness of a core endurance and a core strength training protocol on endurance, basic strength, and specific performance measures.

**METHODS:** Ten college students (age 21 ± 7.0) were randomly assigned to either a core endurance trained group (n = 5) or a core strength trained group (n = 5). Training consisted of 3 specific exercises and training protocols for each group which took place 2 days per week for 6 weeks. Core muscle endurance was assessed using flexion, extension, and lateral tests. Strength tests were a back squat and bench press conducted on a smith machine. Performance tests consisted of a vertical jump, 10 yard sprint, and pro agility test.

**RESULTS:** A significant improvement in flexor (153.4 ± 91.3 to 175.6 ± 94.4, p < 0.05) and back extensor (124.8 ± 42.7 to 151.4 ± 40.0, p < 0.05) endurance times along with strength values with both the back squat (54.9 ± 27.3 to 62.2 ± 25.4, p < 0.05) and bench press (34.0 ± 14.82 to 37.7 ± 15.63, p < 0.05) occurred with the strength trained group. Also, a significant improvement in flexor (87.4 ± 37.2 to 150.2 ± 53.6, p < 0.05) and right lateral (65.4 ± 35.7 to 104.6 ± 45.4, p < 0.05) endurance times along with strength values with both the back squat (54.9 ± 27.3 to 62.2 ± 25.4, p < 0.05) and bench press (34.0 ± 14.82 to 37.7 ± 15.63, p < 0.05) occurred with the strength trained group.

**CONCLUSION:** Although the results from this limited sample cannot be considered conclusive, they suggest that both core endurance and strength training may improve selected core muscle endurance parameters and possibly assist in increasing strength with specific movements. Also, the endurance training protocol was not superior to the strength training protocol, and they both lacked effectiveness in improving functional performance.

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**2620 Board #295 MAY 31 2:00 PM - 3:30 PM**

**Effects of Short-term Core Endurance Training on Running Economy**

Kelsey Figg, Colleen Kirk, Kelcie Wittman, Kathryn Appel, Ashleigh Handorf, Gary Van Guilder, Jeffrey Janot. University of Wisconsin-Eau Claire, Eau Claire, WI. (Sponsor: Mark Blegen, FACSM)

(No relationships reported)

The core musculature assists in stabilizing the spine during dynamic movement. Poor core endurance has been shown to increase the risk of spinal injury and may be linked to movement inefficiency. Therefore, improving core endurance may produce favorable changes in body posture and stability leading to improved health and exercise performance. With respect to performance, previous research has produced conflicting results regarding the potential benefits of core training on running economy (RE).

**PURPOSE:** The aim was to determine if short-term, core endurance training improves RE in healthy young adults.

**METHODS:** Three males and 13 females, age 18-25 years, participated in a 4-wk (30-min, 3 days/week) core training program (12 sessions total). A total of 13 exercises were employed to train the anterior, lateral, and posterior core musculature. Measurements of anthropometry, core endurance, and RE were performed prior to and following the 4-wk program. Dependent t-tests were used to compare outcome variables pre- and post-training.

**RESULTS:** Right and left side bridge, flexor, and back extensor endurance times were significantly (p < 0.05) increased following training. Interestingly, despite increases in core endurance, a significant (p < 0.05) decrease in RE was observed.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-training</th>
<th>Post-training</th>
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<tbody>
<tr>
<td>Left side bridge</td>
<td>56.7 ± 13.3</td>
<td>86.6 ± 21.6*</td>
</tr>
<tr>
<td>Right side bridge</td>
<td>56.0 ± 11.3</td>
<td>86.8 ± 24.1*</td>
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<td>Flexor endurance</td>
<td>152.9 ± 118.6</td>
<td>318.8 ± 258.2*</td>
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<tr>
<td>Back extensor</td>
<td>310.3 ± 24.6</td>
<td>151.1 ± 30.1*</td>
</tr>
<tr>
<td>Oxygen consumption</td>
<td>44.3 ± 2.2</td>
<td>15.2 ± 2.6*</td>
</tr>
</tbody>
</table>

*Post-training significantly (p < .05) greater than pre-training

**CONCLUSION:** These results showed that an inverse relationship between improvements in core endurance and oxygen uptake may exist during a given submaximal running workload. Further research is warranted to examine the impact of endurance training on RE with and without core training and the overall impact of core endurance improvements on energy expenditure.

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The effects of diet and exercise on physical capacity in weight loss programs (WLP) for overweight (W) and obese (O) people has been studied in few studies, concluding that physical capacity measures improve after intervention, although it is unknown the most effective exercise training.

**PURPOSE:** To determine which protocol is the most effective to improve the cardiovascular fitness in W and O in WLP.

**METHODS:** One hundred eighty-nine W and O (body mass index [BMI] 25-34.9 kg/m²), aged from 18 to 50 years, performed an incremental test until exhaustion on a treadmill, using a modified Bruce protocol, before (pre) and after (post) the 24 weeks intervention. Subjects were randomized to one of the following training groups: strength training (S), endurance training (E), a combination of S and E (SE) (Training frequency: 3 times per week) and control group (C). All of them in combination with a 25% calorie restriction diet. Two-way ANOVA with repeated measures was used to determine differences between pre and post intervention in each training group. The significant level was set at 0.05.

**RESULTS:** Maximum oxygen uptake (VO₂max) increased significantly in all groups in W (Pre and post values, respectively; S: 2466.1 ± 728.6 vs. 2745.6 ± 727.5; E: 2429.0 ± 655.3 vs. 2745.6 ± 655.3; SE: 2725.1 ± 802.7 vs. 3134.7 ± 888.1; C: 2447.1 ± 704.6 vs. 2735.8 ± 753.9 mL·min⁻¹), although in the O the increase was only significant in SE (3102.8 ± 691.8 vs. 3405.2 ± 906.7 mL·min⁻¹). The position of aerobic threshold respect to VO₂max changed in all groups in W (S: 44.6 ± 7.1 vs. 49.5 ± 7.6; E: 41.2 ± 7.5 vs. 55.1 ± 11.3; SE: 43.3 ± 8.7 vs. 48.6 ± 8.6; C: 44.3 ± 6.2 vs. 52.3 ± 7.8 %; p<0.05), although in O the change was only significant in E (48.1 ± 7.6 vs. 52.7 ± 8.1 %) and (C (47.9 ± 10.7 vs. 52.4 ± 8.4 %). There were no significant changes in the position of anaerobic threshold respect to VO₂max, only in O showed a significant increase (81.7 ± 7.9 vs. 85.7 ± 7.8 %).

**CONCLUSION:** The proposed protocols improved the cardiovascular fitness in W while in O only SE increased VO₂max and E changed the thresholds position.

The PRONAF Study takes place with the financial support of the Ministerio de Ciencia e Innovación, Convocatoria de Ayudas I+D 2008, Proyectos de Investigación Fundamental No Orientada, del VI Plan de Investigación Nacional 2008-2011.

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**Board #297 MAY 31 2:00 PM - 3:30 PM**

**Effects Of A Training Program On Sedentary Graphic Arts Workers**

André Luiz Mores1, Felipe Borges Trama2, Laurinda Abreu1, Daniel Alexandre Boullosa Alvarez1.

1Universidade Catolica De Brasilia, Brasilia, Brazil. 2Universidade Católica De Brasilia, Sao Paulo, Brazil. Lavadores, Vigo, Spain.

*Corresponding Author: Andre Luiz Mores, andre.mores@unicamp.br (No relationships reported)*

The reliability and validity of the individual IPAQ-S questions with body composition and the blood lipid profile response to exercise are unclear.}

The purpose of this study was to evaluate the changes in physical and anthropometric parameters in a group of sedentary workers after joining a physical training program.

**METHODS:** Fifty graphic arts workers (37.7 ± 8.6 yrs; 82.1 ± 15.3 kg) volunteered for participation on this study. The training program consisted of concurrent strength and endurance training sessions of moderate intensity (i.e. 70% RM and 70% HR reserve, for strength and endurance exercises, respectively) that were performed 2-3 times a week. The workers were divided into four groups depending on the number of sessions completed: G1 (n=12) ~ 10-21 sessions; G2 (n=14) ~ 22-35 sessions; G3 (n=14) > 36 sessions; and control group (n= 10). Handgrip dynamometry, scapular dynamometry, shoulder abduction strength, shoulder flexion strength, and anthropometric measures (i.e. % body fat, and excess of weight) were evaluated before and after the completion of each training period.

**RESULTS:** G1, G2, and G3 showed significant improvements (from -45% to +114%; p=0.000-0.041) in all physical tests parameters (except for scapular dynamometry in G2, p=0.104-0.186) and anthropometric measurements over the training period. Analysis of variance showed that only G3 demonstrated significant changes in physical performance parameters with respect to the control group (p values ranged from 0.001 to 0.045). In contrast, there were no differences among experimental groups with respect to the control group in any anthropometric variable (p > 0.05).

**CONCLUSION:** Few sessions (i.e. 10-21) of regular moderate resistance and aerobic training could rapidly improve health-related parameters in a group of sedentary graphic arts workers, with more than 36 sessions being necessary for experiencing the greater benefits. Implementation of a training program in graphic arts workers could be effective for a greater fitness which may improve employees’ productivity and quality of life.

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**Board #298 MAY 31 2:00 PM - 3:30 PM**

**Association of IPAQ-S, Body Composition, and Lipid Profile Response To Exercise**

William W. Edwards1, Shyam S. Mali2, D. Drew Pringle, FACSM1. 1Lander University, Greenwood, SC. 2Texas A & M University - Kingsville, Kingsville, TX.

3Wright State University, Dayton, OH.

*Corresponding Author: Shyam S. Mali, shyam.mali@lander.edu (No relationships reported)*

The International Physical Activity Questionnaire-Short Form (IPAQ-S), a non-invasive seven-question assessment of physical activity, has received considerable recent international attention. The reliability and validity of the individual IPAQ-S questions with body composition and the lipid profile response to exercise are unclear.

**PURPOSE:** To determine the association of the individual IPAQ-S components with body composition and the lipid blood profile response to exercise in young adults.

**METHODS:** Twenty healthy recreationally trained college students (13M, 7F; 20.1±1.3 yr; 82.0±24.4 kg; BMI 27.4±6.7, respectively) enrolled in a resistance training activity class participated. All were free of any illness or medication that might affect lipid profile. Total body water (TBW), extracellular water (ECW), intracellular water (ICW), basal metabolic rate (BMR), BF %, fat-free mass (FFM) and fat mass (FM) were obtained via bioelectrical impedance analysis. Fasting seated blood samples were taken immediately before (pre) and after (post) a class exercise session and measured for total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), triglycerides (TG) and HDL/LDL ratio.

**RESULTS:** Correlations between the IPAQ-S body composition, and lipid profile were generally weak to moderate. The strongest correlations for body composition and IPAQ-S were FMF vs. IPAQ-S (r = -0.65), and TBW vs. IPAQ-S (r = -0.64); weakest were ECW vs. IPAQ-S (r = 0.01), and BMR vs. IPAQ-S (r = 0.07). Strongest correlations for lipid profile and IPAQ-S were post TC vs. IPAQ-3 (r = 0.46), and post LDL vs. IPAQ-3 (r = 0.45). Strongest negative correlations were post TC/HDL ratio vs. IPAQ-5 (r = -0.36), and post TC vs. IPAQ-6 (r = -0.34).

**CONCLUSION:** Our data suggest that the strongest correlations for IPAQ-S and body composition were IPAQ-S x weight, while for lipid profile and IPAQ-S were post-exercise with IPAQ-3, IPAQ-5, and IPAQ-6. To better understand the association and validity of the individual IPAQ-S questions, future research may associate these with body composition and lipid profile response across age, gender, ethnicity, and training status.

*Supported by a Grant from the TAMUK College of Education.*

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**Board #299 MAY 31 2:00 PM - 3:00 PM**

**The Effects of Short-Term Power Training on Vertical Jump Performance**

Matthew Miltenberger1, Todd Miller1, Shyam S. Mali1, Frank Pullo1, 1East Stroudsburg University, East Stroudsburg, PA. 2George Washington University, Washington, DC.

*Corresponding Author: Matthew Miltenberger, mmilten@gmail.com (No relationships reported)*

It has been well established that power is a major determining factor in the ability to be successful in athletics. Olympic lifters are common examples that are employed by exercise professionals; the question of specificity arises when determining the use of push vs. pull exercises.

**PURPOSE:** To assess the effects of short term power training using the power clean (PC) and the ground base jammer (GBJ) on vertical jump performance.

**METHODS:** After familiarization of exercises, the experimental protocol consisted of a 2 group design (PC and GBJ). Each group trained for 10 sessions over a 20 day period with 5 sets of 3 repetitions at approximately 85-90% of calculated 1RM. Subjects (n=9) were college age males defined as untrained and free from injury that would prevent or inhibit participation. Vertical jump height was assessed using the Vertec® system for both the countermovement vertical jump (VJC) and the non-countermovement vertical jump (VJNCM). The VJC was performed by subject quickly squatting to 90° of knee flexion followed by an explosive upward movement. The VJNCM consisted of the subject quickly squatting to 90° of knee flexion before the concentric phase of
the jump was initiated. Each subject performed 3 jumps; maximal jump height was recorded and converted to watts for comparison. Descriptive statistics were used to illustrate emerging trends within the data.

RESULTS: The findings of this study suggest that the PC training group increased their VJCM and VJNCM performances by 231 watts or 4.6% and 29 watts or .6% respectively. The GBJ group also increased their performances in both the VJCM and VJNCM by 92 watts or 2% and 124 watts or 3% respectively.

CONCLUSIONS: Although a small sample was used, data suggests a trend toward specificity of push vs. pull exercises. The push (GBJ) appeared to affect the VJNCM while the pull (PC) affected the VJCM. In the perspective of specificity, spots involving movement without a countermovement (football lineman) may benefit more from training with the GBJ while spots involving countermovement ability (volleyball) may benefit more from training with the PC. In addition, the data also suggests that short term power training in general may be enough to elicit some adaptation increasing performance across conditions.

D-31 Free Communication/Poster - Sedentary Behavior
May 31, 2012 1:00 PM - 6:00 PM
Room: Exhibit Hall

2625 Board #300 May 31 3:30 PM - 5:00 PM
The Importance Of Sitting Time And Physical Activity On BMI In Hard To Reach Men
Andy J.W Smith, Stephen Zwolinsky, Andy Pringle, Jim Mckenna, Steve Robertson, Alan White. Leeds Metropolitan University, Leeds, United Kingdom.

CONCLUSIONS: Although a small sample was used, data suggests a trend toward specificity of push vs. pull exercises. The push (GBJ) appeared to affect the VJNCM while the pull (PC) affected the VJCM. In the perspective of specificity, spots involving movement without a countermovement (football lineman) may benefit more from training with the GBJ while spots involving countermovement ability (volleyball) may benefit more from training with the PC. In addition, the data also suggests that short term power training in general may be enough to elicit some adaptation increasing performance across conditions.

2626 Board #301 May 31 3:30 PM - 5:00 PM
Daytime Patterns Of Time Spent In Sedentary Behaviors Among Us Middle-Aged Adults
Youngdeok Kim, Saori Ishikawa, Anah R. Smith, Joel D. Reece, Ryan T. Conners, Rose M. Carter, Minsoo Kang, FACSM. Middle Tennessee State University, Murfreesboro, TN.

CONCLUSIONS: This study investigates the patterns of sedentary time in adults during daytime among US middle-aged adults. Those transition points where the minutes of SBs increase should be targeted in future research in order to reduce the total amount of SBs among middle-aged adults.

2627 Board #302 May 31 3:30 PM - 5:00 PM
Physical Activity Level According to Sitting Time in Adults

CONCLUSIONS: This study investigates the patterns of sedentary time in adults during daytime among US middle-aged adults. Those transition points where the minutes of SBs increase should be targeted in future research in order to reduce the total amount of SBs among middle-aged adults.
CONCLUSIONS: To examine the validity of SenseWear™ Pro Armband (Armband) in assessing sedentary behaviour and light physical activity in free living activities in adults.

METHODS: Participants in the 2003-06 National Health and Nutrition Examination Survey were included (analyses conducted in fall 2011). Dietary quality was determined by Healthy Eating Index (HEI)-2005 calculated from two 24-hour recalls. TVV was reported as low (β=2.41, p=0.03) as well as adult men (low β=3.39, p=0.02) and adolescent girls (low β=3.65, p=0.002). Multivariate linear regression models were used to analyze TVV and HEI-2005, adjusted for body mass index (percentile for children 2-18 years), age, ethnicity and physical activity. Analyses were conducted separately for sex and age [preschool: 2-5 years (n=1423), school age: 6-11 years (n=1749), adolescent: 12-18 years (n=3343), and adult: 19 years (n=8222)].

RESULTS: Lower volumes of HEI were significantly associated with healthier HEI for all age groups including preschool boys (low β=3.85, p=0.04) preschool girls (low β=4.08, p=0.003, middle 2.75, p=0.01), school-age boys (low β=3.39, p=0.02), school-age girls (low β=3.65, p=0.002), adolescent boys (low β=2.28, p=0.004, middle β=1.04, p=0.004) and adolescent girls (low β=2.41, p=0.03) as well as adult men (low β=1.89, p=0.003, middle β=1.73, p=0.001) and women (low β=3.17, p=0.001).

CONCLUSIONS: Excessive TVV (≥4 hr/day) is associated with a less healthy diet determined by a composite dietary formula for each age and sex group. Research is needed to determine the most effective interventions to target both behaviors as well as the combined effect of poor diet and excessive TV viewing on disease risk.

PURPOSE: To determine associations between sitting time and the prevalence of LFRs.

METHODS: Men aged 18+ (n=384) provided data for analysis. Data was collected prior to engagement in interventions at professional UK soccer clubs. Analysis identified LFRs totals; men sitting c<4 hours/day, screen time was 3.4±0.1 hrs/day, and strength training was 9.8±0.6 times/30days. After adjustment, MHO and OA adolescents reported more screen time than normal adolescents (3.6±0.2 and 3.3±0.3 respectively, vs. 3.0±0.2p<0.01). However, no differences were found between CR groups within BMI group for screen time, MVPA or strength training.

CONCLUSION: Overweight/obese adolescents spend more time viewing TV/videos/computer than NWN, but unlike adults, MVPA, screen time and strength training did not differ by CR within BMI. Thus, targeting SB may be a useful strategy for obesity reduction in adolescence, but modifying PA or SB may not be sufficient to alter CR within BMI group.
Table 1

<table>
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<th>Number of LRFs</th>
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* = RF present, - = RF absent

CONCLUSIONS: HRS time was significantly associated with increased LRFs in men engaging the intervention.

2632 Board #307 MAY 31 3:30 PM - 5:00 PM
Time Spent In Sedentary/Light Activities Reported By Adolescent Girls Between 6th, 8th, And 11th Grades
Brit I. Saksvig, JoAnn Kuo, Deborah Rohm Young, FACSM. University of Maryland SPH, College Park, MD.
(No relationships reported)

Reducing sedentary/light behaviors (SLB) is a recommended obesity prevention strategy. Understanding the types of SLB that adolescent girls participate in over time may help to target obesity prevention interventions.

PURPOSE: To examine time spent in SLB among two cohorts of adolescent girls between 6th and 8th grade and 8th and 11th grade.

METHODS: Three random samples of girls participated in the Trial of Activity in Adolescent Girls (TAAG) in the 6th grade (2003) and 8th grade (2005 and 2006). In 2010 Maryland TAAG girls participated in TAAG II in 11th grade. Girls completed a modified version of the 3-Day Physical Activity Recall (3DPAR). The number of 30-minute blocks over 3 days spent in the following activities was calculated and expressed as a percentage of awake time: 8 SLBs (personal care, eating, screen time, riding in a vehicle, socializing, homework, listening to music/reading, and attending church), physical activity (PA), school, and work (e.g. part-time job, babysitting).

RESULTS: 1,362 girls completed the 3DPAR in both the 6th and 8th grade and 587 did so at both 8th and 11th grade. The percent of awake time spent in SLB decreased from 58.2% in 6th grade, 59.1% in 8th grade, and 55.1% in 11th grade. The percent of awake time spent in PA also decreased: 15.6% in 6th grade, 12.5% in 8th grade, and 11.2% in 11th grade. Time in school and riding in a vehicle remained stable while time at work increased (6th: 0.5%; 8th grade: 0.6%; 11th grade 4.8%). Among the 8 SLBs, awake time spent in screen time decreased (6th: 15.7%; 8th: 14.9%; and 11th: 10.1%), time socializing increased (6th: 10.3%; 8th: 13.1%; 11th: 13.2%), as did time spent doing homework (6th: 4.2%, 8th: 5.1%; 11th: 7.9%). Percent of time in all other SLB activities remained relatively stable.

CONCLUSIONS: Overall, time spent in sedentary and light behaviors as well as physical activity decrease between 6th and 11th grade, however, time spent in some individual SLBs increases over time.

2633 Board #308 MAY 31 3:30 PM - 5:00 PM
Is Sedentary Behavior Associated With Metabolic Syndrome In Adults? The Cardiovascular Risk In Young Finns Study.
Harri Helajarvi1, Katja Pahkala1, Olli J. Heinonen1, Heinoenik Ikka2, Tuja Tammelin3, Mirja Hirvensalo4, Kristiina Mansikkaniemi1, Jorma Viikari2, Olli Raitakari2.
1Paavo Nurmi Centre, University of Turku, Turku, Finland. 2University of Turku, Turku, Finland. 3LIKES Research Centre, Jyväskylä, Finland. 4University of Jyväskylä, Jyväskylä, Finland. 5University of Helsinki, Helsinki, Finland. (Sponsor: Raija Laukkanen, FACSM)
(No relationships reported)

PURPOSE: We have shown that sitting (sedentary behavior) per se increases BMI and waist circumference, and that it is associated with individual cardiometabolic risk markers in adults. This study investigated, how leisure-time sedentary behavior in adults is associated with metabolic syndrome (MetS), defined by different criteria.

METHODS: In the Cardiovascular Risk in Young Finns study, MetS was defined by: 1) EGIR (European Group for the Study of Insulin Resistance), 2) IDF (International Diabetes Federation), and 3) HARM (according to harmonized criteria, Alberti et al. 2009) in 1084 women and 909 men aged 30-45. Data on total leisure-time sedentary behavior (i.e. time spent watching TV, computing, reading, listening to music/radio, etc), physical activity (leisure-time physical activity and active commuting), occupational physical activity, and smoking were collected with a questionnaire. Food frequency questionnaire was used to study diet composition, energy intake, and alcohol consumption. Linear regression analysis was used to study the association of leisure-time sedentary behavior with MetS.
RESULTS: Increased total daily sedentary behavior was independently associated with increased prevalence of MetS in males (EGR p<0.02, IDF p<0.008, HARM p<0.009), but not in females. Adjustment with physical activity, occupational physical activity, energy intake, diet composition, alcohol, smoking, BMI, and age did not affect the result.

CONCLUSIONS: Leisure-time sedentary behaviour is directly associated with MetS among men, as defined by three different MetS criteria. Reduction of sedentary behavior can be one important clinical tool in preventing metabolic syndrome.

2634 Board #309 May 31 3:30 PM - 5:00 PM
Relation between Physical Activity, Sedentary Behavior and Selected Cardiovascular Disease Risk Factors in Adolescent Female
Kieran P. Dowd1, Sarah M. Hughes2, Steven Gastinger3, Grainne Hayes1, Michael Harrison3, Alan P. Macken1, Clodagh S. O’Gormain1, Niall M. Moya1, FACSM1, Alan E. Donnelly1.1University of Limerick, Limerick, Ireland. 2Dublin City University, Dublin, Ireland. 3University of Rennes 2, Rennes, France. 4Waterford Institute of Technology, Waterford, Ireland. (No relationships reported)

BACKGROUND: Cardiovascular disease risk factor (CVRF) levels for an individual tend to track over time in a given rank within the distribution of the population. Long-term exposure to multiple CVRF and lifestyle behaviours confers a lifelong burden of CVD risk resulting in the development of early systemic atherosclerosis. Measurement of carotid intima-media thickness (CIMT) and large artery stiffness (LAS) are commonly used to determine the extensiveness and severity of asymptomatic disease and potential future risk.

PURPOSE: To examine the relation between both physical activity (PA) and sedentary behaviour (SB) and i) selected CVRF and ii) subclinical disease in adolescent females.

METHODS: Data were presented as mean ± standard deviation, except where otherwise indicated. Participants (n=35; age = 14.4 ± 1.1 y.; BMI = 22.6 ± 2.9 kg/m²; percentage body fat 31.2 ± 3.0; mean arterial pressure (MAP) = 85.0 ± 8.3 mmHg) were randomly selected from 4 high-schools in Ireland. Height, weight, percentage body fat, blood pressure, CIMT, and LAS data was obtained for each participant. SB and PA were recorded for 4–6 days using an ActivPAL™ physical activity monitor. The amount of time spent sedentary, standing, and in both light and moderate to vigorous PA (MVPA) was calculated. Sedentary data was also examined to identify sedentary bouts of specific duration.

RESULTS: The mean left and right-sided CIMT score was 0.47 ± 0.0 cm and the mean LAS index was 5.20 ± 0.58. Participants spent 19.42 ± 0.94 h/d in sedentary activities (9.93 ± 1.03 waking sedentary h/d), 3.08 ± 0.74 h/d standing, 0.73 ± 0.17 h/d in light activity and 0.78 ± 0.26 h/d in MVPA. There was a significant inverse relation between light physical activity levels (independent of standing time) and mean arterial pressure (MAP), (r = 0.5, p<0.05), BMI (r = 0.5, p<0.01) and percentage body fat (r = 0.4; p<0.05). There was no relation between other PA variables and CVRF or LAS. There was no significant relation between SB and CVRF, CIMT or LAS.

CONCLUSIONS: Objectively measured light PA (independent of standing time) is correlated with MAP, BMI and percentage body fat, but not CIMT or LAS in this population of adolescent females. Although a large amount of time was spent sedentary (9.93 hr), SB were not related to CVRF, CIMT or LAS in this population of adolescent females.

2635 Board #310 May 31 3:30 PM - 5:00 PM
Associations Between Physical Activity, Sedentary Behavior, Waist Circumference And Aliminoteransferase In Young: NHANES 2003-2006
Jennifer L. Thrul1, Russell R. Pate, FACSM1, Andrew Ortogallia, Marsha Dowda, FACSM1, Steven N. Blair, FACSM1, Timothy S. Church2, Matteo Bottai1, 1University of South Carolina, Columbia, SC. 2Pennnington Biomedical Research Center, Baton Rouge, LA. (No relationships reported)

Pediatric non-alcoholic fatty liver disease (NAFLD) is a significant public health issue, as NAFLD leads to cirrhosis, hepatocellular carcinoma, and cardiovascular disease in adults. At least 8% of U.S. youth have elevated alanine aminotransferase levels (ALT), a biomarker for NAFLD. Regular physical activity (PA) improves ALT in adults with NAFLD, but information is scarce for youth.

PURPOSE: To examine associations between PA, sedentary behavior (SED), waist circumference (WC) and ALT in youth.

METHODS: Data were obtained from youth (N=2088, aged 12-19 years) in the National Health and Nutrition Examination Survey (NHANES) 2003-2006. Traditional statistical methods (linear and logistic regression) were compared with quantile regression to examine associations between accelerometer-measured moderate-to-vigorous physical activity (MVPA), vigorous physical activity (VPA), SED, and ALT. Variables with previously reported associations to ALT (age, race, gender, WC) were a priori included in all models as covariates, along with SED (for PA models) or MVPA (for SED models). WC also was examined after adjusting for all other variables.

RESULTS: The results of the logistic regression showed a small positive (β=0.01) significant association between MVPA and log transformed ALT (p=0.02). For the logistic regression, each observation was dichotomized and the odds of observing ALT ≥ 30 U/L was modeled. Results of the logistic regression suggested that a 1 minute increase in VPA results in the odds of ALT ≥ 30 changing by a factor of 1.02 (p=0.04). No other PA or SED associations were found for the linear or logistic regression models (p>0.05). The results of the quantile regression suggest positive, but clinically-negligible associations between the 40th, 50th, and 60th adjusted ALT percentiles and MVPA (β=0.02, 0.03, 0.03, respectively). No significant associations were found for VPA or SED across adjusted ALT percentiles. A strong positive association was found for all three models between WC and ALT.

CONCLUSION: Neither PA nor SED were clinically associated in NHANES youth of whom the majority (92%) were within normal ALT levels. Further studies need to examine whether PA or SED affects above normal ALT levels in larger samples of youth with NAFLD.

Supported by NIH Grant F32 HD066924/NICHD.

2636 Board #311 May 31 3:30 PM - 5:00 PM
A Comparison Of Sedentary Behavior Between A Self-report Diary And Accelerometers
Elizabeth K. Lenz1, Ann M. Swartz1, Amy E. Harley2, Nancy A. Mathiowetz2, Scott J. Strath2, 1The College at Brockport-SUNY, Brockport, NY. 2University of Wisconsin-Milwaukee, Milwaukee, WI. (No relationships reported)

Research has demonstrated negative impacts on health related to increased time spent engaging in sedentary behavior (SB). Older adults engage in significantly more SB than other age groups. Currently there are a few methods being used to assess SB but little research has examined these methodologies in older adults.

PURPOSE: The purpose of this project was to compare three SB assessment methods in a sample of older adults.

METHODS: Seventy-three older adults (73.5±6 years) participated in this study. Concurrently, each participant completed a previously piloted self-report diary over a three-day period (one weekend day and two weekdays) and wore two triaxial accelerometers (AG; Actigraph GT3X, Pensacola, FL; AP, activPal™, Glasgow, Scotland). Sedentary behavior was classified as minutes per day (mins/d) of activities that are done while sitting/lying down in the diary and SB was classified in mins/d with accelerometer (AG = ≤50 cts/min; AP = sitting/lying posture). Means ± SD is presented for all measures of time spent in SB. Pearson correlation coefficients between methods were determined. Two-tailed paired sample t-tests were conducted.

RESULTS: Participants self-reported engaging in 618.2±90.5 mins/d of SB, the AG and AP recorded 613.1±86.6 mins/d and 603.9±10 mins/d, respectively. The SB recorded by the AG and the diary (r=0.74, p<0.05) and the AG and AP (r=0.97, p<0.05) were significantly correlated. However, the SB recorded by the AP was significantly correlated to the SB reported in the diary (r=0.62, p<0.05). There were no significant differences in SB recorded with the AG and AP [t (70)=-0.52, p=0.61], the AG and diary [t (71)=-0.13, p=0.36], or the AP and the diary [t (71)=1.25, p=0.22].

CONCLUSION: The older adults in this sample engaged in approximately 10.1-10.3 hours of SB when reporting their behavior in a diary or when it was objectively measured with accelerometer. Upon examining the relationship between methods, only the SB recorded with the AP and diary were significantly related however there were no differences in mins/d of SB when examined between methods. These results suggest that a diary can capture SB similarly to accelerometer in older adults.

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RESULTS: different measures were examined using Pearson correlation coefficients. Convergent validity (accelerometer as standard) was assessed with correlation coefficients (ρ). In Phase 2, 199 participants in the 2011 Livestrong® Austin Marathon and Half-Marathon were recruited to complete the new questionnaire.

RESULTS: In Phase 1, the MSTQ demonstrated good reliability with ICCs of 0.76 and 0.72 for day and non-day total sitting, respectively. Only two settings had ICCs <0.60. Convergent validity was stronger with accelerometer adjusted for accelerometer wear time (p=0.34 and 0.61 for day and non-day workday respectively). In Phase 2, 195 and 199 participants reported day and non-day workday sitting time, respectively. Total sitting did not differ between marathon and half-marathon participants, but was significantly higher on workdays than non-workdays (645 and 480 min respectively, p<0.0001). Most workday sitting was done during work activities while most non-workday sitting was composed of TV/movie watching. Median reported training time was 6.5 h/wk and was higher in marathoners.

CONCLUSIONS: Preliminary validation of the MSTQ indicates good potential for assessing usual sitting across several contexts. Despite far exceeding PA guidelines, this sample of recreational runners reported sitting over 10 hr on weekdays and 8 hr on non-workdays, suggesting endurance athletes may be an appropriate population for investigating the interaction between PA and sedentary behavior on health.
METHODS: Funded by NIH RC HL099557

time (\(SBSR\) domain related to BMI (\(r^2\)) was 374 (±72) for SB50, 443 (±74) for SB100, and 486 (±72) for SB150. \(SBSR\) total time was marginally correlated with SB50 (\(r=0.22; p=0.07\)). Correlations between total \(SBSR\) and SB100 and SB150 were (\(r=19; p=0.12\)) and (\(r=20; p=0.10\)), respectively. The only \(SBSR\) domain significantly correlated with accelerometer \(min.\) was computer time (\(r^2\) range 0.24-0.29 across cut points, \(p<0.05\)). Accelerometer sedentary time was not related to BMI whereas total \(SBSR\) was marginally related (\(r=0.22; p=0.07\)). TV viewing was the only \(SBSR\) domain related to BMI (\(r=0.35; p<0.01\)).

CONCLUSION: Self-reported SB showed poor convergent validity with objective accelerometry. Total self-reported SB was most closely linked to SB50, the lowest cut point of objective SB tested.

Funded by a research grant (1R1SDP002138-01) from the Centers for Disease Control and Prevention.

2641 Board #316 MAY 31  3:30 PM - 5:00 PM Effects Of Sedentary Behavior And Steps/day On Insulin Sensitivity Corianne Oliver, Sarah Kozev-Keadle, Richard Viskochil, Barry Braun, FACSJM, Patty S. Freedson, FACSJM. University of Massachusetts Amherst, Amherst, MA. (No relationships reported)

The benefits of physical activity (PA) on insulin sensitivity have been previously established. However, the effects of sedentary behavior (SB) on insulin sensitivity are not well understood.

PURPOSE: To determine the association between habitual SB, steps/day, and insulin sensitivity in non-exercising, overweight/obese individuals.

METHODS: Fifty-seven non-exercising, overweight/obese (mean ± SD: BMI = 35.1 ± 4.6 kg-m²) participants 43.6 ± 9.9 yrs wore an inclinometer to measure free-living SB (time sitting/lying, expressed as % of wear time [%sed]) and steps for 7-days. Plasma insulin and glucose concentrations were measured during a 2-hour oral glucose tolerance test following the wear time and the composite insulin sensitivity index (CISI) was calculated. The independent effects of SB and steps overall, on weekdays and weekends on CISI were evaluated using linear regression. Correlations (\(r\)) between SB and steps/day with CISI were also calculated.

RESULTS: SB was not associated with CISI. Steps/day on the weekend, controlling for SB and BMI, was positively associated with CISI (\(p<0.05\)).

CONCLUSION: In a group of overweight/obese men and women who do not exercise, SB was not related to insulin sensitivity. However, steps/day, particularly on the weekend, was significantly associated with insulin sensitivity. Both SB and steps were more variable on the weekend compared to weekdays, which may play a role in the sensitivity differences observed.

Funded by NIH RC HL099557

Table 1. Correlations and Independent Effects of Sedentary Time (% Sed) and Steps on CISI

<table>
<thead>
<tr>
<th>% Sed Overall</th>
<th>% Sed Weekday</th>
<th>% Sed Weekend</th>
<th>Steps Overall</th>
<th>Steps Weekday</th>
<th>Steps Weekend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>68.6 ± 8.0</td>
<td>70.8 ± 7.8</td>
<td>62.3 ± 12.2</td>
<td>987.8 ± 1998.8</td>
<td>6011.8 ± 2135.6</td>
</tr>
<tr>
<td>(r)</td>
<td>0.181</td>
<td>0.284</td>
<td>0.157</td>
<td>0.393*</td>
<td>0.283</td>
</tr>
<tr>
<td>(p)</td>
<td>0.748</td>
<td>0.322</td>
<td>0.164</td>
<td>0.070</td>
<td>0.184</td>
</tr>
</tbody>
</table>

\(^{*} p<0.01; ^{*} p<0.05\) controlling for % Sed and BMI

D-32 Free Communication/Poster - Skeletal Muscle Physiology MAY 31, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2642 Board #317 MAY 31  2:00 PM - 3:30 PM NAD(P)/H Kinetics At Onset Of Contractions In Single Myofibers: Effect Of Prior Contractions

Paulo Gandra, Leonardo Nogueira, Amy A. Shiah, Michael C. Hogan, FACSJM. UCSD, La Jolla, CA. (No relationships reported)

INTRODUCTION - Evidence supports the notion of delayed respiratory activation occurring in skeletal muscle mitochondria during the transition from rest to exercise. NAD(P)H autofluorescence can be used to measure changes in mitochondrial activity since it reflects the mitochondrial potential energy status.

PURPOSE: Determine the changes in NAD(P)H fluorescence in single myocytes at the onset of successive contractile bouts and in the absence of the cross-bridges cycling.

METHODS: Intact Xenopus single fibers were stimulated to contract repetitively at maximal tetanic tension (1 contraction/2 sec) for 2 min and both isometric tensio and NAD(P)H autofluorescence were measured (n=7 fibers). A second bout of contractions was performed 5 min (5-min rest) after the first bout. In a different set of fibers (n=4 fibers), a contractile bout was performed in the presence and in the absence of the specific cross-bridge inhibitor N-benzyl-l-toluene sulfonamide (BTS, 15 \(\mu\)M) with a 60 min interval between each bout.

RESULTS: For the first bout of contractions, the NAD(P)H autofluorescence demonstrated a decrease during stimulation after a time delay of 14.1 ± 1.3 sec. In the second contraction period (after 5 min of rest), NAD(P)H decreased immediately after the first contraction. The time constant of NAD(P)H kinetics was shorter during the second contractile period (3.3 ± 0.3 sec) vs the first period (5.0 ± 0.3 sec; \(p<0.05\)). Interestingly, when cross-bridge cycling was inhibited by BTS, the time-delay of NAD(P)H fluorescence kinetics at the onset of contractions was slightly increased in 3 of the 4 fibers compared to control (i.e., no BTS) while the time constant of NAD(P)H fluorescence was significantly increased with BTS (8.1 ± 0.7 sec) compared to control (3.5 ± 0.8 sec; \(p<0.05\)).

CONCLUSION: Priming skeletal muscle by a previous contractile activity results in a faster adjustment of NAD(P)H oxidation at the onset of contractions. In addition, reduction of the energy cost by the inhibition of cross-bridges cycling resulted in a slower rate of NAD(P)H oxidation. Thus, mechanisms directly related to the mitochondrial potential energy as well as other mechanisms, such as a regulation parallel to the cross-bridge cycling regulate mitochondrial activity at the onset of contractions.

Supported by NIH grant SR01AR040155-17.

2643 Board #318 MAY 31  2:00 PM - 3:30 PM Influence of MHC Hybrid Isoform Protein Proportions on Single Muscle Fiber Function in Humans

James R. Bagley, Kevin A. Munich, Kirlin Minchev, Robert A. Standley, Todd A. Trappe, Scott W. Trappe, FACSJM. Human Performance Laboratory, Ball State University, Muncie, IN. (No relationships reported)

Human skeletal muscle contains pure myosin heavy chain (MHC) fiber types (I, IIa, and IIx) along with hybrid fibers expressing multiple MHC isoforms (I/IIa, Ia/Ix, and Ia/IIx). Although hybrid fibers represent a common component of human muscle, little research exists on their relative MHC protein distribution or single fiber functional profiles.

PURPOSE: Quantify the proportion of co-expressed MHC isoforms in hybrid fibers and determine its influence on single muscle fiber function.

680

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CONCLUSIONS: Human muscle fibers (n=68) were isolated from vastus lateralis biopsies, analyzed for single fiber physiology (size, strength, speed, power), typed electrophotographically, digitally imaged, and identified as one of three hybrid fiber types (MHC Ila/IIX (n=47), MHC Ila/IIX (n=20), and MHC Ila/IIX (n=1)). Two researchers independently quantified (in duplicate) the proportion of MHC isoforms expressed in these fibers via densitometry.

RESULTS: Significant correlations in densitometry measures existed between observations from the same researcher (r=0.995) and different researchers (r=0.998, ICC=0.997), indicating strong test-retest and inter-rater reliability. Proportions of MHC Ila isoform expressed in Ila/IIX hybrid fibers ranged between 7-94% and 28-83% of total MHC protein, respectively. MHC Ila isoform percentage positively correlated with strength (P<0.001, R²=0.40), speed (V₁₅₀, R²=0.78), and normalized power (R²=0.76) in MHC Ila/IIX fibers. No significant correlations were observed between MHC isoform proportions and Ila/IIX hybrid fiber function.

CONCLUSION: Our results indicate that MHC co-expressing fibers represent a subclass of formerly pure MHC slow fibers in the SEN Sol muscle that exhibit a marked amount of atrophy. These results redefine the impact of aging on slow fiber atrophy, and emphasize the necessity of addressing the atrophy potential of both fast and slow fibers in seeking treatments for aging muscle atrophy.
Maximal aerobic energy production is limited by the ability to deliver and transfer oxygen (O2) to mitochondria (MITO) within skeletal muscle. As such, the spatial relationship between capillaries (CAP), MITO, and the muscle fiber plays an important role in determining the aerobic capacity of a muscle. Most skeletal muscle morphology knowledge comes from electron (EM) and/or light microscopy studies and show that both MITO content and CAP density increase with the aerobic capacity of a muscle. However, these studies are typically done by analyzing single 2D slices of muscle fibers and require a fixative which can alter morphology.

**PURPOSE:** Evaluate the in vivo, 3D spatial relationship between CAP, MITO, and three fiber types within murine Tibialis anterior (TA) muscle.

**METHODS:** Two photon excitation microscopy was utilized for simultaneous imaging of MITO (NADH autofluorescence), vasculature, and interstitial space using selective dyes. ~825 x 825 x 280 μm volumes of the TA were analyzed in vivo with flowing blood. A custom contour drawing and analysis program was used to trace fiber boundaries and determine the contact and volume ratios between CAP and muscle fibers for 98 fibers. Fiber type (slow (ST), intermediate (IT), fast-twitch (FT)) was determined based on the relative intensity of the NADH signal and fiber size. EM was performed on cross-sections and longitudinal slices of fixed TA samples for further validation.

**RESULTS:** Microscopy revealed that a significant fraction of ST fiber CAP (51.7 ± 4.0%) had at least 50% of their circumference embedded in a groove in the sarclemma, in vivo. Embedded CAP were tightly associated with dense MITO populations lateral to the CAP grooves and nearly absent below the groove where fibrils dominated. CAP embedding was significantly lower in FT (25.7 ± 4.5%) and IT (14.1 ± 2.1%). EM images confirmed ST-embedded CAP and MITO localization. 35.1 ± 1.5% of ST fiber surface area (SA) was in contact with CAP, whereas IT and FT fiber SA contact was only 13.2 ± 1.4% and 8.4 ± 0.7%, respectively.

**CONCLUSIONS:** A specialized sarcoclemmal/CAP groove is present in murine ST fibers resulting in the embedding of CAP in a MITO rich region of the cell. This structure optimizes the CAP O2 delivery to highly aerobic ST fibers as well as selectively restricts the O2 delivery to FT fibers in these mixed fiber muscles.

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**Board #322**

**MAY 31 2:00 PM - 3:30 PM**

**Selective Embedding of Capillaries within Murine Slow Twitch Skeletal Muscle Fibers Visualized Using In Vivo Microscopy**

Brian Glancy, Li-Yueh Hsu, Lam Dao, Matthew Bakalar, Stephanie French, David J. Chess, Joni L. Taylor, Mathew P. Daniels, Shervin Esfahani, Robert S. Balaban. **National Institutes of Health, Bethesda, MD.**

(Max no relationships reported)

**CONCLUSIONS:** A specialized sarcoclemmal/CAP groove is present in murine ST fibers resulting in the embedding of CAP in a MITO rich region of the cell. This structure optimizes the CAP O2 delivery to highly aerobic ST fibers as well as selectively restricts the O2 delivery to FT fibers in these mixed fiber muscles.

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**Board #323**

**MAY 31 2:00 PM - 3:30 PM**

**Fiber Type Comparison Between Wild-type And Desmin Knock-out Mice**

Allen C. Parcell, FACSM, Brenda Benson, Michael Leavitt, Daniel Nelson, Derek Stewart. **Brigham Young University, Provo, UT.**

(Max no relationships reported)

Proteins of the muscle cytoskeleton are important for the transmission of forces and appear to be a component of the adaptive response to chronic overload. Questions remain as to how cytoskeletal proteins may mediate the translation of a contractile stimulus to an adaptive response.

**PURPOSE:** As an initial phase to approach these questions the purpose of this research was to conduct a contemporary examination of muscle morphology in a desmin knockout mouse with regard to muscle fiber-type composition.

**METHODS:** The gastrocnemius and tibialis anterior muscles were dissected from wild-type and desmin knockout mice. Tissue cross-sections were stained for myosin ATPase with an acid preincubation pH of 4-4.5. Sections were assessed for type I and type II cells by two independent evaluators after which fiber counts and distributions were calculated.

**RESULTS:** Wild type (WT) mice possessed and fiber-type distribution in the gastrocnemius of 7% type I, 7% type IIa/IIx, and 86% type IIb cells. WT tibialis anterior muscle was composed of 34% type I, 11% type IIa/IIx, and 55% type IIb cells. Desmin knockout (KO) mice had a gastrocnemius muscle composition of 11, 7, and 82% type I, IIa/IIx, and type IIb fibers, respectively. KO tibialis anterior muscle was composed of 40% type I, 10% type IIa/IIx, and 50% type IIb cells. Fiber type composition values were not different between WT and KO.

**CONCLUSIONS:** The absence of the protein desmin appears to have no impact on fiber type distribution in the gastrocnemius or tibialis anterior muscle of mice.

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**Board #324**

**MAY 31 2:00 PM - 3:30 PM**

**A Model For Understanding Eccentric Contractions-induced Muscle Damage: Bupivacaine-induced Elevations In Intramyocytic Ca2+**

Tadakatsu Inagaki, Takashi Sonobe, David C. Poole, FACSM, Yutaka Kano. **University of Electro-Communications, Chofu, Japan. National Cerebral and Cardiovascular Center Research Institute, Suita, Japan. The University of Electro-Communications, Chofu, Japan.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.

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**Board #325**

**MAY 31 2:00 PM - 3:30 PM**

**Sources of Variation in Maximal Dorsiflexor Muscle Strength in Young and Older Adults**

Stephen A. Foulis, Anita Christie, Logan Maynard, Jane A. Kent-Braun, FACSM. **University of Massachusetts-Amherst, Amherst, MA.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations offer a potentially powerful mechanistic tool to determine the precise linkage (e.g., degree of perturbation of [Ca2+]i and the duration necessary) between [Ca2+]i and damage within individual myocytes. These are key steps to resolving the mechanisms responsible for ECC-induced muscle damage.

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**Board #326**

**MAY 31 2:00 PM - 3:30 PM**

**Muscle Specific Strength vs. Volume: A Comparison Between Dorsiflexors of Young and Older Adults**

Elizabeth A. Liss, Sara A. Dobos, Stephen J. Neumann, Michael E. Fontaine, John A. Fouts, FACSM. **University of New Mexico, Albuquerque, NM.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.

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**Board #327**

**MAY 31 2:00 PM - 3:30 PM**

**Muscle Strength and Volume: A Comparison Between Dorsiflexors of Young and Older Adults**

Elizabeth A. Liss, Sara A. Dobos, Stephen J. Neumann, Michael E. Fontaine, John A. Fouts, FACSM. **University of New Mexico, Albuquerque, NM.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.

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**Board #328**

**MAY 31 2:00 PM - 3:30 PM**

**Muscle Specific Strength vs. Volume: A Comparison Between Dorsiflexors of Young and Older Adults**

Elizabeth A. Liss, Sara A. Dobos, Stephen J. Neumann, Michael E. Fontaine, John A. Fouts, FACSM. **University of New Mexico, Albuquerque, NM.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.

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**Board #329**

**MAY 31 2:00 PM - 3:30 PM**

**Muscle Specific Strength vs. Volume: A Comparison Between Dorsiflexors of Young and Older Adults**

Elizabeth A. Liss, Sara A. Dobos, Stephen J. Neumann, Michael E. Fontaine, John A. Fouts, FACSM. **University of New Mexico, Albuquerque, NM.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.

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**Board #330**

**MAY 31 2:00 PM - 3:30 PM**

**Muscle Specific Strength vs. Volume: A Comparison Between Dorsiflexors of Young and Older Adults**

Elizabeth A. Liss, Sara A. Dobos, Stephen J. Neumann, Michael E. Fontaine, John A. Fouts, FACSM. **University of New Mexico, Albuquerque, NM.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.

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**Board #331**

**MAY 31 2:00 PM - 3:30 PM**

**Muscle Specific Strength vs. Volume: A Comparison Between Dorsiflexors of Young and Older Adults**

Elizabeth A. Liss, Sara A. Dobos, Stephen J. Neumann, Michael E. Fontaine, John A. Fouts, FACSM. **University of New Mexico, Albuquerque, NM.**

(Max no relationships reported)

**CONCLUSIONS:** Elevations of [Ca2+]i in “whole” muscle and single fibers of rat spinotrapezius muscle.
CONCLUSIONS: Specific strength, voluntary activation, and MUDR were similar in Y & O, indicating no impairment in isometric torque generation with old age. The observation that 76% of the variation in muscle strength was accounted for variation in muscle size in Y, but only 34% in O, suggest that the sources of strength variation do vary by age, but are independent of activation and rate coding. The remaining variation may be due to differences fiber type or muscle architecture.

Methods: Previously it was shown that lengthening the pulse duration increases skeletal muscle activation during isometric actions. However, it is not known whether adjusting the stimulation interface for oxygen delivery and utilization in muscle - have been reported in MM, particularly around respiratory-deficient fibers, despite normal muscle levels of oxygen delivery and low capacity for oxygen extraction. This is surprising given that a low oxygen reserve level, through the stabilization of the Hypoxia Inducible Factor 1α (HIF-1α), is considered the main driver of new capillary growth in skeletal muscle. Interestingly, recent findings from transgenic animals have indicated that fluctuation in cellular energy intermediates could induce angiogenesis through the metabolic regulator PCG-1α, independently of the canonical HIF-1α pathway.

Purpose: To evaluate the hypothesis that elevated PGC-1α in response to a myofiber energy deficit is the mechanism leading to capillary proliferation surrounding fibers containing oxidatively impaired mitochondria in MM muscle.

Methods: A 52 y old male with a single, large-scale mt-DNA deletion causing Cytochrome C Oxidase (COX)-deficiency was studied. In-situ labeling was performed in serial cross-sections obtained from a vastus lateralis muscle biopsy to identify at the single cell level: oxidatively-deficient fibers (histochemical stain for COX); capillary number around a fiber (NCAP, lead-ATPase); PGC-1 content; and fiber type (based on myosin heavy chain protein expression).

Results: Findings revealed that COX-deficient fibers were exclusively type IIa. Interestingly, both NCAP (5.70 ± 1.5 vs. 4.1 ± 0.8, p<0.05) and PGC-1 content (2628 ± 563 vs. 2122 ± 98 AU, p<0.05) were significantly increased in COX-deficient compared to COX normal myofibers.

Conclusions: These results suggest that enhanced myofiber angiogenesis in MM patients is mediated by an increase in PGC-1α expression secondary to energy insufficiency resulting from the severe mt-DNA defect. As such, they provide the first experimental support for the non-canonical regulation of angiogenesis via PGC-1α in humans.
Neuromuscular Parameters For Ramp And Step Incremental Cycle Ergometer Tests

Jorge M. Zuniga1, Chad Harris, FACSM2, Clayton L. Camic2, Terry J. Zuniga, FACSM2, Haley C. Bergstrom3, Daniel A. Traylor3, Miranda T. Goodman1, Richard J. Schmidt4, Glen O. Johnson1. 1Western New Mexico University, Silver City, NM. 2University of Wisconsin-Platteville, Platteville, WI. 3University of Nebraska-Lincoln, Lincoln, NE. (Sponsor: Chad Harris, FACSM)

(No relationships reported)

PURPOSE: The purpose of the study was to examine the patterns of electrical (EMG) and mechanical (MMG) responses, as well as submaximal mean values for step (30 W increments every two min) versus ramp (15 W min−1 increments) incremental cycle ergometer tests.

METHODS: Seven male and seven female (age and body mass = 23.36 ± 3.34 years and 71.65 ± 11.10 kg) visited the laboratory on three separate occasions. The initial visit was an orientation session and the next two visits were randomly ordered step (30 W increments every 2 min) and ramp (15 W min−1 increments, 1 W increase every 4 s) incremental cycle ergometer tests. The EMG and MMG signals were collected from the vastus lateralis of the dominant leg. In addition, the work performed (kJ) during each protocol was calculated. Two-way repeated measures ANOVAs were used to analyze the data. Polynomial regression analyses were used to determine the patterns of responses for the EMG and MMG signals. A paired t-test was used to analyzed the difference in the work performed (kJ) during each protocol. All the data was analyzed using the common power outputs (i.e., 30, 60, 90, 120, and 150 W).

RESULTS: The polynomial regression analyses showed that most subjects had the same patterns of responses for the ramp and step incremental tests for EMG amplitude (79%), but different patterns for MMG amplitude (57%). The ramp incremental cycle ergometer test resulted in significantly (p = 0.03) lower mean (ramp = 127.2 ± 45.1 µVrms and step = 137.5 ± 39.9 µVrms) EMG amplitude values (collapsed across power output) than the step protocol. Furthermore, there was a significantly (p = 0.001) greater amount of work performed at the common power outputs for the step (54.20 ± 0.08 kJ) vs. the ramp (45.66 ± 0.06 kJ) incremental cycle ergometer test.

CONCLUSION: The results of the present study indicated that the different pattern of responses for MMG amplitude associated with changes in motor unit recruitment may be due to the different workload increments (step vs. ramp). Furthermore, the greater mean EMG amplitude values for the step than the ramp protocols suggest that the there was an increase in motor unit activation (i.e., recruitment and firing rate) in response to the greater work performed for the step vs. ramp incremental cycle ergometer test.

Electromyography in relation to body composition of young recreational trained women was not significantly different during a vibration platform training program.
Anti-catabolic Effects Of Cla/n-3 In Resting And Loaded Muscles Of A High Fat Diet-fed Mice

Sang-Rok Lee, Andy V. Khamoun, Edward Jo, Bong-Sup Park, Michael C. Zourdos, Neema Bakhshalian, Samuel C. Grant, Bahram H. Arjmandi, Michael J. Ormsbee, Jeong-Su Kim. The Florida State University, Tallahassee, FL (Sponsor: Lynn B. Panton, FACSM)

(No relationships reported)

Conjugated Linoleic Acid (CLA) and Omega-3 polyunsaturated fatty acids (n-3) have attracted interest due to their health enhancing benefits. However, their efficacy in attenuating high fat diet (HFD)-induced impairments in skeletal muscle remains poorly understood.

PURPOSE: To determine the combined effects of CLA and n-3 intake on muscle morphology as well as transcript levels of catabolic factors in resting and loaded muscle during 20 wks of a HFD.

METHODS: After sacrificing eight randomly selected C57BL/6 male mice (ages 9 mo), for baseline in vivo tissue, the remaining animals were randomly allocated to five experimental groups (n=10/group): 1) normal diet (CON), 2) high fat diet (HFD), 3) HFD + resistance training (HFD/RT), 4) HFD + CLA/n-3 (HFD/HCN), or 5) HFD + RT + CLA/n-3 (HFD/RT/HCN). Progressive RT was administered on a ladder climbing device 3d/wk for 20 wks. The supplement consisted of 1% CLA (0.5% of c9, t11 and 0.5% of t10, c12) and 1% n-3. Muscle wet weight, myofiber dimensions (eigen values and fractional anisotropy (FA) determined from diffusion tensor imaging (DTI)) and transcript levels of catabolic factors were assessed. Data were analyzed with ANOVAs, and significance was set at p<0.05.

RESULTS: There were significant group effects in wet weight. Gastrocnemius wet weight significantly decreased in CON (-27%), HFD (-37%) and HFD/HCN (-25%) from baseline while remaining in HFD/RT and HFD/RT/HCN. Soleus wet weight significantly decreased in HFD (-21%) but was maintained in CON, HFD/HCN, and HFD/RT. In contrast, soleus wet weight increased in HFD/RT/HCN (+19%). While no changes in DTI eigen values were observed, FA was significantly decreased in HFD/RT/HCN (-21%). This indicates a positive effect of CLA/n-3 administration on myofiber hypertrophy as FA is inversely correlated with cross-sectional area. Interestingly, there were trends for greater mRNA expression associated with muscle wasting (i.e. Atrogin-1, MURF1, Cap-3, and Cap-9) in HFD/HCN compared to baseline with no change in HFD/RT/HCN.

CONCLUSION: Twenty-wks of HFD-induced muscle wasting. However, daily CLA/n-3 intake partially attenuated HFD-induced impairments while facilitating RT-induced muscle hypertrophy.

Study partly supported by Sekwang Inc., Vital Pharmaceuticals, and Ocean Nutrition

Association Between Knee Extension Power and Functional Performance in Patients After Total Knee Arthroplasty

Adam R. Marmon, Lynn Snyder-Mackler. University of Delaware, Newark, DE.

Lower extremity functional ability in patients after total knee arthroplasty (TKA) is largely attributed to quadriceps strength, which is generally obtained during isometric tests. However, during functional tasks knee extension contractions are not static, but do require muscle power, as can be tested with isokinetic contractions.

PURPOSE: The aims of this study were: 1) to compare peak knee extension power during isokinetic contractions between the surgical (SL) and non-surgical limbs (NSL) of patients’ six-months after undergoing TKA, and 2) to evaluate the associations between tests of lower extremity performance and peak knee extension power of the SL.

METHODS: Performance-based tests and knee extension power were assessed in patients, six-months after undergoing unilateral TKA. Paired t-tests were used to compare peak knee extension power of the SL and NSL (normalized to body mass) at three isokinetic speeds (60, 90, 120 deg/s). The functional relevance of knee extension power was assessed with Pearson’s correlation analyses between peak knee extension power by the SL and performance measures.

RESULTS: Preliminary data are presented (N=4). Peak normalized knee extension power was not significantly different between the limbs of patients 6-months after TKA (60 deg/s SL 2.3 ± 1.0 vs NSL, 2.3 ± 0.9; 90 deg/s SL 3.0 ± 1.5 vs NSL 2.9 ± 1.3; 120 deg/s SL 3.4 ± 1.1 vs NSL 3.4 ± 1.6 W/kg). Peak knee extension power was strongly associated with performance measures (Table 1).

CONCLUSION: Understanding the functional relevance of dynamic knee extension strength may have implications on the treatment of patients after TKA and serve as a useful assessment tool for evaluating post-surgical interventions.

Table 1. Correlation coefficients between power and performance measures. *P<0.05; **P<0.01

<table>
<thead>
<tr>
<th>Test</th>
<th>SL vs NSL 60 deg/s</th>
<th>SL vs NSL 90 deg/s</th>
<th>SL vs NSL 120 deg/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Up-and-Go</td>
<td>-0.926</td>
<td>-0.944</td>
<td>-0.998**</td>
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<tr>
<td>Stair Climbing Test</td>
<td>-0.924</td>
<td>-0.928</td>
<td>-0.999**</td>
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<td>6-Minute Walk</td>
<td>0.988**</td>
<td>0.999**</td>
<td>0.904</td>
</tr>
</tbody>
</table>

Association Between Knee Extension Power and Functional Performance in Patients After Total Knee Arthroplasty

Steve H. Faulkner1, Richard A. Ferguson1, Nicola Gerrett1, Simon G. Hodder1, Maarten Hupperets2, George Havenith1. 1Loughborough University, Loughborough, United Kingdom. 2Adidas AG, Herzogenaurach, Germany.

(No relationships reported)

Elevations in muscle temperature (Tm) have been shown to be important for enhancing maximal muscle power output during short duration, sprint based activities, hence the completion of a warm up prior to many exercise types. However, in many sporting activities and competition it is not uncommon for there to be delays between warm up completion and performance execution, during which time activity levels may be insufficient to maintain elevations in Tm. Excessive decline in Tm may lead to sub-optimal contractile conditions and impaired exercise performance.

PURPOSE: To determine whether a delay between warm up and competition may influence Tm and performance and whether this may be attenuated using an insulated athletic pant.

METHODS: On two separate occasions, 11 male cyclists (24±5 yrs; 182.4±7.6cm; 77.4±10.0 Kg) completed a standardized 15 min intermittent sprint-based warm up on a cycle ergometer, followed by a 30 min passive recovery period before completing a 30 sec maximal sprint test. Tm of the vastus lateralis was measured at depths of 1, 2 and 3 cm prior to and following the warm up and immediately before the sprint test. Measures of absolute and relative peak power output and blood lactate were taken. During the recovery period subjects wore a trusskit top and either i) a standard trusskit ensemble (CONT) or ii) a pair of insulated athletic pants (INS).

RESULTS: The warm up increased Tm at all depths by ~2.5°C, with no differences between conditions. During the recovery period INS Tm declined to similar values at 1cm (36.5±0.6°C vs. 36.3±0.4°C, INS vs. CONT), 2cm (36.7±0.4 vs. 36.6±0.3°C) and 3cm (37.0±0.3°C vs. 36.9±0.2°C). There were no differences for INS vs. CONT in absolute (1545.1 ± 2660 W vs. 1468.2 ± 260.2 W), relative (20.3 ± 2.3 vs. 19.2 ± 1.7 W/kg) and mean power output (707.8 ± 127.9 Vs. 711.4 ± 153.1W) nor in ∆blood lactate concentration following the sprint test (4.8 ± 2.3 vs. 4.1 ± 0.9mmol/L).

CONCLUSION: The use of an insulated athletic trouser has little benefit at reducing the decline in Tm that is associated with forced periods of inactivity between warm up completion and competition.

Insulated Athletic Pants Do Not Prevent Muscle Temperature Decline Following Warm Up Nor Benefit Performance

Adam R. Marmon, Lynn Snyder-Mackler. University of Delaware, Newark, DE.

Association Between Knee Extension Power and Functional Performance in Patients After Total Knee Arthroplasty

Steve H. Faulkner1, Richard A. Ferguson1, Nicola Gerrett1, Simon G. Hodder1, Maarten Hupperets2, George Havenith1. 1Loughborough University, Loughborough, United Kingdom. 2Adidas AG, Herzogenaurach, Germany.

(No relationships reported)

Elevations in muscle temperature (Tm) have been shown to be important for enhancing maximal muscle power output during short duration, sprint based activities, hence the completion of a warm up prior to many exercise types. However, in many sporting activities and competition it is not uncommon for there to be delays between warm up completion and performance execution, during which time activity levels may be insufficient to maintain elevations in Tm. Excessive decline in Tm may lead to sub-optimal contractile conditions and impaired exercise performance.

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It is well known that starvation causes insulin resistance. The mechanism is unclear but may relate disturbances in lipid metabolism i.e. incomplete mitochondrial FA oxidation and/or accumulation of lipid intermediates. Exercise results in increased substrate oxidation and may thus remove interfering lipid metabolites and reverse starvation-induced insulin resistance. However, the effect of acute exercise and starvation on insulin sensitivity is not known.

**METHODS:** Nine healthy lean subjects underwent 84h starvation on two occasions separated by at least 2 weeks. The starvation period was followed by either exercise (EX; 5x10 min intervals with 2-4 min rest, starting at 70 % VO_{2} max) or an equal period of rest (NE). Before and after the starvation period (3h after exercise/rest) subjects were investigated with muscle biopsies, blood samples and an intravenous glucose tolerance test. Muscle samples were used for measurements of mitochondrial respiration in permeabilized muscle fibers (Oroboros oxygraph), glycogen content and activation of signaling proteins.

**RESULTS:** Insulin sensitivity was significantly higher in the EX group compared to the NE group (p<0.05). After starvation mitochondrial respiration was lower in both groups with complex I substrates whereas respiration with complex I+II substrates was higher in EX (p<0.05 vs. basal and NE). Muscle glycogen was decreased to 73% (NE) and 31% (EX) of the basal values. The EX group had a significant increased activation of AS160. Plasma FA was increased 3-4 fold after starvation to 1.39±0.32 (NE) and 1.80±0.49 (EX) (mmol/l) and plasma beta-hydroxybutyrate increased about 50-fold to 6.43±2.01 (NE) and 7.12±1.59 (EX)(mmol/l).

**CONCLUSION:** Acute exercise reverses starvation-induced insulin resistance. Plasma FA and BOH were increased to similar extent after NE and EX and cannot explain the changes in insulin sensitivity. However, an increased substrate oxidation together with the observed increased capacity for mitochondrial FA oxidation after EX may be involved in the activation of AS160 and the reversal of starvation-induced insulin resistance.
RESULTS: Significant reductions in MVC were noted following the S treatment (-5.30±2.40kg, p<0.01), but not for the MS treatment (+0.52±0.26kg, p = 0.06). No significant changes in PA were observed for either the S (+0.31±1.33°, p = 0.27) or MS (+0.41±1.12°, p = 0.09) treatments. The relationship between PA and MVC was found to be insignificant (p = 0.946).

CONCLUSION: PA change was not a mechanism which contributed to the reduction in MVC due to stretching.

**Board #340**

**MAY 31 2:00 PM - 3:30 PM**

**Relationship Between Oxidative Capacity And Work Capacity With 3-week Upper Limb Immobilization**

Shinsuke Nirengi, Toshiyuki Kurihara, Masako Fujikawa, Takeshi Saiki, Takafumi Hamaoka, FACSM. **Ritsumeikan University, Shiga, Japan.** (Sponsor: Takafumi Hamaoka, FACSM)

(No relationships reported)

It is well known that muscle disease causes decreased muscle mass, muscle strength, and muscle oxidative capacity. On the other hand, the change in work capacity following muscle disease and its mechanism remain to be conclusive. We have chosen a 3-week upper limb immobilization that created only muscle functional decline without muscle mass reduction (Homma et al., 2009).

**PURPOSE:** To investigate whether the 3-week immobilization without muscle function decline and to clarify the relationship between oxidative capacity and work capacity with the 3-week upper limb immobilization.

**METHODS:** Eight healthy men (19.5±0.9 years, mean±SD) participated in this study. For all subjects non-dominant arm was immobilized for 3 weeks with a cast (IMM) and the dominant arm was measured as control (CON). We measured the following parameters for participant pre- and post-immobilization: maximal voluntary contraction (MVC) of the grip, forearm cross-sectional area (CSA), work capacity per CSA (dynamic handgrip exercise at 30% of MVC of the day, 1 Hz until exhaustion). The oxidative capacity was evaluated by the time constant for the recovery of phosphocreatine (PCrTC) using 1H-phosphorus-magnetic resonance spectroscopy (1H-MRS).

**RESULTS:** There was no significant change in CSA (pre: 3604±662 mm², post: 3568±607 mm²) pre- and post-immobilization, MVC (pre: 415.5±72.4 N, post: 305.9±80.5 N), PCrTC (39.6±10.6 s, 58.4±14.4 s), and work capacity (0.55±0.18 Nm²/m², 0.42±0.16 Nm²/m²) were significantly decreased post-immobilization. A negative correlation was found between work capacity and PCrTC (r = -0.62, p<0.01) pre-immobilization, but no correlation was observed between the change (post - pre) in PCrTC and work capacity pre- and post-immobilization.

For all the measurements there was no significant difference observed between pre- and post- intervention in the CON.

**CONCLUSIONS:** The work capacity and the oxidative capacity were decreased, but the decrease in the work capacity showed no relationship in oxidative capacity post immobilization.

**Board #341**

**MAY 31 2:00 PM - 3:30 PM**

**The Effect of Low-Pressure Functional Elastic-Property Tights on Reoxygenation Recovery Following Exhaustive Knee Extension Exercise**

Kohei Kido1, Shinsuke Nirengi1, Yuko Kurosuwa1, Masako Fujikawa1, Tetsuya Kinmura1, Toshiyuki Kurihara1, Keita Sato1, Yutaka Ishida2, Fumiko Nakamura2, Junko Deguchi2, Shoichi Akita1, Takafumi Hamaoka, FACSM1. **Ritsumeikan University, Shiga, Japan.** 2Kokugakuin University, Tokyo, Japan. 3Asahi Kasei Fibers Corporation, Shiga, Japan. (Sponsor: Takafumi Hamaoka, FACSM)

(No relationships reported)

In recent years, various types of functional tights such as graduated compression tights have been used to aim at enhancing athletic performance. However, there is limited information about the effect of low-pressure functional elastic-property tights (TightsLP) on physical performance and muscle metabolism.

**PURPOSE:** To clarify the effects of TightsLP on muscle oxygenation in the rectus femoris (RF) and vastus lateralis (VL) muscles during exhaustive knee extension exercise.

**METHODS:** Six subjects performed knee extension exercise on the dominant leg using isokinetic ergometer (Biodex). The maximal load torque (Wmax) for each subject was determined using the ramp exercise test (20 Nm increment per a stage from 20 Nm until exhaustion). The subjects performed three sets of exhaustive exercise at Wmax, with one contraction every 2.5 s, followed by the active recovery (30%Wmax each for 5 min). The subjects performed the knee extension exercise with or without TightsLP (Electron PRO, soft type, Asahi Kasei Fibers Corporation). Muscle deoxygenation using near infrared spectroscopy and electromyography (EMG) activity in the RF and VL were simultaneously measured during both the Wmax and the active recovery. The muscle fatigue index was defined as the ratio between the mean square RMS of the last 36 s (RMS36) and the RMS of the initial 36 s (RMS0) during 30%Wmax. Leg blood flow was measured using ultrasonic Doppler in the femoral artery during the active recovery.

**RESULTS:** The recovery half time of muscle reoxygenation was significantly shortened with the TightsLP for the second set in the RF (P<0.05) and the VL (P<0.05) and, although it did not reach statistical significance, for the third set in the VL (P=0.06). The muscle fatigue index showed a decrease tendency for the third set in the RF (P=0.08). Blood flow during 30%Wmax showed a increase tendency with the TightsLP.

**CONCLUSIONS:** We found that TightsLP was effective for the faster recovery from muscle deoxygenation and gradual decline in muscle fatigue index during 30%Wmax, suggesting an enhancement of blood flow (venous return) in the lower limb without low-intensity active recovery.

**Board #342**

**MAY 31 2:00 PM - 3:30 PM**

**Regulators of Muscle Hypertrophy are Unaffected by Free Leucine Supplementation in Older Individuals**

Matthew Cooke1, Annie Allison2, Clayton Dorsa3, Carrie Nie2, Jorge Raudales2, Brian Shelmadine2, Matthew McPeeters2, Paul La Bounty3, Mike Greenwood, FACSM1. **Darryn Wilkoughby, FACSM2.** 3Victoria University, Melbourne, Australia. 2Baylor University, Waco, TX. 3Texas A&M, College Station, TX.

(No relationships reported)

**METHODS:** Twenty three non-resistance trained males (61.22±7.13 yrs, 176.93±5.99 cm, 92.59±14.59 kg) were randomized in a double blind manner. Participants ingested either leucine (LEU) [3.6g/d LEU + 5g carbohydrate (CHO)] or maltodextrin (CHO) (5g/d CHO) while participating in a supervised high intensity resistance training program (3 sets x 10 repetitions at 75% of 1RM), 3 days per week for 12 weeks. Testing sessions were completed prior to (0 weeks), 4 weeks, 8 weeks and 12 weeks post resistance training and supplementation. Each testing session included blood collection and vastus lateralis muscle biopsy. The blood serum was analyzed for IGF-1, free testosterone and HGF and the muscle tissue for phosphorylated c-Met. Data was analyzed using repeated measures ANOVA.

**RESULTS:** No significant time effects were observed for serum free testosterone (0 weeks:18.79±11.2pg/ml vs. 12 weeks: 18.19±12.9pg/ml, p=0.862), IGF-1 (0 weeks:0.68±0.50pg/ml vs. 12 weeks:0.68±0.58pg/ml, p=0.809), HGF (0 weeks:267.28±289.14pg/ml vs. 12 weeks:173.32±177.04pg/ml, p=0.192), or phosphorylated c-Met (0 weeks:0.105±0.185ng/mg vs. 12 weeks:0.230±0.239ng/mg, p=0.09). Furthermore, no significant group or group by time interactions were observed.

**CONCLUSIONS:** The ingestion of free leucine with carbohydrate, as compared to carbohydrate alone, when combined with 12-weeks of high intensity resistance training was unable to enhance serum IGF-1 and testosterone levels and/or indirect markers of satellite cell activation in older males.
PURPOSE: This study was aimed to examine the effect of regular exercise on different tissues oxygenation in retired female basketball players.

METHODS: In this study, retired domestic A-class female basketball players were recruited. All subjects were categorized into two groups as non-exercise (n=6, aged 56.7±2.14) and regular exercise (n=6, aged 57.2±1.6) groups. Each subject’s oxygenation for different tissues including left and right side of forehead, upper triceps and lower gastrocnemius muscle. Oxygenation include total hemoglobin, oxyhemoglobin, de-oxymeglobin and oxygen saturation were determined by using near infrared spectroscopy (NIRS) at sitting position in a quite environment.

RESULTS: We found muscle total hemoglobin, oxyhemoglobin, deoxyhemoglobin and oxygen saturation was not significantly different for brain, triceps and gastrocnemius muscle. We speculate that retired athletes who participated in regular exercise may have better oxygenation. However our data didn’t show this trend.

CONCLUSIONS: The reason behind no changes in oxygenation levels between non-exercise and exercise elder athletes might be the measurement of oxygenation at sitting position. Hence, we recommend further studies to measure the oxygenation levels during dynamic process.

INTRODUCTION: Potentiation may be induced following a conditioning contraction which can either be evoked (post-tetanus (PT)) or voluntary (postactivation (PA)). However, these conditioning contractions activate the muscle fibers using dissimilar combinations of motor unit discharge rate and recruitment pattern. Additionally, evoked contractions exclude the central nervous system, which is active during a voluntary contraction.

PURPOSE: To explore whether PT potentiation of contractile properties differs from PA potentiation, in the human tibialis anterior.

METHODS: In 8 recreationally active male subjects (age ~26.0 y), we assessed potentiation of isometric contractile properties by comparing baseline contractions to PT and PA contractions. In the following order, baseline measurements were: maximal twitch torque and peak rate of twitch torque development, maximal evoked 50Hz torque, and maximal voluntary (ballistic) peak rate of torque development. In random order, potentiation was induced by either a 10s 50Hz evoked contraction, or a torque-matched 10s voluntary contraction (~76% MVC torque). Immediately following the conditioning contraction, two twitches were evoked followed by two maximal voluntary ballistic contractions. Prior to all conditioning contractions, subjects rested for a minimum of 6 min, and twitch torque had returned to baseline.

RESULTS: Baseline twitch torque was 5.7±1.9 Nm, which was potentiated equally (P=0.05) for PT (9.5±2.4 Nm), and PA (9.3±3.4 Nm) contractions. Peak rate of twitch torque development at baseline was 182.1±44.9 Nm/s, and was increased equally (P=0.05) for PT (305.8±65.2 Nm/s), and PA (290.9±89.1 Nm/s) contractions. Ballistic rate of torque development was not different between baseline, PT, or PA (P > 0.07).

CONCLUSIONS: For this experimental paradigm, PT and PA have similar potentiating effects on twitch contractile properties, and neither significantly potentiates voluntary rate of torque development immediately following either tetanus or voluntary activation.

Supported by NSERC

6269 Board #345 MAY 31 2:00 PM - 3:30 PM
Skilled Muscle Metabolism and Glucose Tolerance after Spinal Cord Injury; Influence of Intramuscular Fat and Injury Duration
Terence E. Ryan, Jared T. Brizendine, Hui-Ju Young, Melissa L. Erickson, Kevin K. McCully, FACSM. The University of Georgia, Athens, GA.

No relationships reported

Spinal cord injury (SCI) represents one of the most extreme health conditions resulting in physical inactivity, especially in the paralyzed musculature. This lack of muscle activity results in muscle atrophy, increases in intramuscular fat, and reduced mitochondrial function.

PURPOSE: To examine the relationships between injury duration and intramuscular fat (IMF), mitochondrial function, and glucose tolerance in individuals with complete (AIS-A) SCI.

METHODS: Eleven individuals (2 female) with chronic (1.7-22.1 years post-injury) SCI gave informed consent prior to testing. All subjects completed a standard 75-gram oral glucose tolerance test at the Shepherd Hospital (Atlanta, GA). Blood samples were taken and analyzed for glucose and insulin. Magnetic resonance testing was performed in a 3 Tesla magnet. Axial T1-weighted magnetic resonance images of the thighs were collected to assess muscle volume and IMF. Muscle metabolism of the m. vastus lateralis was measured as the rate of phosphocreatine recovery after electrical stimulation using 31P MRS. Statistical significance was tested using a one-tailed t-test.

RESULTS: The results showed relationships between the duration of injury and mitochondrial impairment (r=0.58, p=0.03), IMF and mitochondrial impairment (r=0.58, p=0.03), and IMF and glucose tolerance (r=0.59, p=0.026). In this study we found no relationship between mitochondrial function and glucose tolerance.

CONCLUSIONS: The duration of spinal cord injury appears to be related to the degree of mitochondrial dysfunction and level of intramuscular fat. Intramuscular fat may be a predictor of glucose tolerance; while the role of mitochondrial function in glucose tolerance is still being investigated. Future studies will help guide the development of effective interventions to improve the health of individuals with spinal cord injury.

Supported by NIH Grant RO1 HD039676.

6267 Board #346 MAY 31 2:00 PM - 3:30 PM
Skeletal Muscle Mitochondrial and Lipid Droplet Volume Density: Validity of Electron Microscopy Point-counting Measurements
Nicholas T. Broskey, Jean Daraspe, Bruno M. Humbel, Francesca Amati. University of Lausanne, Lausanne, Switzerland. (Sponsor: Elizabeth F. Nagle, FACSM)

No relationships reported

Mitochondrial (M) and lipid droplet (L) volume density (vd) are often used in exercise research. Vd is the volume of muscle occupied by M and L. The means of calculating these percent are accomplished by applying a grid to a 2D image taken with transmission electron microscopy; however, it is not known which grid best predicts these values.

PURPOSE: To determine the grid with the least variability of Mvd and Lvd in human skeletal muscle.

METHODS: Muscle biopsies were taken from vastus lateralis of 10 healthy adults, trained (N=6) and untrained (N=4). Samples of 5-10mg were fixed in 2.5% glutaraldehyde and embedded in EPOE. Longitudinal sections of 60 nm were cut and 20 images were taken at random at 33,000x magnification. Vd was calculated as the number of times M or L touched two intersecting grid lines (called a point) divided by the total number of points using 3 different sizes of grids with squares of 1000x1000nm sides (corresponding to 1μm²), 500x500nm (0.25μm²) and 250x250nm (0.0625μm²). Statistics included coefficient of variation (CV), 1 way-ANCOVA and spearman correlations.

RESULTS: Mean age was 67 ± 4 yo, mean VO2peak 2.29 ± 0.70 L/min and mean BMI 25.1 ± 3.7 kg/m². Mean Mvd was 6.39% ± 0.71 for the 1000nm squares, 6.01% ± 0.70 for the 500nm and 6.37% ± 0.80 for the 250nm. Lvd was 1.28% ± 0.03 for the 1000nm, 1.41% ± 0.02 for the 500nm and 1.38% ± 0.02 for the 250nm. The mean CV of the three grids was 6.65% ± 0.15 for Mvd with no significant differences between grids (P>0.05). Mean CV for Lvd was 13.83% ± 3.51, with a significant difference between the 1000nm squares and the two other grids (P=0.05). The 500nm squares grid showed the least variability between subjects. Mvd showed a positive correlation with VO2peak (r = 0.89, p < 0.05) but not with weight, height, or age. No correlations were found with Lvd.

CONCLUSION: Different size grids have different variability in assessing skeletal muscle Mvd and Lvd. The grid size of 500x500nm (240 points) was more reliable than 1000x1000nm (56 points). 250x250nm (1023 points) did not show better reliability compared with the 500x500nm, but was more time consuming. Thus, choosing a grid with square size of 500x500nm seems the best option. This is particularly relevant as most grids used in the literature are either 100 points or 400 points without clear information on their square size.
RESULTS:
CONCLUSIONS:

Exercise countermeasures have been frequently tested during 2 weeks of BR. Resistance exercise (3 d · wk⁻¹) consisted of squat, leg press, hamstring curl, and heel raise (3 sets, 12 repetitions). Aerobic (6 d · wk⁻¹) sessions alternated continuous (75% VO₂ peak) and interval exercise (30s, 2 & 4min) and were completed on a supine cycle ergometer and vertical treadmill. Muscle volumes were calculated pre, mid, and post-BR using magnetic resonance imaging. Maximal isometric force (MIF), rate of force development (RFD), and peak power were measured twice before BR (averaged to represent pre) and once post BR. ANOVA with repeated measures and a priori planned contrasts tested differences.

RESULTS:

Table 1

<table>
<thead>
<tr>
<th>Muscle Group</th>
<th>Pre</th>
<th>Mid</th>
<th>Post</th>
<th>% change*</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadriceps (mL)</td>
<td>974 ± 104</td>
<td>989 ± 104</td>
<td>992 ± 109</td>
<td>+1.84%</td>
<td>0.083</td>
</tr>
<tr>
<td>Hamstrings (mL)</td>
<td>466 ± 76</td>
<td>468 ± 82</td>
<td>471 ± 83</td>
<td>+0.70%</td>
<td>0.662</td>
</tr>
<tr>
<td>Adductors (mL)</td>
<td>386 ± 57</td>
<td>382 ± 67</td>
<td>377 ± 63</td>
<td>-1.03%</td>
<td>0.321</td>
</tr>
</tbody>
</table>

Mean ± SD *Pre to Post: 1ANOVA time effect

CONCLUSION: A combination of high intensity, short duration exercise countermeasures performed during 2 weeks of BR increased concentric power and protected muscle from unloading induced atrophy and dysfunction.

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Prolonged inactivity results in skeletal muscle atrophy including increased reactive oxygen species generation, inflammation, protein degradation, and weight loss. Over-expression of peroxisome proliferator-activated receptor-γ coactivator-1α (PGC-1α) has been shown to increase mitochondria biogenesis and reduce oxidative stress. **PURPOSE:** Thus, we hypothesize that PGC-1α over-expression may ameliorate skeletal muscle atrophy caused in rats.

**METHODS:** FVB/N mice (Age 8 mo; N=20) were randomly divided into four groups; (1) control and injected with empty vehicle (GFP) transfection (Con-GFP); (2) control and injected with Flag-PGC-1α (Con-PGC-1α); (3) 3 days nebulization after 2 weeks of immobilization with hindlimb banding and injected with GFP (RM-GFP); and (4) RM and injected with PGC-1α (RM-PGC-1α). GFP or PGC-1α was injected to tibialis anterior (TA) muscle of one of the hindlimbs with a skeletal muscle gene electroporation.

**RESULTS:** There was a decrease in Cytochrome C (Cyt C) expression after 2 weeks immobilization, whereas Cyt C was significantly increased by ~3.9-fold in both Con and RM groups with PGC-1α in vivo transfection. RM mediated ~20% decrease in Tfm expression (p<0.05), however, its level was restored by PGC-1α overexpression in RM group (p<0.01). mtDNA:αDNA ratio was decreased by 72% in RM groups (p<0.01), whereas PGC-1α increased the mtDNA significantly (p<0.05). PGC-1α increased cytochrome c oxidase (COX) activity by 55% in CON (p<0.05) and by 29% in RM and mitochondrial ATP production rate (MAPR) was increased by 18% in RM-PGC-1α (p<0.05).

**Conclusions:** PGC-1α enhanced mitochondrial biogenesis and oxidative capacity in the recovery of skeletal muscle from disuse atrophy.

**PURPOSE:** The aim of this study was to investigate the effect of sex-related on local muscle oxygenation kinetics and oxygen desaturation through relative intensity exercise.

**METHODS:** Nine male (M) (aged 65 ± 2.2 yr) and seven female (F) (aged 60 ± 5.7yr) were recruited. All subjects performed 20, 30, 40, 50 and 60% maximum voluntary contraction (MVC) of knee extension exercise by a custom-made isometrics strength device. Local muscle oxygenation was recorded by a frequency-domain Near-infrared spectroscopy (Imagent, ISS Inc.). Infrared light of 690 and 830 nm wavelengths were applied to estimate hemodynamic parameters of vastus lateralis obliquus muscle. Outcome measures derived from oxy-hemoglobin (Hb), deoxy-Hb, total Hb (Hbt) and oxygen saturation using a hyperbolic tangent equation to fit the oxygen saturation curves of exercise phase and recovery phase. Inflection time (time to reach 50% of the change range) represents the efficiency of reaching steady-state level. Time constant (the changing rate of oxygen desaturation) was used to represent the characteristic of oxygenation adjustment during isometrics contraction. The minimum and maximum values of each phase will be found to estimate the change volume. The dependent variables both groups were compared by Mann-Whitney U test.

**RESULTS:** In exercise phase, the inflection time in M was longer than F at 60% MVC (41.66 ± 2.52s vs. 38.71 ± 2.75s, p<0.05). Time constant was significantly lower in F than M at 20% MVC (4.2 ± 2.21 vs. 6.92 ± 2.17, p<0.05) and a larger constant time in W at 40% MVC (7.99 ± 1.53 vs. 5.16 ± 1.36, p<0.05). A great oxygen desaturation in man at 20% MVC (8.51 ± 5.79% vs. 2.17 ± 1.32%, p<0.05), 30% MVC (11.51 ± 7.26% vs. 4.18 ± 2.18%, p<0.05), 50% MVC (14.96 ± 7.82% vs. 7.92 ± 4.02%, p<0.05) and 60% MVC (15.75 ± 8.23% vs. 8.64 ± 2.46%, p<0.05) for all genders were used.

**Conclusions:** At the same relative exercise intensity, female reduce oxygen consumption which can support energy demand during muscle contraction. The results suggest that sex-related difference in muscle oxygenation can be observed in exercise phase. Future, it is important to find the sex-related difference in muscle oxygenation at other age levels to get a better understanding on sex-related factor.

**Board #350**

**MAY 31 2:00 PM - 3:30 PM**

**Pgc-1α Enhances Skeletal Muscle Recovery From Disuse Atrophy**

Choung-Hun Kang, Craig Goodman, Troy Hornberger, Li Li Jia, FACSM. University of Wisconsin-Madison, Madison, WI.

**No relationships reported.**

**Board #351**

**MAY 31 2:00 PM - 3:30 PM**

**Sex-Related Difference in Muscle Oxygenation Kinetics during Isometrics Contraction in Older Adults**


**No relationships reported.**

**PURPOSE:** The goal of the present study was to analyze the activity and protein expression of the antioxidant enzymes catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPx) as well as a lipid peroxidation biomarker (thiobarbituric acid reactant substances; TBA-R) in the skeletal muscle of rats subjected to swimming exercise.

**METHODS:** Eighteen male Wistar rats were used. With 90 days of age, the animals were divided into 2 groups: Control Group (C: n=10); rats maintained as sedentary controls; Trained Group (T: n=8); rats subjected to swimming exercise. The exercise protocol consisted of 1h/day of swimming exercise, 5x/week, during 8 weeks. The animals carried out overload equivalent to 20% MVC (4.2 ± 2.21 vs. 6.92 ± 2.17, p<0.05) and a larger constant time in W at 40% MVC (7.99 ± 1.53 vs. 5.16 ± 1.36, p<0.05). A great oxygen desaturation in man at 20% MVC (8.51 ± 5.79% vs. 2.17 ± 1.32%, p<0.05), 30% MVC (11.51 ± 7.26% vs. 4.18 ± 2.18%, p<0.05), 50% MVC (14.96 ± 7.82% vs. 7.92 ± 4.02%, p<0.05) and 60% MVC (15.75 ± 8.23% vs. 8.64 ± 2.46%, p<0.05) for all genders were used.

**CONCLUSIONS:** At the same relative exercise intensity, female reduce oxygen consumption which can support energy demand during muscle contraction. The results suggest that sex-related difference in muscle oxygenation can be observed in exercise phase. Future, it is important to find the sex-related difference in muscle oxygenation at other age levels to get a better understanding on sex-related factor.

**Board #352**

**MAY 31 2:00 PM - 3:30 PM**

**Protein Expression and Activity of Antioxidant Enzymes in the Muscle of Rats Subjected to Exercise**

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**No relationships reported.**

**PURPOSE:** To examine the expression of type IV collagen and its degrading enzymes MMP-2 and MMP-9 in slow and fast-twitch muscles of younger (3 month old) and older (22 month old) mice.

**METHODS:** Younger and older WT mice were run on a rodent treadmill at a 17% downhill gradient at 15 meters/min for 3 bouts of 30 min. Blood was taken pre, immediately post, and 1 day post-exercise. Gastrocnemius (GAST) and soleus (SOL) muscles were isolated and trunk blood collected 1 day post-exercise. Semi-quantitative PCR was performed to determine levels of MMP-2, MMP-9, and TIMP-1 mRNA. Plasma MMP-2, pro-MMP-9, total MMP-9, and TIMP-1 protein levels were determined by ELISA assay. Type IV collagen immunohistochemistry was performed on 10-um-thick serial cross sections of GAST and SOL. Threshold analysis using ImageJ was performed to determine collagen-staining quantity.
RESULTS: The relative percentage of type IV collagen immunostaining was significantly greater in muscle sections from older GAST and SOL compared to younger muscle. Plasma levels of MMP-2 were significantly lower in older compared to younger mice, while neither pro- nor total plasma MMP-9 levels differed between younger and older mice. MMP-2 mRNA levels were significantly lower in both GAST and SOL of older mice compared to younger mice. Plasma TIMP-1 levels were significantly higher in older compared to younger mice, however TIMP-1 mRNA levels did not differ between the two age groups but were greater in the SOL compared to the GAST.

CONCLUSION: Age-related changes in systemic and/or muscle MMP-2 expression may contribute to the accumulation of type IV collagen observed in aging muscle. Supported by NIH Grant KO1 AR050505-0

2679 Board #354 MAY 31 2:00 PM - 3:30 PM Intramuscular Doxorubicin Accumulation and Skeletal Muscle Function
Eric C. Bredahl, Noah M. Gibson, Stephanie E. Greufe, Keith B. Pfannenstiel, Traci L. Parry, Carole M. Schneider, FACSM, Reid Hayward, David S. Hydock, University of Northern Colorado, Greeley, CO.

(Doxorubicin (DOX) is powerful anthracycline antibiotic used to treat a wide variety of cancers. DOX has been linked to debilitating side effects, and recent studies have reported a DOX-induced decline in skeletal muscle function. However, the connection between intramuscular DOX accumulation and muscle dysfunction has yet to be determined.

PURPOSE: To evaluate the effects of DOX on type I and type II muscle function and DOX accumulation.

METHODS: Male Sprague-Dawley rats received 15 g/kg DOX i.p. (n=27) or an equivalent volume of saline i.p. as a control (CON, n=11). Soleus (SOL) and extensor digitorum longus (EDL) function was assessed ex vivo 1 day (n=9), 3 days (n=10), or 5 days (n=8) post DOX injections. DOX accumulation in skeletal muscle was then assessed using high performance liquid chromatography.

RESULTS: No significant SOL or EDL maximal twitch force differences were observed 1 day or 3 days post DOX when compared to CON (p>0.05). However, SOL maximal twitch force 5 days post DOX was significantly lower than CON (19±5 mN vs. 39±3 mN, respectively, p<0.01), and EDL maximal twitch force 5 days post DOX was significantly lower than CON (34±4 mN vs. 76±8 mN, respectively, p<0.01). SOL DOX accumulation at 1, 3, and 5 days post injection was (in mg DOX/g of tissue) 425±32, 299±67, and 117±24, respectively whereas EDL DOX accumulation at 1, 3, and 5 days post injection was (in mg DOX/g of tissue) 269±35, 147±29, and 168±45, respectively. The only significant DOX accumulation difference observed between SOL and EDL was at day 1 (p<0.01). Significant reductions in intramuscular DOX levels were observed in SOL between days 1 and 5 (p<0.01) and days 3 and 5 (p<0.05), but significant reductions in intramuscular DOX levels were not observed between days 1, 3, or 5 in the EDL (p<0.05).

CONCLUSIONS: Although DOX treatment resulted in depressed skeletal muscle function in both the SOL and EDL, differences in intramuscular DOX accumulation and clearance were observed between the SOL and EDL. DOX levels were higher in the SOL when compared to EDL, but this elevated level also declined significantly over time in the SOL suggesting differential accumulation and clearance of DOX in type I and type II muscle.

2680 Board #355 MAY 31 2:00 PM - 3:30 PM Skeletal Muscle Quality Is Associated With Physical Function In People With COPD
Priscila Robles1, Dina Brooks1, Roger Goldstein2, Ali Naraghi2, Marshall Sussman2, Larry White2, Sunita Mathur1, University of Toronto, West Park Healthcare Centre, Toronto, ON, Canada. 1University of Toronto, University Health Network, Toronto, ON, Canada.

(Doxorubicin (DOX) is powerful anthracycline antibiotic used to treat a wide variety of cancers. DOX has been linked to debilitating side effects, and recent studies have reported a DOX-induced decline in skeletal muscle function. However, the connection between intramuscular DOX accumulation and muscle dysfunction has yet to be determined.

PURPOSE: To compare skeletal muscle quality in people with COPD to controls using magnetic resonance imaging and proton spectroscopy (MRI/1H-MRS) and to correlate it with measures of muscle function and physical activity.

METHODS: Seven individuals with moderate to severe COPD and seven control subjects underwent T1-weighted MRI at 1.5T to obtain maximal muscle cross-sectional area (CSAmax) of the quadriceps, hamstrings, dors- and plantar-flexors, and 1H-MRS of the vastus lateralis and soleus muscles to obtain lipid:water ratio. Isometric and isokinetic peak torque of the same muscle groups, six-minute walk distance (6MWD) and physical activity levels using a questionnaire (PASE score) were also assessed.

RESULTS: People with COPD and controls were matched for age (72±6.7 vs 69±9.3 yrs), sex (3 males, 4 females) and body mass index (25±6.2 vs 25±4.6 kg/m²). Compared with controls, people with COPD had ~ 30% lower CSAmax of the quadriceps, hamstrings and plantarflexors (p < 0.05); however, muscle strength of the same muscle groups was ~ 60% lower in people with COPD (p < 0.05). Lipid:water ratio was ~ 55% higher in COPD vs controls for the vastus lateralis and soleus (p<0.003; p<0.02). 6MWD was lower in people with COPD (248 m vs 639 m; p=0.02); however, no difference was observed between groups for PASE score. CSAmax of the quadriceps and plantarflexors were correlated with peak torque (r=0.87; r=0.83). Correlation were also observed between lipid:water ratio and peak torque (r=-0.93), 6MWD (r=-0.91) and PASE scores (r=-0.89). CONCLUSION: Muscle atrophy and greater fatty infiltration was observed across thigh and calf muscles of people with COPD and was associated with muscle strength, 6MWD and physical activity. Functional impairments in muscle strength were more profound than muscle atrophy and highly associated with poor muscle quality in people with COPD.

Support by Ontario Respiratory Care Society, University of Toronto (Dean’s fund)

2681 Board #356 MAY 31 2:00 PM - 3:30 PM Prevalence of Mitochondrial Respiratory Chain Deficiency in Skeletal Muscle of Chronic Obstructive Pulmonary Disease Patients
Yana Konokhova, Martin Picard, Gilles Gouspilliou, Sophia Kachpinsky, Jacinthe Baril, Thomas Jagoe, Tanja Tavassalo. McGill University, Montreal, QC, Canada.

(No relationships reported)

Chronic obstructive pulmonary disease (COPD) is characterized by exercise intolerance and peripheral muscle weakness and dysfunction. Alterations in skeletal muscle structure and metabolic properties are common and include fiber atrophy, type II fiber predominance and decreased mitochondrial content and oxidative capacity. Interestingly, these cellular characteristics are also common features of healthy aging muscle. Consequently, it has been suggested that COPD pathophysiology is characterized by a premature aging phenotype. A major marker of age-related cellular muscle damage is the focal loss of cytochrome c oxidase (COX, a respiratory chain enzyme encoded by mitochondrial DNA) activity, which arises secondary to mitochondrial DNA damage from oxidative stress, resulting in compromised mitochondrial respiratory capacity. However, the prevalence of this COX deficiency in COPD has not previously been investigated.

PURPOSE: To quantify the levels of COX deficient myofibers in patients with COPD.

METHODS: Histochemistry using combined COX and succinate dehydrogenase (SDH, a respiratory system enzyme encoded by nuclear DNA) stains was used to identify respiratory deficient myofibers in quadriceps of 12 COPD patients (mean age 68±5yr, FEV1=48±15% predicted). The proportions of COX normal and deficient fibers, as well as fiber cross-sectional area, were determined using Image 3 software by two independent investigators.

RESULTS: Muscle sections from 9 patients had COX deficient myofibers. On average, 0.37% of all myofibers analyzed (n=10,945) were COX deficient, a proportion exceeding over 7-fold the established standard values for that age group (~0.05%; Sleigh et al. Muscle and Nerve 2011). Compared to COX normal, COX deficient fibers were not significantly different in size.

CONCLUSION: The higher proportion of COX deficient myofibers in our patients support the notion that COPD is characterized by an accelerated aging phenotype. Biochemical and molecular genetic analyses are currently underway to determine if the COX deficient fibers identified in these patients contain age-related clonally-expanded mitochondrial DNA deletions and greater oxidative stress compared to COX normal fibers, which would provide a molecular basis for this age-related biochemical defect.

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**Board #357**  
**MAY 31**  
**2:00 PM - 3:30 PM**  
*In Vivo Measurement of Intracellular pH and Contractile Performance During Repetitive Stimulation in Rat Tetanic Skeletal Muscle*

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(No relationships reported)

Homeostasis of intracellular pH (pHi) serves a crucial role for maintenance of cellular function. However, the relationship between muscle force/fatigue and pH under physiological (circulation intact) conditions remains unclear.

**PURPOSE:** Using an in vivo muscle imaging model that muscle fatigue would be associated closely with a reduction in pHi during tetanic muscle contractions, METHODS: The intact sartorius muscle of adult Wistar rats (n = 7) was exteriorized and loaded with the fluorescent probe BCECF-AM (10 μM). Tetanic isotonic contractions (20 contractions/min for a total of 10 sets of 50 contractions) were elicited by electrical stimulation (100 Hz, 4-7 V). The fluorescence ratio (F500 nm/F445 nm) was determined from images captured following each set of contractions was used to estimate pH and changes thereof.

**RESULTS:** Tetanic force at the end of set 3 was decreased significantly to 54.7 ± 2.3% of initial force (P < 0.01). On the other hand, there was no significant change of pHi throughout this period. Subsequently, tetanic force declined gradually until set 10 (38.3 ± 3.2% of initial force at set 1) by which time pH was reduced substantially (set 5: -10.0 ± 2.7%, set 10: -19.9 ± 3.9% vs. pre-contractions). Below ~55% initial force further reductions in force and pHi correlated tightly (r = 0.97, P < 0.001).

**CONCLUSIONS:** These results demonstrate two distinctly different profiles of pHi during fatiguing stimulation protocol. Although initial muscle fatigue is independent of the pHi, decline of pHi during sequential bouts of muscle contractions is associated closely with fatigue. This model offers a unique opportunity to investigate the consequences of experimental manipulations of pH on muscle fatigue under close-to-physiological conditions.

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**Board #358**  
**MAY 31**  
**2:00 PM - 3:30 PM**  
*Effect Of Aging On The Relationship Between Knee Angle And Triceps Surae Power Output*

Matti D. Allen, Brian H. Dalton, Geoff A. Power, Charles L. Rice, FACSM  
The University of Western Ontario, London, ON, Canada.  
(No relationships reported)

**INTRODUCTION:** Human adult aging is associated with a loss of strength, contractile velocity and power of the plantar flexors, but the effect of knee joint angle on the force-velocity relationship and hence power is unknown. As the dominant plantar flexor (PF), the triceps surae is comprised of the bi-articular gastrocnemii and the mono-articular soleus, and in young men isometric PF torque and power are reduced in knee flexion compared with extension. In addition to mechanical differences in these muscles there are dissimilar histochemical and electrophysiological properties; but it is unknown how changes in these may alter torque and power with aging.

**PURPOSE:** To assess the effects of adult aging and knee angle on PF power performance.

**METHODS:** Neuromuscular properties were recorded from 11 young (-25 y) and 11 old (-78 y) men with either the knee extended (170°) or flexed (90°). Participants performed isometric maximal voluntary contractions (MVCs), followed by maximal dynamic shortening contractions using the isotonic mode of a Biodex at loads from 15%, 20%, 30%, 45%, 60% and 75% of MVC; applied in random order.

**RESULTS:** The young were stronger (~25%), faster (~13%) and more powerful (~30%) than the old in all static and dynamic contractions. In both young (170 Nm vs 203 Nm) and old (128 Nm vs 154 Nm), MVC was greater in the extended than flexed position, respectively, with no difference in voluntary activation (~96%). There was no difference between age groups in the degree of strength decrement from the extended (young ~17%, old ~15%) to the flexed position. The young men produced (7-10%) faster shortening velocities with their knee extended for the 15%, 20% and 30% of MVC contractions, but no differences for higher loads; whereas there were no differences in shortening velocity between knee positions in the old group across all relative loads. In the young, power production was ~20-25% greater in the extended knee across all loads, whereas the old had greater power at lower loads, but similar power in both knee positions at >45% of MVC.

**CONCLUSION:** Results indicate that the presumed age-related preferential loss of Type II muscle fibers may lead to impairment in gastrocnemii function, causing an age-related attenuation of differences in plantar flexion function between extended and flexed knee angles. Supported by NSERC

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**Board #359**  
**MAY 31**  
**2:00 PM - 3:30 PM**  
*Median Power Frequency As A Parameter To Measure Muscle Fatigue During Intense Exercise*

Gustavo Sierra. UACJ, Cd Juarez, Mexico.  
(No relationships reported)

Fatigue may be explained as a task dependent multifactorial phenomenon. Alterations in muscle performance, especially during muscle fatigue may be analyzed through the use of surface electromyography (sEMG). Changes in sEMG during muscle contraction can be observed and have been used to describe various aspects of motor unit activation.

**PURPOSE:** The purpose of the study was to quantify the level of muscle fatigue at the end of a VO2max test in comparison with anaerobic test (AnT). To assess muscle fatigue, the median power frequency (MPF) of the sEMG signals was computed before, during and after the two tests.

**METHODS:** Six aerobically conditioned men (28 ± 6.5 yr; 60.9 ± 9.7 mL/kg/min) performed two cycle ergometry tests on different days. VO2max testing began at 15% of peak watts (previously determined) and every minute an increment of 11% was added until exhaustion. AnT began at 100% of peak watts and continued until exhaustion. Six bipolar channels continuously assessed sEMG of the rectus femoris (RF), vastus medialis (VM) and vastus lateralis (VL) for both legs. Raw data segments of 20% of the total test time were further analyzed. MPF values were normalized to the maximal voluntary contraction (MVC) preceding each test. Data were analyzed using separate muscle- and leg-specific 2 (test type) by 2 (pre-, post-test) ANOVAs with repeated measurement and α =.05 to observe differences in the MPF during the last 20% segment of the tests.

**RESULTS:** The interaction effect was significant for the left VM (VO2max=79.39 ±11.26% vs anaerobic test = 88.28 ±9.6%): F(1,6)= 8.517, p=0.027; the right RF (VO2max=92.91 ± 8.85% vs anaerobic test = 93.46 ± 7.87%): F(1,5)= 9.208, p=0.02; and the right VL (VO2max=93.46 ± 7.87% vs anaerobic test = 93.46 ± 7.87%): F(1,5)= 7.583 p=0.033.

**CONCLUSION:** For our sample, muscle fatigue at the end of a VO2max was not maximal; there was a reserve of muscle fiber recruitment mainly from the slow-twitch fiber type. EMG signals may be used to evaluate muscle fatigue during intense exercise. We found the median frequency to be the most sensitive signal.

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**Board #360**  
**MAY 31**  
**2:00 PM - 3:30 PM**  
*Mechanomyographic Frequency Domain Responses During Fatiguing Concentric Isokinetic Leg Extensions*

Trent J. Herda1  Eric D. Ryan2  Michael A. Cooper2  Joel T. Cramer, FACSM3  
1University of Kansas, Lawrence, KS. 2University of North Carolina - Chapel Hill, Chapel Hill, NC. 3University of Oklahoma - Oklahoma City, OK.  
(No relationships reported)

The mechanomyographic (MMG) represents a summation of the mechanical activity from individual motor units. During voluntary contractions, it has been suggested that the frequency domain parameters may reflect the firing rate. Furthermore, during fatiguing concentric isokinetic muscle actions it is believed that the median frequency may reflect the decrease in recruitment of fast-twitch muscle fibers.

**PURPOSE:** The purpose of the present study was to examine the MMG median frequency (MDF) responses of the vastus lateralis (VL) and rectus femoris (RF) during concentric isokinetic leg extension endurance tests.

**METHODS:** Twenty-four healthy men (mean ± SD, age = 23 ± 4 yrs, body mass 82 ± 12 kg) volunteered for this investigation. The MMG sensor (EGAS-FS-10/-V05; Measurement Specialties, Inc., Hampton, VA) was placed over the VL and RF of the muscle at 50% of the distance between the greater trochanter and lateral condyle of the femur. Each participant completed the leg extension endurance test on the Biodex System 3 isokinetic dynamometer. Three to five submaximal trials preceded 50 consecutive maximal concentric isokinetic leg extensions.
extension muscle actions performed at 180° s−1 with the right leg. Not all subjects were able to complete all 50 repetitions; however, all subjects did complete at least 48 repetitions. Therefore, the first 48 repetitions were analyzed. Percent decline calculations were used to measure the changes in MMGend during the endurance tests (percent decline = initial MMGend - final MMGend / initial MMGend × 100). The initial MMGend was calculated as the average of the 3 highest values, whereas the final MMGend represented the average of the 3 lowest values during the endurance test. A paired-samples t-test was used to examine if there was a difference between the VL and RF on percent decline of MMGend.

RESULTS: There was a greater (P<0.001) percent decline in MMGend for the RF (59.52 ± 4.85%) than the VL (50.95 ± 7.38%) during the fatiguing leg extension tests.

CONCLUSION: The results of the present study indicated that the MMGend responses during the fatiguing concentric isokinetic leg extensions reflected the differences between fiber type compositions of RF and VL muscles. MMGend may have reflected a fatigue-induced “dropout from recruitment” of fast-twitch fibers, which are more abundant in RF than the VL.

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**2686 Board #361 MAY 31 2:00 PM - 3:30 PM**

**Creatine Kinase Inhibition with Iodoacetamide Does Not Alter Microvascular PO2 On-kinetics and Twitch Tension in the Rat EDL**

R. Reed Lambert, Tyler G. Robertson, William L. Sexton, FACSM. A.T. Still University, Kirksville, MO.

**Purpose**

Creatine kinase (CK) catalyzes the reversible reaction in which high-energy phosphates are shuttled between phosphocreatine and ADP. Thus, CK is a pivotal regulator of energy flux in skeletal muscle at the onset of contractions when the metabolic demand increases. The microvascular PO2 (PO2mv) reflects the dynamic relationship between oxygen delivery (QO2) and oxygen consumption (VO2). Inhibition of CK with iodoacetamide (IA) has recently been shown to slow VO2 on-kinetics and to impair force production in vasodilated canine muscle.

**Methods**

The purpose of this study was to determine the impact of CK inhibition on PO2mv on-kinetics and muscle twitch tension in the auto-perfused rat extensor digitorum longus muscle (EDL).

**Methods**

Methods: The predominantly fast-twitch, EDL of female Sprague Dawley rats (n=20) was isolated and the distal tendon was attached to load cell interfaced with a Muscle Tension Analyzer. PO2m was measured with the phosphorescence quenching method using Oxyphor G2. All animals first completed a 3 min electrical stimulation (1 Hz, 6V) during which PO2m and twitch tension were measured continuously. After recovery the rats were randomly assigned to either a IA treatment group (46 mg/kg) or a saline vehicle control. The stimulation bout was repeated 10 min later to assess the effect of CK inhibition.

**Results**

Results: Baseline PO2m, PO2m on-kinetics, and EDL twitch tension for IA and C groups were not different during the initial contraction bout. During the second contraction bout (after IA), there was no difference in pre-stimulation PO2m in IA and C rats (25 ± 1 and 23 ± 1 mmHg) or on-kinetics as reflected in similar time delay (IA 4 ± 1, C 3 ± 1 s) and time constant (IA, 15 ± 2, C, 15 ± 2 s). Twitch tension was not different between IA and C revealing only minimal fatigue (IA, -5 ± 2, C, -8 ± 2%) over the 3 min bout.

**Conclusions**

Conclusions: Contrary to expectations, IA did not alter PO2m on-kinetics or muscle contractile function. The reason for the lack of effect of IA in the present study is unclear, however, they may reflect differences in the experimental preparation (i.e., twitch contractions in an auto-perfused, predominantly fast-twitch muscle in rats) or that the dose of iodoacetamide was insufficient. (Supported by Graduate Program Committee, KCOM-ATSU.)

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**2687 Board #362 MAY 31 2:00 PM - 3:30 PM**

**Resveratrol Improves Muscle Function, Increases Utophin Expression, And Decreases Inflammation In The Mdx Mouse**

Bradley S. Gordon, Diana C. Delgado Diaz, Matthew C. Kostek. University of South Carolina, Columbia, SC. (Sponsor: James A. Carson, FACSM)

**Purpose**

Duchenne Muscular Dystrophy (DMD) is a fatal X-linked genetic muscle disease characterized by reduced muscle function, increased oxidative stress, and inflammation for which there is no good treatment. Resveratrol is a compound found in various foods that has anti-inflammatory and antioxidant effects.

**Methods**

The effect of resveratrol in the mdx mouse model of DMD on muscle function and pathology, Mice were given resveratrol (100 mg/kg) via oral gavage everyday for 10 days or every other day for 8 weeks. Rotarod performance and in-situ muscle function were examined before and after 8 weeks of treatment. Inflammation was quantified from H&E stained gastrocnemius muscle samples after 10 days of treatment. PGC-1α and utrophin mRNA expression, and total utrophin protein were analyzed by qRT-PCR and western blot respectively after 10 days of treatment.

**Results**

Results: Resveratrol treatment increased Rotarod performance 53 ± 15% (P<0.05). In-situ peak tension of the triceps surae muscle complex increased 9.5 ± 2% with resveratrol treatment (P<0.05). Time to fatigue during a tetanic contraction of the triceps surae muscle complex increased 44 ± 18% with resveratrol treatment (P<0.05). Overall inflammation was reduced 20.7 ± 6% after 10 days of resveratrol treatment (P<0.05). PGC-1α and utrophin mRNA expression increased 1.4 ± 0.2 fold and 1.7 ± 0.2 fold respectively after 10 days of resveratrol treatment (P<0.05).

**Discussion**

We conclude that resveratrol improves muscle function and decreases muscle pathology in the mdx mouse. The improvement is likely due to increases in oxidative capacity, improved membrane integrity (utrophin), and decreased inflammation.

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**2688 Board #363 MAY 31 2:00 PM - 3:30 PM**

**Morphological Characteristics of Deep Aponeurosis of Pennate Muscle in Men and Women**

Kenya Kumagai1, Takashi Abe2. Nagasaki International University, Nagasaki, Japan. 2University of Oklahoma, Norman, OK. (No relationships reported)

**Purpose**

Aponeurosis is a broad tendinous sheet that attaches to pennate muscle and is known to be an important component that affects muscle function. Sex differences in muscle contractile properties and fatigue resistance have been previously reported. However, it is unknown if a morphological difference in the aponeurosis exists between men and women.

**Methods**

Eight young men (mean age, 19 [SD 1] yr; height, 1.73 [SD 0.06] m; weight, 60.2 [SD 7.5] kg) and 8 young women (mean age, 19 [SD 1] yr; height, 1.60 [SD 0.04] m; weight, 50.1 [SD 4.8] kg) volunteered. Continuous cross-sectional images of the thigh were obtained using magnetic resonance imaging (MRI). In each slice, anatomical muscle cross-sectional area (CSA) was measured, and muscle length, muscle volume and mean muscle CSA (muscle volume divided by muscle length) of quadriceps muscle (QF) were calculated. For aponeurosis of vastus lateralis muscle (VL), width of the aponeurosis (aponeurosis width) was measured in each slice, and aponeurosis length and aponeurosis area were determined.

**Results**

Results: Muscle length (men, 39.4 ± 1.6 cm; women, 35.1 ± 1.4 cm), muscle volume (men, 1792 ± 382 cm3; women, 978 ± 84 cm3), and mean muscle CSA (men, 45.2 ± 8.0 [SD 2] cm2; women, 27.8 ± 19.9 cm2) of the QF were greater (P<0.01) in men than in women (12%, 8%, and 63%, respectively). Maximal aponeurosis area (men, 9.7 ± 0.9 cm2; women, 7.8 ± 1.2 cm2), aponeurosis length (men, 22.8 ± 3.0 cm; women, 18.8 ± 1.7 cm), and aponeurosis area (men, 150 ± 15 cm2; women, 111 ± 20 cm2) of the VL were also greater (P<0.01) in men than in women (25%, 31%, and 35%, respectively). However, the ratio of aponeurosis maximal width to length of the VL was quite similar between men (0.43 [SD 0.08]) and women (0.42 [SD 0.07]). There was a significant correlation between VL aponeurosis area and QF mean muscle CSA in women (r=0.87, P<0.01), but not in men (r=0.52). QF muscle length was correlated to VL aponeurosis length in men (r=0.84, P<0.01), but not in women (r=0.14). VL maximal aponeurosis width did not associate with QF muscle length in either sex.

**Conclusions**

Our results suggest that there are morphological differences in the deep aponeurosis of the VL muscle between young men and women.

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**2689 Board #364 MAY 31 2:00 PM - 3:30 PM**

**Fatty Acid Intake and Exercise Improve Body Composition and Functionality in High Fat Diet-Fed Mice**

Jeong-Su Kim, Sang-Rok Lee, Samuel C. Grant, Edward Jo, Andy V. Khamoui, Bong-Sup Park, Michael C. Zourdos, Shirin Hooshmand, Michael J. Ormsbee, Bahram H. Arjmandi. The Florida State University, Tallahassee, FL. (Sponsor: Lynn B. Panton, FACSM) (No relationships reported)

Conjugated Linoleic Acid (CLA) and Omega-3 polyunsaturated fatty acids (n-3) have received attention due to their health benefits; however, their potential synergistic effects with resistance training (RT) during a high fat diet are not well established.
PURPOSE: To determine the effects of combined CLA and n-3 administration independently or with RT on body composition, strength, and sensorimotor function in middle aged male mice during 20 wks of a high fat diet.

METHODS: Nine-month old C57BL/6 male mice were randomly assigned to five groups (n=10/group): 1) normal diet (CON), 2) High fat diet (HFD), 3) HFD + RT (HFD/RT), 4) HFD + CLA/n-3 (HFD/CLAN), and 5) HFD + RT + CLA/n-3 (HFD/RT/CLAN). Progressive RT (4 sets of 3 repetitions with 1-min inter-set rest) was conducted using a ladder climbing device 3x/wk for 20 wks. The combined supplement was comprised of 1% CLA (0.5% of c9, t11 and 0.5% of t10, c12) and 1% n-3. Lean (LM) and fat mass (FM) were determined using dual energy x-ray absorptiometry while grip strength and sensorimotor function were evaluated with a strain gauge and the incline-plane test, respectively. All measures were obtained pre- and post-intervention. Data were analyzed with a group x time repeated measures ANOVA, and significance was set at p<0.05.

RESULTS: There were significant group x time interactions for LM, FM, grip strength, and sensorimotor function. FM increased in HFD (+30%) and HFD/RT (+34%), while LM decreased in HFD (-32%) and HFD/RT (-55%). No significant changes in LM or FM were observed for CON, HFD/CLAN, and HFD/RT/CLAN. Strength significantly declined in HFD (-15%) and HFD/CLAN (-17%) but was maintained in both CON and HFD/RT. Sensorimotor function declined significantly in HFD (-11%) with no change in CON, HFD/CLAN and HFD/RT. Interestingly, CLA/n-3 administration appeared to facilitate greater RT-mediated improvements in strength (+22%) and sensorimotor coordination (+17%).

CONCLUSION: Body composition and functionality were negatively altered following 20 wks of high fat diet. Daily CLA/n-3 intake appears to attenuate these negative alterations while even facilitating RT-induced improvements in body composition and functionality. Study partly supported by Sekwang Inc., Vital Pharmaceuticals, and Ocean Nutrition.

694

2690 Board #365  MAY 31  2:00 PM - 3:30 PM
Muscle Regeneration: Impact of Mast Cells on Inflammatory Cell Recruitment and Muscle Cell Proliferation
Elsie Duchesne, Marie-Pier Roussel, Claude H. Côté. CHUQ Research Center, Université Laval, Québec, QC, Canada.

Inflammatory cells are traditionally associated with pain, heat, redness and swelling. However, accumulating studies have shown that some of these cells can also contribute to tissue repair. Indeed, neutrophils and macrophages can contribute to the resolution of inflammation and to skeletal muscle regeneration via the release of cytokines and growth factors. We recently showed that tryptase, the most abundant mediator in mast cell granules, could potentially support muscle regeneration by increasing skeletal muscle cell proliferation.

METHODS: To evaluate if mast cells can stimulate skeletal muscle cell proliferation.

RESULTS: In vitro: mast cells were isolated from peritoneal cavity of female C57BL/6 mice. L6 muscle cells were cultured with either mast cells activated with compound 48/80 or mast cell-derived conditioned media. L6 cell number was determined with CellTiter assay 24h post-seeding. In vivo: mice were injected with activated mast cells or mast cell-conditioned media. L6 cell number was determined with CellTiter assay 24h post-seeding. In vivo: mice were injected with activated mast cells or mast cell-conditioned media. L6 cell number was determined with CellTiter assay 24h post-seeding. In vivo: mice were injected with activated mast cells or mast cell-conditioned media. L6 cell number was determined with CellTiter assay 24h post-seeding.

PURPOSE: Muscle regeneration: impact of mast cells on inflammatory cells.

CONCLUSION: Increased recruitment of mast cells resulted in increased skeletal muscle cell proliferation.

2691 Board #366  MAY 31  2:00 PM - 3:30 PM
Signaling Responses In Unloaded Rat Soleus Muscle To Combination Of Heat Stress And Intermittent Reloading
Toshiyuki Yoshishara1, Takao Sugiuara, Hisashi Naito1, Juntendo University, JSPS Research Fellow., Inzai, Japan, 3Yamaguchi University, Yamaguchi, Japan.

Heat stress and intermittent reloading are known as the effective countermeasure for skeletal muscle atrophy. However, it remains unclear whether the combination of heat stress and intermittent reloading is effective to attenuate muscle atrophy.

PURPOSE: To examine the effect of the combination of heat stress and intermittent reloading on signaling responses in unloaded rat soleus muscle induced by hindlimb unloading.

METHODS: Forty male Wistar rats (10wk of age, 261.7±1.17 g) were randomly divided into four groups: control (CON, n=10), hindlimb unloading (HU, n=10), hindlimb unloading with intermittent reloading (IR, n=10), hindlimb unloading with intermittent reloading and heat stress (IR+H, n=10). The HU, IR and IR+H group were unloaded for seven days. IR and IR+H group were released from unweighting for 1h every second day. During this time, IR+H group was exposed to environmental heat stress (41.5-42°C for 30 min) in a heat chamber without anesthesia. After seven days unloading, the soleus muscle were removed and analyzed by western blotting.

RESULTS: Seven-days unloading resulted in a 31% reduction in the soleus muscle mass, but only IR+H significantly prevented the reduction (CON; 168±6.7, HU; 116.3±6.7, IR; 121.0±3.7, IR+H; 131.1±2.4 mg). In soluble fraction, although 80-kDa form of calpain 1 was significantly increased in IR+H group compared to CON and HU group (HU; 102, IR; 132 and IR+H; 147% of CON), the autolyzed form of IR+H group was lower than CON group. Moreover, autolyzed form of calpain 2 (HU; 267, IR; 236 and IR+H; 147% of CON) and ubiquitinated protein (HU; 164, IR; 140 and IR+H; 112% of CON) in particulate fraction were significantly increased in IR+H group compared to CON and HU group (CON; 112, IR; 140 and IR+H; 112% of CON). The level of MuSK mRNA expression was decreased in IR+H group compared to CON and HU group (CON; 112, IR; 140 and IR+H; 112% of CON).

CONCLUSION: The combination of heat stress and intermittent reloading attenuates soleus muscle atrophy through the prevention of calpain autolysis and protein ubiquitination, but independent of Akt/mTOR pathway.

2692 Board #367  MAY 31  2:00 PM - 3:30 PM
Developmental Change in Domain Size of Endplate Nucleus in the Rat Diaphragm
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PURPOSE: Nuclei around the neuromuscular junction play an important role for the maintenance of motor endplate morphology and function in skeletal muscle. In this study, we examined the number of endplate nuclei, 3-dimensional morphological properties of the motor endplate, and the expression level of muscle-specific kinase (MuSK) in rat muscles during the postnatal development.

METHODS: Segments of the mid-costal diaphragm (DIA) and sternocleidomastoideus (STM) muscles were removed at 1, 2, 3, 4, 11 and 25 weeks after birth (n=7 in each age group). Motor endplates were labeled with a-bungarotoxin conjugated tetramethylrhodamine. Then, several single muscle fibers with labeled endplate were isolated from the segments under fluorescent microscopy, and myonuclei, including endplate nuclei, were stained with DAPI (4’, 6-diamino-2-phenylinodole) to examine the space distribution of these nuclei. Thirty to fifty single fibers from each muscle segment were imaged using a laser-scanning confocal system, and the domain sizes of endplate nuclei were calculated from endplate volume and number of endplate nuclei. Furthermore, total RNA was extracted from the remains of muscle segments and the level of Pax7 mRNA expression was determined using real time RT-PCR analysis system.

RESULTS: In DIA collected during the developmental period (1 to 25 weeks after birth), the mean values of muscle fiber diameter and endplate volume were significantly increased from 13,075±4,108 µm² to 604±15,071 µm² and from 451±304 µm³ to 1045±781 µm³, respectively. The mean values of the number of endplate nuclei were increased from 3.9±1.2 at 1 week to 10.2±4.7 at 25 weeks; therefore, domain sizes of endplate nuclei were identical during the developmental period (115±77 µm² at 1 week and 102.5±75 µm² at 25 weeks). The level of MuSK mRNA expression was dramatically decreased by 60% during this period. There were no obvious differences in the above data between DIA and STM muscles.

CONCLUSIONS: The domain sizes of endplate nuclei were speculated to be constant during postnatal development and between muscles, indicating that a regulation mechanism of the domain size exists in the neuromuscular junction. It was also speculated that the domain size was not directly regulated by the expression of MuSK.
2693  Board #368  MAY 31  2:00 PM - 3:30 PM

Exercise Performance And Muscle Metabolic Response In Endurance Trained, Strength Trained and Untrained Elderly Men

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(No relationships reported)

Ageing is accompanied by gradual deterioration of exercise performance and skeletal muscle oxidative capacity. However, information on effects of different life-long training regimes is sparse.

PURPOSE: To study performance, muscle metabolic capacity and response to exhaustive sub-maximal cycle exercise in lifetime endurance trained, strength trained and untrained 470 yrs old men.

METHODS: Life-time endurance trained (ET, n=8), strength training (ST, n=7) and untrained (UT, n=7) elderly men cycled at 75% VO2max until exhaustion. M. Vastus Lateralis biopsies were collected prior to and after exercise and antecubital vein blood samples were frequently drawn.

RESULTS: Exercise time was 87.8±8 min for ET which was 42 and 56% longer than for ST and UT, respectively. Power output was 34 and 32% higher (p<0.05) in ET than in ST and UT. Glycogen utilization per work unit was 41% lower (p<0.05) in ET than ST. Muscle lactate at exhaustion was lower (p<0.05) for ET than ST (141 ± 28.9 mmol kg-1 d.w.) and blood lactate was lower (p<0.05) for ET than UT from 15 min of exercise with an intermediate response for ST (15 min: 2.2, 3.8 and 3.0 mM, respectively). VO2max, CS activity and capillarities per fibre, respectively, were higher (p<0.05) for ET than for ST (39, 24 and 19%) and UT (46, 53 and 35%). The MCT1 content in ET was 49% higher (p<0.05) than in UT, but not different from ST (22%, NS). No differences were evident in exercise performance, oxidative capacity or muscle metabolic response between ST and UT, except that ST had a 23% higher (p<0.05) CS activity. Exhaustion time correlated with the fraction of ST fibres (r=0.41, p<0.05) and negatively with blood lactate at exhaustion (r=-0.51, p<0.05). Muscle lactate at exhaustion correlated negatively with muscle HAD activity (r=-0.62) and positively with glycogen utilization (r=0.51) and type II fibres (r=0.54).

CONCLUSIONS: Life-long endurance trained elderly had a markedly untrained and strength trained master athletes resulting in attenuated muscle lactate production and glycogen utilization during continuous exhaustive cycle exercise. Exercise performance and muscle metabolic exercise response did not differ between strength trained and untrained elderly men. The Danish Ministry of Culture funded the study.

2694  Board #369  MAY 31  2:00 PM - 3:30 PM

Plasma Matrix Metalloproteinase-9 (MMP-9) is Increased Following Downhill Running in Sedentary Individuals

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(No relationships reported)

Our lab has investigated the utility of plasma MMP-9 as a potential systemic indicator of muscle damage in humans. We have previously reported that the systemic response is variable and unchanged in the week following an eccentric arm task in sedentary subjects, and a downhill run in concentrically-trained subjects. Although concentrically-dominated training has been associated with increased susceptibility to muscle damage, subjects may not have experienced the degree of damage that might ensue in a sedentary population. Sedentary subjects did not have a systemic MMP-9 response after completing an eccentric arm task, but the volume of muscle damaged may have been too small to detect a response. Thus, it is still not clear whether plasma MMP-9 or its inhibitor, tissue inhibitor of metalloproteinase-1 (TIMP-1), change following a downhill run in sedentary subjects.

PURPOSE: To quantify systemic changes in MMP-9, TIMP-1, and other muscle damage indices following a downhill run in sedentary subjects.

METHODS: 8 sedentary males (n=3) and females (n=5) ran downhill (-10°) for 30 minutes. Plasma creatine kinase (CK) activity, MMP-9 and TIMP-1 concentrations, soreness ratings, and leg strength were collected pre-exercise (pre-ex), immediately post-, 1-, 2-, 4-, and 7-days post-exercise (post-ex). Trends were analyzed with a linear mixed model approach. Means ±SE are presented with p<0.05 considered significant.

RESULTS: Soreness significantly increased (p=0.013) from 4.1 ±2.3 mm pre-ex to a peak of 44.0 ±7.5 mm at 1-day post-ex (p=0.003). Values returned to baseline by 4-days post-ex. Plasma CK activity was significantly increased (p=0.005) from 74.5 ±29.4 U/L pre-ex to a peak of 102.7 ±25.2 U/L at 1-day post-ex. Plasma MMP-9 was significantly increased (p=0.009) from 25.4 ±2.4 ng/ml pre-ex to 35.8 ±4.1 ng/ml at 4-days post-ex. Plasma TIMP-1 levels were unchanged throughout the time course.

CONCLUSIONS: Plasma MMP-9 levels are increased at 4-days post-downhill running in sedentary individuals. These results, along with our previous results, suggest that the plasma MMP-9 response to exercise may be related to either physical training history or the severity of an exercise task. We plan to follow-up on this by examining the tissue response to either concentric or eccentric exercise in sedentary human muscle biopsies.

2695  Board #370  MAY 31  2:00 PM - 3:30 PM

Comparison of Skeletal Muscle Tissue Oxygen Saturation Responses between Genders

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(No relationships reported)

Special attention should be given to subcutaneous thigh fat accrual and its impact on the amount of skeletal muscle blood flow and accumulation when using different initial restrictive pressure (IRP) during blood flow restriction (BFR) training. Due to different patterns of fat distribution and deposition in males and females, it is important to test the effects of subcutaneous fat on tissue oxygenation and lactate production during exercises with BFR.

PURPOSE: The present study investigated the importance of thigh subcutaneous fat as a variable that may be associated with affecting the magnitude of initial pressure (tightness of cuffs before inflation with air) on skeletal muscle tissue oxygen saturation and lactate between males and females.

METHODS: Twenty healthy volunteers, 10 males (25 ± 4.83 yr) and 10 females (20.7 ± 1.06 yr), performed exercises with an IRP of 40mmHg. The following procedures were performed in order: a) subcutaneous fat thickness, b) pre-maximal isometric force (MVC), c) 4 sets (1 × 30 reps and 3 × 15 reps) of dynamic knee extension exercises performed at 20% MVC, d) post-MVC. Skeletal muscle tissue oxygen saturation was continuously monitored before, during, and after exercises with near-infrared spectroscopy placed to a mark that was made at 50% on the line from the anterior superior iliac spine to the superior part of the patella. Plasma lactate levels were assessed prior to, in between the first and second set, immediately after post MVC, 5min-post, 10 min-post, and 20 min-post.

RESULTS: Thigh subcutaneous fat thickness was significantly greater in females than males (p<0.01). Tissue oxygenation significantly decreased (p<0.03) throughout exercise in both genders with an observed significant time × gender interaction (p<0.01). Both male and females responded to the BFR similarly with a significant decrease (p<0.01) in peak force production from pre to post exercise, while plasma lactate levels significantly decreased (p<0.01) throughout the exercise with no time × gender interaction (p>0.3).

CONCLUSIONS: The observed gender difference in tissue oxygenation in response to BFR with an IRP of 40mmHg underline the necessity for future studies to consider subcutaneous fat as a variable to influence the magnitude of physiological adaptations between genders and adjust the IRP accordingly.

2696  Board #371  MAY 31  2:00 PM - 3:30 PM

A Computational Model of Neuromuscular Function That Predicts Age-Related Fatigue Resistance

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(No relationships reported)

Numerous studies indicate that the muscles of older individuals fatigue relatively less than younger individuals during isometric contractions. Due to the many differences in neuromuscular function between young and old, it is difficult to ascertain with precision the physiological mechanisms of age-related fatigue resistance. While computational models have been developed that predict muscle fatigue, and others have been designed to predict altered neuromuscular function with old age, no integrative model has been presented that examines age-related changes of the neuromuscular system in the context of fatigue.
PURPOSE: To develop a comprehensive computational model that evaluates the effects of old age on neuromuscular function during fatigue-inducing voluntary contractions.

METHODS: We combined de novo experimental data and literature values to derive functions that describe multiple components of neuromuscular function (motor unit recruitment, excitation-contraction coupling, force generation, bioenergetics, and ankle dorsiflexion torque) during voluntary activation. These functions were parameterized in two versions; one to represent the neuromuscular function of younger men (YM) and the other to characterize older men (OM). Separate forward dynamics simulations were run using each model to predict isometric torque-generating capacity during repeated, maximal voluntary activations. We tested the validity of this model to predict fatigue, defined as a relative decline in maximal torque, by comparing model estimates of torque to values from the literature.

RESULTS: The model simulated contractions of similar duration and duty cycle to an example from the literature, and less fatigue was predicted by OM (84.4% initial) than YM (79.1%). These values are highly consistent with those reported in vivo for younger and older men (Root mean square difference [RMSD] = 6.6% and 0.11% respectively).

CONCLUSIONS: By simulating contraction protocols from the literature, we have demonstrated sensitivity of the present model to age-related differences in neuromuscular function and fatigue. These findings validate the present model as a unique and powerful tool for testing hypotheses related to the phenomenon of age-related fatigue resistance.

Support: NIH K02A6023582

2697  Board #372  MAY 31  2:00 PM - 3:30 PM
Estrogen Receptor (ER) Mediated Recovery Of Atrophic Muscle Following Hind Limb Unweighting (HLU)

(No relationships reported)

Estrogen (E2) is necessary for normal muscle function. Genomic E2 effects are mediated through two ER, alpha and beta but whether they are important for the recovery of atrophic muscle has not been identified.

PURPOSE: 1) to determine if the recovery of atrophic muscle (mass and contractile function) is ER mediated.

METHODS: Mature 4 mos old female C57BL6 mice (n=70) were divided into sham ovarioctomy (OVX) and OVX groups. All but 10 sham controls were HLU for 4 wks. One third of the HLU mice were studied immediately after unweighting, one third were studied after 3 days of recovery following HLU and the final third were studied after 3 days of recovery and 3 days of injections with 1CI 182780, an E2 antagonist that blocks both ER alpha and beta. Contractile tension was determined in soleus, plantaris, gastrocnemius and tibialis anterior. Muscle mass and fiber cross-sectional area (CSA) were also determined for each muscle. RESULTS: HLU significantly reduced muscle mass and contractile force in all 4 muscles studied. In Sham OVX, recovery resulted in a significant (p<0.05) return toward baseline for muscle mass; recovery in mass was barely apparent in OVX mice. ICI attenuated recovery in Sham OVX and blocked recovery in OVX females. Evidence of recovery in muscle force (Po) was evident in Sham OVX but not in OVX with the exception of the soleus (e.g., sham Con 9.0 ± 3.1, OVX HLU 5.0 ± 2.7, OVX HLU + recovery 5.6 ± 1.0 and OVX HLU + recovery + ICI 6.7 ± 1.5). Values for CSA mirrored those of mass.

CONCLUSIONS: Without ER, estrogen is attenuated suggesting an alternative but slower route mediating E2 effects. Without E2 or ER, recovery of atrophic muscle is compromised but effects are muscle specific. Supported by NIH HD 058834 and the MO Spinal Injuries Research Board.

2698  Board #373  MAY 31  2:00 PM - 3:30 PM
Effect of Exercise Order on Testosterone Availability in Post-exercise Recovery
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(No relationships reported)

It has been suggested that performing arm prior to lower-body resistance exercise could reduce testosterone-rich blood delivery to the arm in recovery, thereby hampering potential hypertrophy over time.

PURPOSE: To determine the availability of testosterone to the arm, after arm exercise performed before or after intense lower-body resistance exercise,

METHODS: In a randomized cross-over design, four men (28 ± 5 y, BMI = 25.8 ± 2.0 kg m-2; means ± SD) performed 4 sets of isotonic arm exercise on a Biodex before (A-L) or after (L-A) intense bilateral leg resistance exercise. Blood samples for hormone analysis as well as brachial artery blood flow measures (Doppler ultrasound) were obtained immediately after arm and leg exercise and at intervals for 75 min of post-exercise recovery. Testosterone and growth hormone (GH) delivery were calculated as the product of blood flow and hormone concentration.

RESULTS: There was a 3-fold increase in brachial artery blood flow after exercise by either legs or arm alone, followed by a further 1.5-fold increase after subsequent leg or arm exercise; consequently, there were no overall differences between exercise order for brachial arterial blood flow. Testosterone and GH increased similarly with both A-L and L-A, each peaking 15 min after leg exercise. After A-L and L-A (respectively), testosterone delivery (AUC, arbitrary units) was 159 ± 26 and 141 ± 58 and GH delivery was 454 ± 111 and 462 ± 128. Total work output across 4 sets of arm exercise was higher in A-L (162 ± 35 kJ) than L-A (131 ± 50 kJ; P = 0.03).

CONCLUSIONS: Exercising the legs after arm exercise enhances rather than impairs blood flow to the exercised arm. Total testosterone and GH availability to the arm is different depending on whether arm exercise is performed before or after intense leg exercise and so would not impair hypertrophy. Supported by CIHR and NSERC.

2699  Board #374  MAY 31  2:00 PM - 3:30 PM
A Description of the Relationship between Straight Leg Raise (SLR) Test and Muscle Hardness
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(No relationships reported)

The objective of this study was determine whether gender differences exist in skeletal structures.

METHODS: Participants, the SRL of 23 males (age, 23.2±10.78 yrs; height, 174.6±7.83 cm; weight, 82.9±23.2 kg) were measured for both legs, and the muscle hardness for five different conditions: relaxed, voluntarily SLR, passively SLR, forcedly SLR, and maximal voluntary contraction with four different muscles: vastus medialis, vastus lateralis, rectus femoris, and biceps femoris. As the statistical data analysis, the descriptive statistics such as means and SDs for each variable were calculated. Also, linear regression and correlation analyses were conducted in order to identify any significant relationship. In order to judge collinearity, tolerance and VIF coefficients were calculated for each predictor.

RESULTS: The linear regression analysis revealed a set of significant regression coefficients that the SLR for left leg is predicted by all the muscle hardness scores (5 conditions * 4 muscles = 20 predictors), (R=0.35; p<0.028; df=20).

CONCLUSION: Even though there is only one statistically significant regresional relationship, it may be possible to identify other significant pathways by such as collecting a larger sample. However, the description of dispersion with the participants’ SLR and muscle hardness scores is beneficial for the future study.

2700  Board #375  MAY 31  2:00 PM - 3:30 PM
Gender Differences in Leg Length, Q-Angle, Navicular Drop, and Tibial Torsion of College Age Subjects
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(No relationships reported)

The objective of this study was determine whether gender differences exist in skeletal structures.

Methodology: A convenience sample of 24 males (age=22.46yrs ±2.41; height (HT)=68.06in ±3.50; weight (WT)=186.75lbs±49.84) and 34 females (age=21.50yrs ±1.73; HT=66.05in ±2.61; WT=138.98lbs ±20.98) was chosen from a large Midwestern university in the United States. Leg length (LL), Q-Angle, Navicular Drop (ND) and Tibial Torsion (TT) were measured for each subject. Data was analyzed using a one-way ANOVA.
RESULTS: Analysis yielded significant differences between TT (p<.001), LL (p<.001) and Q-Angle (p<.005), however no significant difference was found in ND (p=.189) and LL/HT ratio (p=.601). Males had significantly longer LL (94.68cm ±6.37) and TT (19.79±19.87) compared to females (LL=89.72cm ±4.56; TT= 13.29±11.65); however women had significantly larger Q-angles (9.03±8.64; Q-Angle Character - &#7560;11.52±11.02); than males (7.50±5.03). CONCLUSION: This study validated studies that have stated that females have larger Q-angles than males. While lateral rotation of the tibia occurs at sexual maturation, males tend to have a great rotation of the tibia than females. Leg length was also significantly greater in males than females (p=0.001), however this may be attributed to the males in this study being taller than females since LL/HT ratio was not significantly different (p=.601). Inter-tester reliability may also be in question, as inter-tester reliability at 99% confidence indicated high correlation (R ≥0.85) between TT and LL measurements, however lower correlations (R=0.65-0.85) for Q-Angle and ND. Further investigation is required to determine why males have greater lateral rotation than females.

2701 Board #376  MAY 31 2:00 PM - 3:30 PM
Aging-related Changes In Isokinetic Torque Generation Capacities Of Knee Extensor
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The purpose of this study was to investigate the effect of aging on the concentric and eccentric peak torque (PT) generation capacities of knee extensors in three different angular velocities (30, 60, and 180°/s). Concentric and eccentric PTs were measured in 130 healthy men (27-76 years). PT was compared between three age groups (young: 20 - 39 years, intermediate: 40 - 59 years, and old: 60 years and older). Concentric quadriceps PT at all angular velocities in intermediate and old group was significantly lower than that in young group (p<0.01). Further regression analysis showed that the decrement of the PT explained by aging was larger in higher angular velocities than the lower (concentric PTs of old group were 82.8%, 80.4%, and 72.2% of the PTs of young group at angular velocities of 30°/s, 60°/s, and 180°/s, respectively). However, the eccentric PT did not demonstrate any significant differences among the three age groups (p>0.05). These findings suggest that the neuromuscular aging not only diminishes the concentric peak torque generation but also impede the rate of torque generation capacities of knee extensors. In eccentric contraction, the torque generation capacities might be influenced more by non-contractile, passive properties of muscles than in the concentric contraction.

2702 Board #377  MAY 31 2:00 PM - 3:30 PM
Asymmetry joint loading of Temporomandibular Joint During Clenching in Patients with Temporomandibular Joint Disorders
Han-Yi Cheng, Shih-Tsu Chang, Pei-Wen Pori, Wei-Chun Hou, Yuan-Hsiang Liu, Keng-Liang Ou, Wan-Ju Hsu, Shih-Chi Lec, Yu-An Hde, National Taiwan University, Taipei, Taiwan. "Tri-Service General Hospital, Taipei, Taiwan. "College of Oral Medicine, Taipei, Taiwan. "National Taiwan University of Science and Technology, Taipei, Taiwan. "Taipei Medical University, Taipei, Taiwan. (No relationships reported)

To examine the causal relationship between pain and joint loading at temporomandibular joint (TMJ), one must focus on the magnitude and location of the maximum stresses under physiological loading during functional oral activities such clenching. However, the asymmetry nature of left and right sides joint loading was not fully addressed using finite element analysis (FEA). PURPOSE: To quantify the stress distribution in the mandibular condyle, disc and articular eminence, and to compare the joint loading revealed by von Mises’ and shear stresses on the models of normal young adults and patients with TMJ disorders. METHODS: The CT images of TMJ of three healthy adult female volunteer and three patients with TMJ disorders were used to build the models for FEA. As loading condition, 290N for masseter, 140N for temporalis, and 143N for medial pterygoid were introduced bilaterally. For each subject, the highest von Mises’ stresses and highest shear stresses at TMJ during clenching were calculated. RESULTS: For the comparison of joint loading at right and left sides, all the normal young adults manifest symmetry joint loading in terms of their highest von Mises’ stresses (Y: 2.321-2.855 MPa at the mandibular condyle, 0.634-0.957 MPa at articular disc, and 1.743-1.976 MPa at articular eminence; TMJ: 2.652-3.717 MPa at the mandibular condyle, 0.620-1.789 MPa at articular disc, and 1.632-2.010 MPa at articular eminence) and of highest shear stresses (Y: 3.023-3.725 MPa at the mandibular condyle, 0.815-1.291 MPa at articular disc, and 2.289-2.518 MPa at articular eminence; TMJ: 0.840-2.317 MPa at articular disc, and 2.196-2.650 MPa at articular eminence). CONCLUSION: All the patients with TMJ disorders manifest asymmetry joint loading revealed by von Mises’ stresses at the mandibular condyle, by von Mises’ stresses at the articular disc, by shear stresses at the mandibular condyle, and by shear stresses at the articular disc; while these asymmetry findings were not shown neither by the von Mises’ stresses nor by the shear stresses at the articular eminence. Both the von Mises shear stress during clenching was higher in patient with TMJ disorder than that in healthy subjects. Trends of the asymmetry loading have been observed in the patients with TMJ but not in the normal young adults.

D-33 Free Communication/Poster - Sleep
MAY 31, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

2703 Board #378  MAY 31 3:30 PM - 5:00 PM
Do Sleep Problems Mediate Development of Mental Health Symptoms After Deployment?
Caroline A. Macera, FACSM, Hilary J. Aralis, Mitchell J. Rauh, FACSM, Andrew J. MacGregor. Naval Health Research Center, San Diego, CA. (No relationships reported)

PURPOSE: Many military members who are exposed to combat-related blasts and screen for traumatic brain injury (TBI) subsequently develop mental health symptoms suggesting posttraumatic stress disorder (PTSD) or depression. One common symptom reported after deployment is difficulty falling or staying asleep. The role of sleep in the development of mental health symptoms is unclear.

METHODS: We prospectively followed 29,640 U.S. Navy and Marine Corps men who completed health assessments immediately upon return from deployment in Kuwait, Iraq, or Afghanistan during 2008 and 2009. Among those who did not screen positive for PTSD (n = 29,019), self-reported sleep problems and TBI screening results were obtained and related to PTSD screening results from a separate health assessment administered several months later. After establishing a significant association between TBI and sleep problems, the association of TBI and PTSD was independently tested and retested while controlling for sleep problems. Similar methods were used for the alternative outcome of a positive depression screen (n = 27,702).

RESULTS: After controlling for sleep problems, the odds of receiving a positive PTSD screen decreased from 1.61 (confidence interval [CI]: 1.21-2.14) to 1.32 (CI: 0.99-1.77) for a subject screening positive for TBI relative to a subject screening negative. Sleep problems mediated 26% of TBI’s effect on development of PTSD. After controlling for sleep problems, the odds of receiving a positive depression screen for a subject screening positive for TBI relative to a subject screening negative decreased from 1.41 (CI: 1.11-1.80) to 1.15 (CI: 0.90-1.47), and the ratio became nonsignificant. Sleep problems mediated 41% of the effect of TBI on development of depression.

CONCLUSIONS: We found the effect of a positive screen on the development of PTSD or depression is mediated by sleep problems. The results of our study suggest that sleep problems may be an early indicator of risk for PTSD or depression, and immediate treatment of self-reported sleep problems could mitigate the risk for development of mental health disorders, although future (intervention) studies are needed. This work was supported by the U.S. Navy Bureau of Medicine and Surgery under Work Unit No. 60818.
and had high triglyceride (+0.3±0.1 mmol/L, P=0.026) compared to those who did not. Frequent chocolate snacks were also associated with poor sleep quality (P=0.029) and insomnia severity (+16.7±8.8 Nm, P=0.063) legs.

Healthy eating and sleeping habits are associated with better athletic performance. Additionally, sleeping habits can be altered by dietary intake. These modifiable factors have not been documented in Arab footballers.

PURPOSE: To compare various measures of physical activity with sleep duration and sleep quality.

METHODS: Subjects (n=58, mean age ± 54 years) wore the SenseWear Armband for approximately 12 consecutive days. Duration and intensity of physical activity, steps per day, minutes of sleep, and sleep quality were recorded and averaged over the monitoring period. Pearson correlations were used to examine the association between measures of physical activity and sleep duration and quality. Sleep duration was categorized into tertiles ("high" >409.7 minutes, "moderate" 355.9 - 409.7 minutes, and "low" <355.9 minutes) and physical activity was compared between the three groups using an ANOVA.

RESULTS: There was a consistent trend for measures of physical activity (steps per day, and minutes of moderate and vigorous physical activity) to be negatively correlated with sleep duration and quality, however all correlations were non-significant. The results of the ANOVA indicated that the low sleep group took significantly more steps per day (12,952 steps/day) than the high and middle sleep groups (9,207 steps/day; p < 0.05). Also, there were significant differences in sleep quality between the high and low sleep groups and the moderate and low sleep groups (both p < 0.05). Those that slept for shorter durations generally had a lower sleep quality. Minutes of moderate and vigorous activity were not statistically different between tertiles of sleep duration.

CONCLUSION: The findings indicate that aggregate measures of sleep duration and quality are related to physical activity. Overall, subjects that slept a greater duration were less physically active and had a higher quality of sleep.
and pro-tumoral factors related to tumor associated macrophages, angiogenesis and inflammation within the tumor microenvironment. RESULTS: LBNP time while normothermic (1237 ± 240 sec) and heat stressed (635 ± 275 sec) was not correlated to Tbody within each condition (normothermic range = 36.21-37.24°C, r=-0.15, p=0.33; heat stress range = 37.69-39.46°C, r=0.12, p=0.28). Normothermic LBNP times of those with the lowest (36.35 ± 0.07°C) and highest (36.87 ± 0.15°C) Tbody were not different (1241 ± 256 and 1233 ± 294 sec, respectively; p=0.94). Similarly, heat stressed LBNP times of those with the lowest (37.86 ± 0.09°C) and highest (38.82 ± 0.20°C) Tbody were not different (690 ± 266 and 559 ± 282 sec; p=0.20). For subjects tested in both thermal conditions, decreases in heat stressed LBNP time (606 ± 218 sec) were not correlated to the magnitude of Tbody elevation (1.64 ± 0.23°C; r=0.04; p=0.83); moreover LBNP time of those with the smallest Tbody increase (664 ± 231 sec, 1.38 ± 0.14°C) was not different than those with the largest Tbody increase (611 ± 212 sec, 1.91 ± 0.07°C; p=0.60).

CONCLUSIONS: Between subject variations in normothermic and heat stress do not explain the within-condition variability in tolerance to a simulated hemorrhagic challenge. Although heat stress compromises blood pressure control, differences (1.1-2.0°C) in the magnitude of body temperature increase during a heat stress do not explain the variability in tolerance.

Support NIH GM068865

2709 Board #3 May 31 5:45 PM - 7:00 PM
mTORC2 Is Activated In Muscle During Exercise And Regulates Contraction Induced Glucose Uptake
Maximilian Kleinert, Lykke Sykow, Erik Richter. University of Copenhagen, Copenhagen, Denmark.

PURPOSE: Two distinct mTOR complexes (mTORC) have been defined. While mTORC1 serves as a regulator of protein synthesis, mTORC2 has been found to be downstream of PI3K and to phosphorylate Akt on Ser473. However, little is known about the physiological importance of mTORC2 in skeletal muscle during muscle contractions. Here we test the hypothesis that mTORC2 is activated during exercise and might be involved in contraction-induced glucose uptake in skeletal muscle.

METHODS: mTORC2 activity was judged by phosphorylation of its downstream target N-myc downregulated gene 1 (NDRG1) on the Thr346 residue. Mice ran for 30 min on a treadmill at 70% of their individual maximal running capacity, or EDL and soleus muscles were incubated in vitro and stimulated with insulin or contrain in the presence of absence of pharmacological inhibitors. Radioactive tracers were used to estimate glucose uptake.

RESULTS: In vivo running increased NDRG1 Thr346 phosphorylation by 60% (p < 0.05) compared to resting controls in gastrocnemius muscle. To test whether the running induced increase in mTORC2 activity was dependent upon AMPK activity, NDRG1 Thr346 phosphorylation was measured in mice that overexpress a kinase-dead alpha 2 subunit of the AMPK protein in skeletal muscle (AMPK-KD). In these mice NDRG1 Thr346 phosphorylation increased significantly to the same extent as in WT mice. Treatment of mouse soleus muscles with the total mTOR inhibitor, AZD8055, blocked basal and insulin stimulated NDRG1 Thr346 phosphorylation (p < 0.001) and inhibited Akt phosphorylation and glucose uptake, while rapamycin (a mTORC1 specific blocker) treatment had no effect. In EDL muscle AZD8055 had no effect on insulin stimulated glucose uptake despite ablation of Akt and NDRG1 phosphorylation. During in vitro contractions AZD8055 reduced contraction induced glucose uptake by 23% (p < 0.05) in EDL. In soleus the inhibitor had no effect on contraction induced glucose uptake. While AZD8055 reduced NDRG1 Thr346 phosphorylation to almost undetectable levels, AMPK Thr172 phosphorylation was unaffected by the blocker and increased about 2-fold with contractions in both EDL and soleus (p < 0.05).

CONCLUSIONS: It is concluded that mTORC2 is activated during muscle in exercise and has muscle specific effects and contraction induced glucose uptake.

2710 Board #3 May 31 5:45 PM - 7:00 PM
α-adrenergic Vasocostriction Contributes To The Age-related Increase In Conduit Artery Reactivity and Oscillatory Shear

(No relationships reported)

Aging is associated with greater presence of retrograde and oscillatory shear in peripheral conduit arteries of humans. We previously demonstrated that reduced nitric oxide bioavailability in the resistance vessels contributes, in part, to the age-related alterations in shear rate patterns.

PURPOSE: To further elucidate the potential mechanisms for age-related discrepancies in shear patterns, we examined the contribution of α-adrenergic vasoconstriction in resistance vessels on shear rate profiles in upstream conduit arteries of younger (n=8; 25 ± 2 years) and older (n=11; 65 ± 5 years) healthy adults.

METHODS: Brachial artery diameter and velocities were measured via Doppler ultrasound during 1) rest (control), 2) sympathetic activation via lower body negative pressure (LBNP; -20 mmHg), and 3) intra-arterial administration of phenolamine (non-specific α-adrenergic antagonist).

RESULTS: At rest older adults exhibited greater brachial artery retrograde and oscillatory shear (-9.9 ± 2.7 s-1 and 0.11 ± 0.03 arbitrary units, respectively) compared with younger adults (-3.1 ± 1.0 s-1 and 0.05 ± 0.02 arbitrary units, respectively; P < 0.05 for both). LBNP increased brachial artery retrograde and oscillatory shear in young (-6.7 ± 2.1 s-1 and 0.10 ± 0.02 arbitrary units, respectively, vs. control) and older adults (-3.1 ± 2.1 s-1 and 0.05 ± 0.02 arbitrary units, respectively; P < 0.05 vs. control). With phenolamine retrograde and oscillatory shear were abolished in young adults (-0.2 ± 0.2 s-1 and 0.00 ± 0.00 arbitrary units, respectively; P < 0.05 vs. control) and markedly reduced, however still persistent, in older adults (-3.8 ± 0.9 s-1 and 0.02 ± 0.01 arbitrary units, respectively; P < 0.001 vs. control).

CONCLUSIONS: Our data indicate that α-adrenergic vasocostriction substantially contributes to age-related discrepancies in conduit artery shear rate patterns at rest.
An increased concentration of peripheral monocyte chemoattractant protein-1 (pMCP-1) has been reported in people with diseases, such as cancers and Alzheimer’s disease, with which central fatigue often occurs and has a negative impact on these people, but no study has been done to evaluate a role of pMCP-1 in fatigue.

**PURPOSE:** To investigate pMCP-1 effects on occurrence of fatigue and central fatigue-associated neural factors in the brain.

**METHODS:** Volunteers were randomly divided into three groups: control (C; N=10), intraperitoneal injections of saline (N=10), and Salmonella typhimurium (Sal; N=10). All participants underwent a 10-d unloading protocol. Blood samples were collected at baseline (pre) and after unloading (post) to measure pMCP-1 and dopamine D2 receptor.

**RESULTS:** The Sal group showed a significant increase in pMCP-1 compared to C and Sal+D2 group. The D2 group showed a significant decrease in dopamine D2 receptor compared to C and Sal group. A significant decrease in dopamine D2 receptor was observed in the Sal+D2 group compared to Sal group.

**CONCLUSIONS:** pMCP-1 induces fatigue that is associated with changes in CNS fatigue-associated neural factors, including IL-1β, 5-HT1A, and 5-HT1B receptor subtypes in the brainstem and/or cerebellum. The results are important to elucidate the central mechanisms of fatigue, which occurs with a certain diseases or disorders, such as cancer and infection where elevated levels of pMCP-1 are common.
reduction level of the mitochondrial matrix has been associated with an inhibition of β-oxidation, while birds, via a high ETC conductance, are able to maintain lower matrix reduction, allowing fatty acid oxidation to proceed.

CONCLUSIONS: RE prior to whey protein/AA intake increases the mRNA expression of select AAT above feeding alone at 5h post RE. WHEY induced greater changes in PAT-1 vs. EAALEU suggesting unique benefits of whey protein that extend beyond total leucine content. EAA-L EU resulted in robust increases in select AAT comparable to LEU despite containing ~75% less leucine, suggesting that a high leucine content is not critical in increasing AAT expression after AA intake. The functional physiological significance of these changes remains to be elucidated. Supported by NSERC.

PURPOSE: To determine if fat tissue inflammation correlates with daily PA in postpartum Latinas. Moderate-intensity intervention will likely further reduce fat tissue and systemic inflammation, thus minimize risk for obesity-related diseases.

METHODS: Intact mitochondria were isolated, provided saturating fuels (pyruvate, glutamate, and malate), and the maximal rate of oxygen consumption (Jo) was determined. Mitochondria were then sonicated and maximum NADH oxidation was measured following the rate of oxygen reduction to water. The slope of the oxidation:reduction (redox) potential difference (AEh):Jo relationship, a measure of the conductance of electron flow down the ETC, was also determined.

RESULTS: Intact maximal Jo were 636 ± 87 and 641 ± 83 nmol·mg⁻¹·min⁻¹ in rat and sparrow, respectively, while the ETC Vmax were 731 ± 76 and 1020 ± 108 nmol·mg⁻¹·min⁻¹. Combined, these data indicate greater relative ETC activity in the sparrow; the (intact oxidase pathway)/ETC only ratio was .86 ± .04 in the rat and .65 ± .07 in the sparrow. Additionally, the slope of the AEh:Jo relationship was 1.7x greater in sparrow than the rat mitochondria, 12306 ± 1538 and 7196 ± 924, respectively.

CONCLUSIONS: These data indicate avian mitochondria have greater ETC “excess capacity” as well as greater conductance down the ETC compared to mammalian mitochondria. As a high reduction level of the mitochondrial matrix is associated with an inhibition of β-oxidation, we posit rat fatty acid oxidation is inhibited by high reduction in the mitochondrial matrix while birds, via a high ETC conductance, are able to maintain lower matrix reduction, allowing fatty acid oxidation to proceed.

PURPOSE: To compare the maximal rates of complete substrate oxidation to the oxidation of electrons as well as electron conductance in rat and sparrow mitochondria to elucidate differences between the species in the ability to produce electrons (via dehydrogenase enzymes, β-oxidation, and the citric acid cycle) and the capacity for these electrons be consumed (via travel down the electron transport chain (ETC)).

METHODS: Intact mitochondria were isolated, provided saturating fuels (pyruvate, glutamate, and malate), and the maximal rate of oxygen consumption (Jo) was determined. Mitochondria were then sonicated and maximum NADH oxidation was measured following the rate of oxygen reduction to water. The slope of the oxidation:reduction (redox) potential difference (AEh):Jo relationship, a measure of the conductance of electron flow down the ETC, was also determined.

RESULTS: Intact maximal Jo were 636 ± 87 and 641 ± 83 nmol·mg⁻¹·min⁻¹ in rat and sparrow, respectively, while the ETC Vmax were 731 ± 76 and 1020 ± 108 nmol·mg⁻¹·min⁻¹. Combined, these data indicate greater relative ETC activity in the sparrow; the (intact oxidase pathway)/ETC only ratio was .86 ± .04 in the rat and .65 ± .07 in the sparrow. Additionally, the slope of the AEh:Jo relationship was 1.7x greater in sparrow than the rat mitochondria, 12306 ± 1538 and 7196 ± 924, respectively.

CONCLUSIONS: These data indicate avian mitochondria have greater ETC “excess capacity” as well as greater conductance down the ETC compared to mammalian mitochondria. As a high reduction level of the mitochondrial matrix is associated with an inhibition of β-oxidation, we posit rat fatty acid oxidation is inhibited by high reduction in the mitochondrial matrix while birds, via a high ETC conductance, are able to maintain lower matrix reduction, allowing fatty acid oxidation to proceed.
METHODS: Ninety-five semi-professional badminton players were included in the study at a tournament at the start of the badminton season. All players were interviewed regarding pain. Each tendon was scored using a quantitative grading system (grade 0 to 5) and a qualitative scoring system (color fraction) using color Doppler ultrasound. Eight months later, 86 of the players (91%) were re-tested by the same investigators during an equivalent badminton tournament (incl. 1032 tendon regions - 86 players with 4 tendons each with 3 regions), forming the study group.

RESULTS: At the start of the season 24 players (28%) experienced pain in 37 tendons (11%) and at the end of the season 31 players (36%) experienced pain in 51 tendons (15%), which was a statistically significant increase (P = 0.0002). Abnormal flow was found in 230 tendon regions in 71 players (83%) at start season compared to 78 tendon regions in 41 players (48%) at the follow-up. The decrease in abnormal flow was statistically significant (P < 0.0001). Of the 37 painful tendons at the start of the season 25 had abnormal flow (68%). In contrast 131 tendons (85%) with abnormal flow start season were pain-free. At the end of the season 18 of the 51 painful tendons (35%) had abnormal flow. Ninety-six of the 131 pain-free tendons (73%) with abnormal flow at start season were normalized (no pain and normal flow) at end season.

CONCLUSIONS: It was not possible to verify any association between intra-tendinous flow and pain at start season or at the follow-up (end season). Intra-tendinous flow at the start of the season could not predict symptomatic outcome at the end of the season. The decrease in Doppler flow during season might suggest that intra-tendinous flow could be part of a physiological adaptive response to loading and that intra-tendinous flow as previously believed is not always a sign of pathology.

### Board #2

**May 31 5:45 PM - 7:00 PM**

**Investigating the Participation in Level I/II Activities by Potential Copers and Non-Copers 12 Months after Anterior Cruciate Ligament Reconstruction**

Victoria Allen, Andrew Lynch, Stephanie DiStasi, Lynn Snyder-Mackler. University of Delaware, Newark, DE.

(No relationships reported)

Ability to return to sport (RTS) activity is a common success measure for athletes who sustain an anterior cruciate ligament (ACL) injury. The University of Delaware uses a functional test battery to determine a minimum state of readiness for RTS. Patients complete questionnaires about their perceived knee function, current activity, and what limits their ability to return to their previous level of athletic activity. Recent work showed 78% of non-copers passed Delaware’s RTS criteria 12 months after surgery, but the rate of athletes who return to their previous activity level is still unknown.

PURPOSE: Athletes were examined 12 months after ACL reconstruction (ACLR). The purpose was to (1) evaluate the rate of athletes returning to activity; (2) evaluate activity level based on the Marx Activity Rating Scale (MARS); (3) investigate reasons for not returning to the same level of activity, despite meeting clinical RTS criteria.

METHODS: Data were collected from a total of 88 non-copers (n=52) and potential copers (n=36); subjects were high-level athletes involved in Level I/II activities. The MARS specifically evaluates the frequency that athletes are running, cutting, jumping and pivoting. Two supplemental questions were used, asking athletes to list reasons why they have not returned to all pre-injury sports and why they have not returned to the same level of competition within the sport.

RESULTS: The total pass rate for RTS criteria of 87.5%. However, overall return to activity rate was 65.9%, with 77.3% of potential copers and 45.3% of non-copers returning to pre-injury levels. MARS scores frequently indicated higher activity level than the patient-reported, creating an inconsistency. “Fear of re-injury”, “too little time to participate” and “not yet cleared from doctor”, were listed as predominant reasons for not returning to the same level of activity, despite clinical clearance for RTS.

CONCLUSIONS: Although athletes pass RTS criteria, they may not return to same level of activity. Non-copers demonstrate the need for additional evaluation and education to increase their likelihood of participating in high-level activities. The outcomes reveal the need to intervene with athletes’ activity level after injury to increase the percentage of individuals who engage in at least fifty hours of level I/II sports/year.

### Board #3

**May 31 5:45 PM - 7:00 PM**

**Dogs and Docs - Getting Patients More Active**

Jacqueline N. Epping, CDC, Atlanta, GA. (Sponsor: Robert E. Sallis, FACSM)

(No relationships reported)

PURPOSE: To examine and describe the role that dogs and dog walking may play in initiating, increasing and maintaining physical activity and improving health in patients.

METHODS: The relationship of dog ownership to a variety of health outcomes was examined. Dog walking as a mechanism to increase physical activity, in particular was examined. A rationale was provided for the potential effectiveness of dog walking as a population-based intervention strategy that could be utilized by health care providers.

RESULTS: A growing body of literature was reviewed which demonstrates the relationship of dogs, dog ownership, and dog walking to a wide variety of health outcomes, including increased physical activity and the likelihood of meeting physical activity guidelines and recommendations. For example, a recent review of the literature found that, among dog owners, those owners who walked their dogs were 2.7 times as likely to meet U.S. guidelines for physical activity as owners who do not walk their dogs.

CONCLUSIONS: Recommending dog walking to patients can be a strategy that health care professionals can use to encourage and motivate patients to initiate, increase, and sustain health-enhancing levels of physical activity.

### Board #4

**May 31 5:45 PM - 7:00 PM**

**Primary Prevention of the Female Athlete Triad in College Athletics**

Jill W. Lassiter, Don Sabo, Celia A. Wail. Bridgewater College, Bridgewater, VA.

(No relationships reported)

Primary prevention of the female athlete triad is recommended by numerous athletic organizations as a primary means to address health risks among female athletes. Collegiate athletic departments can play a role in prevention.

PURPOSE: To describe current triad-related preventative practices of college sports medicine departments, and identify characteristics associated with prevention.

METHODS: Surveyed all NCAA member institutions with an online questionnaire that measured the extent of screening and educational practices for each component of the triad. The sampling procedure generated a 37% response rate (N = 327), representing all NCAA athletic divisions (32.5% DI, 8.0% DII, 5.5% DIII, 26.0% DI, 41.5% DIII). ANOVA and independent t-tests were used to compare differences across institutional characteristics.

RESULTS: At least half of the institutions did not screen for the components of the triad (disordered eating 52.9%, menstrual dysfunction 49.5%, osteoporosis 61.2%). Screening most often occurred reactively, when athletes presented with signs and symptoms. Almost half of the institutions (48.6%) provided no education to athletes regarding the triad, and 55.4% provided no education to coaches. Division IA institutions were significantly more likely to implement preventative screenings (F=5.601, p<.001) and to educate athletes and coaches (F=6.921, p<.001, F=2.916, p<.05, respectively) than lower division institutions. Other institutional correlates of preventative practices included participation in the NCAA CHAMPS program, regular presence of a team physician, and larger athletic training staffs (≥ 3 ATC’s).

CONCLUSIONS: Primary preventative practices related to the female athlete triad are not common within college athletics. Comprehensive prevention is minimal, however, Division IA institutions with larger healthcare staffs are significantly more likely to engage in preventative practices. Further steps are needed to encourage implementation of triad related preventative practices within collegiate athletic departments.
Board #5  May 31  5:45 PM - 7:00 PM
Diclofenac Sodium 1% Gel for Relief of Osteoarthritis Pain in the Finger Joints
Roy D. Altman1, John H. Penistorg, Morris S. Gold1, Matthew S. Wieman1. 1David Geffen School of Medicine, Los Angeles, CA. 2Feastervile Family Health Care Center, Feasterville, PA. 3Novariats Consumer Health, Inc., Parsippany, NJ. 4Endo Pharmaceuticals Inc, Chadds Ford, PA.

(R.D. Altman: Consulting Fee; Endo, Novariats, Abbott, Ferring, AstraZeneica, and Rotapharm. Contracted Research Including Principle Investigator; Novariats and Ferring.)

PURPOSE: To compare the relative efficacy of diclofenac sodium 1% gel (DSG) to treat osteoarthritis (OA) pain in the first carpometacarpal (CMC1) and intraphalangeal (IP) joints of the hand. OA of the IP and CMC1 joints may occur in participants of sports that require exceptional grip strength (eg, climbing) or have a high risk for thumb and finger injuries (eg, basketball, boxing). Patients with OA limited to a few finger joints may prefer topical treatments to minimize systemic nonsteroidal anti-inflammatory drug (NSAID) exposure.

METHODS: Patients (aged ≥40 y) with hand OA applied DSG or vehicle gel, 2 g per hand, 4 times daily for 8 weeks. Assessments at 6 weeks included pain intensity (100-mm Visual Analog Scale [VAS]) and Australian/Canadian Osteoarthritis Hand Index (AUSCAN) subscales for pain, stiffness, and function. Efficacy was compared in patients with OA in CMC1 only (n=34), CMC1 plus ≥1 IP joint (CMC1+; n=241), and IP joints only (no CMC1; n=110). Institutional review board approval and patient informed consent were obtained.

RESULTS: In adults with OA of the hand, DSG was superior to relieving pain for a specific degree in all finger joints (IP and CMC1). VAS pain intensity improved by 40%-49% with DSG compared with 34%-37% for vehicle. AUSCAN pain improved by 30%-43% with DSG compared with 28%-30% for vehicle. A general trend for mild to moderate improvement in stiffness and function was observed.

CONCLUSIONS: DSG may be superior to vehicle for reducing OA pain in hand joints, with a trend toward improvement in stiffness and function. Limiting OA treatment to the affected finger joints with topical DSG may be preferable for patients wishing to minimize systemic NSAID exposure.

This study was funded by Endo Pharmaceuticals Inc., Chadds Ford, PA.

Board #6  May 31  5:45 PM - 7:00 PM
Barriers to Intake Assessment in Women Referred for Cardiac Rehabilitation
Mireille Landry, Jennifer A.D. Price, Paula J. Harvey. Women’s College Hospital, Toronto, ON, Canada.

(No relationships reported)

The benefits of exercise-based cardiac rehabilitation (CR) are well-documented in the literature. CR is underutilized, particularly in women. Once referred to CR, women are less likely to attend the first appointment or intake assessment (IA) compared to male counterparts. Previous studies have investigated barriers to attendance or completion of CR once enrolled, but little attention has been paid to barriers that affect attendance to IA.

PURPOSE: To describe women referred to CR but who fail to attend an IA, and their barriers to IA.

METHODS: Women referred to CR from 2008-2010 but did not attend an IA completed a telephone survey. Telephone interviews included a demographics questionnaire, open-ended questions regarding perceived barriers to attending IA, and the Cardiac Exercise Self-Efficacy Instrument (CESEI) and Cardiac Rehabilitation Barriers Scale (CRBS). Descriptive statistics were generated on the collected variables, and compared to women who attended IA. The content of the participant responses to the open-ended questions was analyzed through categorization, coding of data, and frequency counts.

RESULTS: Of the 671 referrals received from 2008-2010, 169 (25%) did not attend an IA, and were eligible to participate in this study. A total of 53 (mean age= 56.6 yrs, SD=12.2 yrs) consented to participate. Depression (n=22, 42%) and arthritis (n=9, 17%) were most frequently cited comorbidities among participants. The presence of arthritis was significantly different in attenders to IA vs. nonattendees (p<0.001). Mean scores on the CRBS and CESEI were 2.37+/-.35 and 3.35+/-.88 respectively. Distance to CR was significantly greater for the nonattendees (p<0.001). Distance and transportation issues were also cited by 26% (n=14) of respondents as a specific challenge to attending CR. 15 participants (28%) went on to attend CR closer to home.

CONCLUSIONS: Improved participation in CR by women can be effected through careful evaluation of factors that influence access to care. Addressing transportation issues at onset of referral may improve attendance to IA in women referred to CR.

Board #7  May 31  5:45 PM - 7:00 PM
Female Former Elite Athletes Suffering From Eating Disorders During Their Career. A 15-20 Year Follow-up
Jorunn Sundgot-Borgen1, Kjersti K. Danielsen1, Monica K. Torstveit1. 1The Norwegian School of Sport Sciences, Oslo, Norway. 2University of Agder, Kristiansand, Norway.

(No relationships reported)

Longitudinal follow up studies on female former elite athletes and knowledge regarding the recovery rate of eating disorders (EDs) is lacking.

PURPOSE: To examine whether female former elite athletes diagnosed with an eating disorder (ED) during their athletic career recover from EDs and whether long term health variables differ from former elite athletes with no history of EDs.

METHODS: In 1989, 18% of the total population of female elite athletes in Norway (n=522) met the criteria for a clinical ED. During the period from 2005-2010 we managed to get hold of 417 (80%) of these 522 athletes. In addition, a bureau of statistics picked a randomly selected sample of controls from the total population of female citizens in Norway aged 30-50 years and a total of 640 females were selected to participate. In phase I, all subjects replied to a postal questionnaire including questions related to training and competitive history, health history including questions about dieting and EDs and validated questions on ED behaviour (Eating Disorders Inventory, EDI), and mental health (WHO-QOL). In phase II, all athletes and non-athlete controls with a total EDI > 40 and/or a self-reported history or present ED, as well as 20 athletes and 20 non-athletes with EDI <40 and no self-reported history of EDs (a total of 130 athletes and 110 controls) participated in a telephone interview in which the Eating Disorder Examination (EDE) was used to diagnose possible EDs.

RESULTS: Seventy (72%) out of those 97 athletes who met the criteria for an ED during their athletic career had recovered, and three new cases of athletes had developed an ED after they stopped competing. Out of the athletes and non-athletes who were interviewed, 30 (23%) athletes and 22 (20%) non-athletes met the DSM-IV criteria for EDs. Athletes with a history of EDs reported more present menstrual dysfunction and lower score on the WHO-QOL than former athletes with no ED history, and controls.

CONCLUSIONS: Most former elite athletes with a history of EDs recover, however more than one out of four are still struggling with their ED 15-20 years after they finished their sport career.

Board #8  May 31  5:45 PM - 7:00 PM
Variability In Hallux Pressures With Cam Walker Boot And Rigid Sandal: Implications For Post-operative Mobilization
Kenneth J. Hunt1, Rebecca Shultz2, Maria Malone2, Alex Sox-Harris1, Daniel Garza, FACSM2, Gordon O. Matheson1. 1Stanford, Redwood City, Ca. 2Stanford, Stanford, CA.

(No relationships reported)

There are numerous surgical procedures for pathologies affecting the hallux metatarsophalangeal (MTP) joint, including arthrodesis, osteotomies, bunionectomies, and soft tissue reconstructions. While early protected weight bearing (WB) has been shown to be safe for some procedures, higher failure rates have been reported for hallux MTP arthrodesis with early WB. Post-operative protocols usually include transition to WB in a short hallux walker boot device or rigid post-operative sandal. The pressures exerted at the great toe (GT) and the hallux metatarsal head (MTH) in these devices are unknown.

PURPOSE: To compare the contact peak pressure and impulse at the great toe and hallux MTH with three different movement tasks during ambulation in each of three foot devices.

METHODS: 20 healthy subjects (age 25-37) performed three movement tasks (normal walking, heel WB, 90 deg pivot turn), while wearing each of three different footwear devices: CAM walker boot, hard-sole post-operative sandal, and running shoes. Insole pressure measurements were collected using Tekscan (South Boston, MA) insoles. Contact pressures, peak pressures

Board #9  May 31  5:45 PM - 7:00 PM
The Clinical Implications of Tailored Exercise in Youth with Eating Disorders: A 15-20 Year Follow-up
Maria Malone2, Kenneth J. Hunt1, Rebecca Shultz2, Monica K. Torstveit1. 1The Norwegian School of Sport Sciences, Oslo, Norway. 2Stanford, Redwood City, CA.

(No relationships reported)

PURPOSE: The prevalence of eating disorders (EDs) is high among female elite athletes. During the period from 1989-2010 we managed to get hold of 522 (64%) of the total population of female elite athletes in Norway aged 30-50 years. The prevalence of EDs is higher in athletes than non-athletes.

RESULTS: Seventy (72%) out of those 97 athletes who met the criteria for an ED during their athletic career had recovered, and three new cases of athletes had developed an ED after they stopped competing. Out of the athletes and non-athletes who were interviewed, 30 (23%) athletes and 22 (20%) non-athletes met the DSM-IV criteria for EDs. Athletes with a history of EDs reported more present menstrual dysfunction and lower score on the WHO-QOL than former athletes with no ED history, and controls.

CONCLUSIONS: Most former elite athletes with a history of EDs recover, however more than one out of four are still struggling with their ED 15-20 years after they finished their sport career.
and impulse (Force x time) were collected at GT and MTH during stance phase for each subject for nine conditions (3 movement tasks and 3 shoe devices). Mixed-effects regression models were used to estimate mean simultaneous pairwise differences and (95% CI) between the nine conditions.

RESULTS: The boot resulted in lower MTH contact pressure than both other devices during all three conditions, with a significant difference occurring between the boot and the sandal during heel walking (p<0.01). MTH impulse was significantly lower with the boot compared to the other devices during pivot, but only versus shoe during walking, with no difference between boot and sandal during walking. The lowest peak pressure occurred during heel walking at both MTH and GT independent of the device; this was significantly lower than the other two movement tasks.

CONCLUSIONS: As safe, early mobilization is often the goal for patients following hallux procedures and during recovery from hallux injuries, it appears a short CAM walker boot may be superior to a rigid sandal in terms of pressures at the hallux MTH and GT.

2727 Board #9  May 31  5:45 PM - 7:00 PM
Recurrent Syncopy in an Adolescent Football Player
Mark Riederer, Prince Kannankeril, Monroe Carell Jr. Children’s Hospital at Vanderbilt, Nashville, TN.
(No relationships reported)

HISTORY: A 17-year-old high school athlete adolescent male is hospitalized overnight after having a syncopal episode. He was “roughhousing” with a few of his friends when he suddenly didn’t feel well and then proceeded to pass out. Two of his friends, trained in cardiopulmonary resuscitation, felt no pulse and performed chest compressions and breaths for about 1 minute until he regained consciousness. He had two prior episodes of syncope, the first when he was 13-years-old when he collided with another boy while playing lacrosse. He had a very brief loss of consciousness after the hit, and then felt well when he awoke. The second episode occurred one year later while lifting weights he suddenly stood up and lost consciousness. Again after he awoke, he felt relatively well. He has no other past medical history or surgical history. He plays high school football and club rugby. There is no family history of sudden death or arrhythmia. His mother has had several episodes of syncope with “stress.”

PHYSICAL EXAMINATION: Vital signs: Heart rate 47, blood pressure 122/62. In general, he is awake, alert and well appearing. His breath sounds are symmetric, and clear to auscultation. His heart is regular in rate and rhythm, normal S1 and S2 without murmur or gallop. His abdomen is soft, nontender and nondistended. His strength is normal. There is no clubbing, edema, or cyanosis. He has a nonfocal neurologic examination.

DIFFERENTIAL DIAGNOSIS:
Neurocardiogenic syncpe
Long QT Syndrome
Hypertrophic cardiomyopathy
Aortic stenosis
Atrioventricular right ventricular cardiomyopathy
Catecholaminergic polymorphic ventricular tachycardia

TEST AND RESULTS: He had a normal resting electrocardiogram, with a normal QT interval, and normal echocardiogram. An exercise stress test showed bidirectional ventricular tachycardia. An intracardiac electrophysiology study was normal, with no inducible arrhythmias. Resequencing of the cardiac ryanodine receptor (RYR2) gene revealed a nonsynonymous mutation in RYR2 (Arg 15 Pro), a rare variant not previously described in the literature.

FINAL WORKING DIAGNOSIS: Catecholaminergic polymorphic ventricular tachycardia
TREATMENT AND OUTCOMES: He did well on high dose beta-blocker therapy, was restricted from strenuous activity, and is doing well without any further episodes of syncope.

2728 Board #10  May 31  5:45 PM - 7:00 PM
Infectious Disease - Swimming
Kari Taggart1, Sherrie Ballantine-Talmadge1, 2 AthleticsCo/Northwestern University, Evanston, IL. 1Northwestern University, Evanston, IL.
(No relationships reported)

HISTORY: 18-year-old female Division I swimmer presented to athletic training room with sore throat, bilateral tonsillar exudates and painful swallowing. She was referred to team physician for further evaluation and treated with Prednisol. Patient improved symptomatically, but returned 13 days later with sore throat, subjective fever, body aches, headache, and muffled voice. She was treated for mono and placed on Prednisone. In four days her condition drastically changed. She called ATC with fever, difficulty breathing, and sharp, constant back/abdominal pain so was sent to ER

PHYSICAL EXAMINATION:
VS: BP 96/55 HR 102 Temp 97.8 RR24
Gen: uncomfortable w/ breathing
HEENT: wnl
CV: S1S2 w/o murmur; tachy rate; regular rhythm
Chest: decreased and course BS at RLL; breath sounds throughout
Abd: tip in RUQ with no guarding or rebound; (+) Murphy’s sign; tip along mid thoracic spine, in mid line, radiating around to LUQ
Ext: no clubbing, cyanosis or edema (+) Homan’s B

DIFFERENTIAL DIAGNOSIS:
1. Mononucleosis
2. Strep throat/pneumonia
3. Community-Acquired Pneumonia
4. Sepsis
5. Pulmonary Embolism
6. Endocarditis/pericarditis
7. Peritonsillar abscess

TESTS/RESULTS:
At Hospital
CXR for B infiltrates (+)
Elevated WBC
Blood cultures: Fusobacterium necrophorum & Streptococcus dysgalactiae
Elevated LFTs

TREATMENT/OUTCOMES:
Began Unasyn at hospital for presumed CAP with sepsis.
Progression back to swimming following tonsillectomy and return to pre-illness levels of training in the fall

RESULTS:
Statistical analysis was performed using one-way ANOVA with Bonferroni corrected post hoc comparisons. The etiology of low bone mineral density (BMD) in male cyclists may be partially due to elevations in cortisol, which increases stress weights, insufficient energy intake could potentially lead to impaired bone strength. Bone Mineral Density (BMD) is closely correlated with bone strength and rowers with previous rib stress fractures have exhibited reduced BMD compared to uninjured rowers.

PURPOSE: To investigate if lightweight rowers were characterized by reduced BMD compared to heavyweight rowers.

METHODS: Total body BMD was measured in male (ML, n=20) and female (FL, n=9) lightweight rowers, and male (MH, n=10) and female (FH, n=10) heavyweight rowers (Danish National Team) by dual energy X-ray absorptiometry (DXA-scan). To enable comparisons between the four groups of rowers BMD was expressed in % of a young adult reference population (20-40 years of age).

RESULTS: Total body BMD was reduced in ML (96.9 ± 5.0 %) compared to MH (111.0 ± 5.2 %, p<0.001), FH (111.1 ± 7.2 %, p<0.001) and FL (107.2 ± 5.4 %, p<0.05). No other group differences were observed.

CONCLUSION: Total body BMD was reduced in male National Team lightweight rowers compared to male heavyweight rowers, whereas no difference was observed between lightweight and heavyweight female rowers. Thus, internationally competitive male National Team lightweight rowers seem to demonstrate an attenuated adaptive skeletal response compared to that observed in National Team rowers without weight restriction, which expose male lightweight rowers to an increased risk of exercise-induced rib stress fracture injury.

E-20 Free Communication/Poster - Bone Mineral Density

2729 Board #1 June 1 9:30 AM - 11:00 AM
Reduced Bone mineralization in Elite Male Lightweight Rowers Compared to Elite Rowers Without Weight Restriction
Anders Vinther1,2, Tine Alkjær1, Inge-Lis Kanstrup1, Bo Zerah1, Charlotte Ekdahl1, Per Aagaard1,2,3,4, Herlev Hospital and Lund University, Herlev and Lund, Denmark. 1Panum Institute, University of Copenhagen, Copenhagen, Denmark. 2Herlev Hospital, Herlev, Denmark. 3Lund University, Lund, Sweden. 4University of Southern Denmark, Odense, Denmark.
(No relationships reported)

During the last decades an increased incidence of exercise-induced rib stress fractures has been observed among rowers at the international elite level. In Denmark, male lightweight rowers have demonstrated a particularly high frequency of injury. Sufficient energy intake is important to ensure optimal bone adaptation, and since lightweight rowers need to comply with strict weight limits, insufficient energy intake could potentially lead to impaired bone strength. Bone Mineral Density (BMD) is closely correlated with bone strength and rowers with previous rib stress fractures have exhibited reduced BMD compared to uninjured rowers.

PURPOSE: To investigate if lightweight rowers were characterized by reduced BMD compared to heavyweight rowers.

METHODS: Total body BMD was measured in male (ML, n=20) and female (FL, n=9) lightweight rowers, and male (MH, n=10) and female (FH, n=10) heavyweight rowers (Danish National Team) by dual energy X-ray absorptiometry (DXA-scan). To enable comparisons between the four groups of rowers BMD was expressed in % of a young adult reference population (20-40 years of age).

RESULTS: Total body BMD was reduced in ML (96.9 ± 5.0 %) compared to MH (111.0 ± 5.2 %, p<0.001), FH (111.1 ± 7.2 %, p<0.001) and FL (107.2 ± 5.4 %, p<0.05). No other group differences were observed.

CONCLUSION: Total body BMD was reduced in male National Team lightweight rowers compared to male heavyweight rowers, whereas no difference was observed between lightweight and heavyweight female rowers. Thus, internationally competitive male National Team lightweight rowers seem to demonstrate an attenuated adaptive skeletal response compared to that observed in National Team rowers without weight restriction, which expose male lightweight rowers to an increased risk of exercise-induced rib stress fracture injury.

2730 Board #2 June 1 9:30 AM - 11:00 AM
The Evaluation of Forearm Muscles Strength and Bone Mineral Density of Archers
Nisa Zekiye Özbek1, Özlem Öner Cokşun1, Sabire Akin1, Hayri Ertan1, Feza Korkusuz1, Middle East Technical University Medical Center, Ankara, Turkey. 1Anadolu University, Eskişehir, Turkey.
(No relationships reported)

PURPOSE: Archery can be described as a static form of strength and endurance of the upper body, in particular the forearm and shoulder girdle. The discipline is described as a three-phase (the stance, the drawing and the sighting) movement. Shooting the high number arrows during both training and competition, a repeated contraction-relaxation strategy by both drawing and bow hand forearm muscles should be developed. The studies that have been done on forearm muscles proved that muscular strength imbalance cause uncoordinated shooting and may impair with wrist injuries. This study investigated the effects of long-term archery training on the forearm isokinetic muscular strength and bone mineral density (BMD).

METHODS: 10 male and 3 female totally 13 high level archers volunteered into the study. Concentric strength of wrist extensor and flexor in both forearms was measured by using Biodex System 3 isokinetic dynamometer. Both forearms were measured at speed of 60°/s and in the distal and total radius-ulna by dual energy x-ray absorptiometry (DEXA).

RESULTS: Dominant forearm BMD and muscle strength values were significantly higher than non-dominant forearm values. These strength and BMD relations indicate sport specific skeletal and muscular adaptations. As a result of sport-specific movement pattern and training programs, the dominant forearm muscle strength is expectedly higher than non-dominant forearm. The results of this study can guide clinicians, coaches and archers.

2731 Board #3 June 1 9:30 AM - 11:00 AM
Cortisol and Bone Mineral Density in Competitive Male Cyclists
Shannon L. Mathis1, Richard S. Farley, Dana K. Fuller, Amy E. Jetton, Jennifer L. Caputo, Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don W. Morgan, FACSMS)
(No relationships reported)

Elevated cortisol is linked to a high prevalence of osteoporosis. The etiology of low bone mineral density (BMD) in male cyclists may be partially due to elevations in cortisol, which increases during physiological and psychological stress.

PURPOSE: To determine whether pre- and post-competition cortisol levels, pre-race competitive state anxiety, daily calcium intake, and training history were related to lumbar spine and hip BMD in male cyclists.

METHODS: Lumbar spine (L1 - L4), total hip, femoral neck, and trochanter BMD were measured with dual x-ray absorptiometry in 33 male cyclists who competed in a state championship time trial event. Calcium intake was measured using a 1 day dietary recall. On a survey, participants reported age, years of bike-specific training, number of races per season, and minutes per week riding a bike, weight training, and running. On race day, a competitive state anxiety questionnaire was used to measure pre-race nervousness. Salivary cortisol was measured within 10 minutes of racing and within 5 minutes of race finish.
CONCLUSIONS: Few studies currently demonstrated the relationship between muscle strength (MS) of hip, trunk and adjacent bone mineral density (BMD) sites. We investigated the relationship between muscle strength and BMD in postmenopausal women with different age groups. The relationship between MS at different age and BMD was also investigated. We found significant relationships between MS and BMD at different age groups. The relationship between MS and BMD was stronger at younger age groups than at older age groups. This finding suggests that intervention programs targeting muscle strength may be more effective in younger women.
RESULTS: Interactions sessions). Fourteen men did not complete the 12 month exercise intervention due to: health problems or injuries unrelated to the intervention (n=9), time commitments (n=2), or discomfort (33.2% of the variance of L2-4BMID in G5).

CONCLUSION: In postmenopausal women, muscle strength of hip and trunk did not show a decreasing trend with age and significant correlation were observed between BMD and MS of hip, trunk. Lean mass is an important determinant of BMD.

2736 Board #8
June 1 9:30 AM - 11:00 AM
Body Composition and Bone Mineral Density Responses to Different Intensity Resistance Training in Postmenopausal Women
Linda Lin1, Michael Lo2, Min-Huei Hsieh3, Wei-Jen Yao4, Yi-Ju Chen1. National Cheng Kung University, Tainan, Taiwan. 2Kun Shan University, Tainan, Taiwan. (No relationships reported)

PURPOSE: The purpose of this study was to compare the effects of 24 weeks high- and medium-intensity resistance training (RT) on bone mineral density (BMD), body composition (BC), and muscular isokinetic strength in postmenopausal women.

METHODS: Thirty -two volunteers (50~67 years) matched for strength and randomly assigned to either the high-intensity (80% 1RM, 8 reps; HI, N = 11), medium-intensity (50% 1RM, 13reps; MI, N = 11) and control group (CG, N = 10). The exercise program consisted of using 9 resistance machines under supervised progressive resistance training 2 sessions per week for 24 weeks.

RESULTS: At baseline, the three groups had similar BMD, BC, and strength characteristics. After 24 weeks training, there were no differences between the three groups in the total bone mineral density and total body fat. HI increased significantly (3.5%) more than CG(-11%) in lean mass of arm (p<0.05). The peak torque in biceps(27%-29%) and quadriceps(15-22%) of both groups were also significantly higher than the control group (-2.4%/p<0.05), but there was no significant differences between three groups in triceps’ peak torque.

CONCLUSIONS: These findings suggest that high- and medium-intensity resistance training effectively increase muscular strength and have equally beneficial effects in postmenopausal women. However, RT with higher intensity might have greater response at the upper body lean mass.

2737 Board #9
June 1 9:30 AM - 11:00 AM
The Relationship Between Protein Consumption And Bone Mineral Density In Postmenopausal Breast Cancer Survivors
Emily Page, Emily Simonavice, Michael J. Ormsbee, Pei-Yang Liu, Jasminka Z. Ilich-Ernst, Jeong-Su Kim, Bahram H. Arjmandi, Lynn B. Panton, FACSM. Florida State University, Tallahassee, FL. (No relationships reported)

Breast cancer survivors (BCS) encounter many side effects from cancer treatments that negatively affect body composition. Specifically, postmenopausal BCS have increased rates of bone turnover, leading to loss of bone mineral density (BMD). There is evidence to suggest a higher level of protein in the diet may be beneficial for bones in older adults. It has not been investigated whether higher protein consumption in BCS can lead to improved BMD.

PURPOSE: To evaluate the relationship between protein intake and BMD of various skeletal sites in postmenopausal BCS.

METHODS: Twenty seven BCS (age: 64±7yrs; BMI:27.7±5.5kg/m²) completed a 24-hour dietary recall to assess nutritional intake. Total body and regional (lumbar spine, femur, and forearm) BMD were measured via dual energy X-ray absorptiometry. One-way analysis of variance was used to determine if BCS consuming greater than 20% protein (>20%) in diet differed in total and regional BMD compared to those consuming less than 20% (<20%). Multiple regression models (controlled for total lean mass, fat mass, vitamin D intake) were developed to examine the influence of protein intake on various BMD sites.

RESULTS: The BCS consumed on average 1920±783 kcal/day with 49±13% from carbohydrates, 34±9% from fat, and 17±7% from protein. Average calcium and vitamin D intake (from food and supplements) were824±264 mg/day and 1218±408 IU/day, respectively. Protein intake was 1.06±0.54 g/kg of body weight per day. BCS consuming >20% protein had significantly higher total BMD (>20%:1.25±2.124 vs <20%:1.18±2.120 g/cm²) and femur BMD (>20%:0.920±0.28 vs <20%:0.390±0.170 g/cm²). There were no differences between the two groups in BMD of other skeletal regions, body weight, lean mass, fat mass, energy intake, calcium or vitamin D intake. In multiple regression models, controlled for total lean mass, fat mass, vitamin D intake, protein intake was a significant determinant of total body and femoral neck BMD.

CONCLUSIONS: Our findings indicate that BCS with greater than 20% daily protein consumption exhibit higher total BMD regardless of calcium, vitamin D, or energy intake. Further research in larger samples is needed to elucidate potential benefits of protein or other dietary regimens on BMD and body composition in postmenopausal BCS.

2738 Board #10
June 1 9:30 AM - 11:00 AM
High Impact Unilateral Exercise Increased Femoral Neck Bone Mineral Density in Older Men
Sarah J. Allison1, Jonathan P. Folland3, Winston J. Rennie2, Greg D. Summers2, Katherine Brooke-Wavell1, 2Loughborough University, Leicestershire, United Kingdom. 3University Hospitals of Leicester, Leicester, United Kingdom. 4Royal Derby Hospital, Derby, United Kingdom. (No relationships reported)

High impact exercise is effective for improving bone mineral density (BMD) in children and young adults, although the few studies in older adults have yielded mixed results. Older men are at risk of osteoporotic fractures but the feasibility of high impact exercise and its influence on BMD in this population is unknown. Age-related changes and lifestyle modification may confound exercise intervention trials in older people. The effect of these confounders can be minimised using a within-subjects unilateral design (exercise vs. control limb) that has greater statistical power.

PURPOSE: To investigate the influence of a 12 month high impact unilateral exercise intervention on femoral neck BMD in older men.

METHODS: Healthy community-dwelling older men completed a 12 month high impact unilateral exercise intervention which progressed to 50 multidirectional (vertical, anteroposterior, mediolateral, rotational) hops, 7 days a week on a randomly allocated leg. BMD of both femurs was measured using dual energy X-ray absorptiometry (DXA) at baseline and after 12 months of exercise, by an observer blind to the leg allocation. Two-way repeated measures ANOVA was used to identify leg (exercise leg [EL] vs. control leg [CL]) x time (pre vs. post) interactions.

RESULTS: Thirty-five men (mean ± SD, age 69.9 ± 4.0 yrs) exercised for 12 months and intervention adherence was 90.9 ± 9.1% (305 ± 30.5 sessions completed out of 336 prescribed sessions). Fourteen men did not complete the 12 month exercise intervention due to: health problems or injuries unrelated to the intervention (n=9), time commitments (n=2), or discomfort during exercise (n=3). Femoral neck BMD increased in the EL relative to the CL (mean ± SEM: EL 0.948 ± 0.018 to 0.954 ± 0.017 g/cm²; CL 0.954 ± 0.018 to 0.945 ± 0.018 g/cm²; ANOVA leg x time P = 0.003) as did femoral neck BMC (EL 5.50 ± 0.13 to 5.54 ± 0.12g; CL 5.51 ± 0.13 to 5.50 ± 0.13g; ANOVA leg x time P = 0.024).

CONCLUSION: A 12 month high impact unilateral exercise intervention was feasible and effective for inducing modest increases in femoral neck BMD and BMC in older men. Carefully targeted high impact exercises may be suitable for incorporation into exercise interventions aimed at preventing fractures in healthy community-dwelling older men.

2739 Board #11
June 1 9:30 AM - 11:00 AM
Risk Factors for Low Bone Mineral Density in Institutionalized Individuals with Developmental Disabilities
Michael A. Vice, Vinayak K. Nahar, Martha Bass, Allison Ford-Wade. The University of Mississippi, university, MS. (Sponsor: Mark Loftin, FACSM) (No relationships reported)

Persons with developmental disabilities are exposed to several factors which have been determined as risks for osteoporosis. Many of these individuals are non-ambulatory, resulting in lack of weight bearing activity which is well established as a major contributor to bone loss. It is suspected that low bone mineral density (BMD) and related fractures are more prevalent in non-ambulatory persons and persons with developmental disabilities. It is also suspected that low BMD in this population is due to the presence of multiple risk factors.

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RESULTS: Data were collected on 69 participants. Thirty-nine were male and 30 were female. Ages ranged from 19 to 67 years with only 10 of the participants being over 55 years old (mean age = 45.58, SD = 11.52). Sixty-six of the participants were ambulatory. All were diagnosed with varying levels of intellectual disability, with 35 being classified with Profound Mental Retardation. Ultrasound BMD measures ranged from a t score of 2.0 to 3.0. Thirty-six participants (52.2%) were classified as healthy BMI, 22 (31.9%) as osteopenic, and 11 (15.9%) as osteoporotic. BMD measures were not significantly associated with age, gender, height, weight, or BMI for this population (p > .05). When BMD was categorized as healthy, osteopenia, or osteoporosis the association with classification of intellectual disability approached significance (X² = 14.83, p = .063). A significant association was also found with anti-seizure medication use (X² = 23.62, p = .009).

CONCLUSIONS: Risk factors for low BMD have been identified for the healthy, normal population. Data collected in this study indicate that institutionalized individuals, with varying diagnosis of intellectual disability, do not share these risk factors. Studies investigating risk factors and determinants of low BMD in this population are warranted.

2740 Board #12 June 1  9:30 AM - 11:00 AM
Effects of Exercise Training on Bone Mineral Density, Inflammatory Cytokines, and Biochemical Bone Markers
Elisa A. Marques1, Jorge Mota1, Diana Tuna2, Tiago Guimarães2, Joana Carvalho1. 1University of Porto - Faculty of Sport, CIAFEL, Porto, Portugal. 2Hospital of S. João, Porto, Portugal. 1University of Porto - Faculty of Medicine, Porto, Portugal.

RESULTS: Average daily energy expenditure was measured via an accelerometer (Philips Respironics Actical, Bend, OR) worn by participants at the right hip for an average of four days. No baseline differences were found between groups for any of the variables. No group x time interaction was detected for any variables. BCS significantly increased upper body use (X² = 14.83, p = .063). A significant association was also found with anti-seizure medication use (X² = 23.62, p = .009).

CONCLUSIONS: Risk factors for low BMD have been identified for the healthy, normal population. Data collected in this study indicate that institutionalized individuals, with varying diagnosis of intellectual disability, do not share these risk factors. Studies investigating risk factors and determinants of low BMD in this population are warranted.

2741 Board #13 June 1  9:30 AM - 11:00 AM
College-age Dancers Have Greater Bone Mass than Runners and Controls Despite Low Energy Availability
Hawley C. Almstedt, Zakkoya H. Lewis-Powell, Loyola Marymount University, Los Angeles, CA.

RESULTS: The Female Athlete Triad is a syndrome comprised of three inter-related conditions: menstrual dysfunction, suboptimal bone health, and poor energy availability (EA). EA is calculated as kilocalorie intake minus energy expended through activity.

PURPOSE: The goal of this research was to evaluate the relationship between EA and bone mineral density (BMD) in runners, dancers, and controls. METHODS: Runners (n=13), dancers (n=11), and controls (n=15) between the ages of 18-22 (mean=19.8±1.1 years) underwent BMD testing at the hip, spine, and whole body using dual-energy x-ray absorptiometry (DEXA, Hologic Explorer, Waltham, MA). Diet intake was assessed using the Block 2005 Food Frequency Questionnaire (Nutrition Quest, Berkeley, CA). Average daily energy expenditure was measured via an accelerometer (Philips Respironics Actical, Bend, OR) worn by participants at the right hip for an average of four days.

RESULTS: Groups were similar in age, height, weight, lean mass, protein and calcium intake. EA did not correlate significantly with BMD at any site. Dancers showed a moderate, nonsignificant, negative relationship between EA and BMD at the femoral neck (r=-0.65, p=0.05). When controlling for lean mass (LM), there were no significant differences in EA between groups: dancers=27.9±17.0 kcal/kg LM, runners=24.0±16.8 kcal/kg LM, and controls=31.9±13.7 kcal/kg LM. An ANCOVA (controlling for BMI) revealed that dancers have significantly greater mean BMD at the anterior-posterior spine (1.06±10.10 g/cm²) than runners (0.84±10.07 g/cm²) and controls (0.97±10.09 g/cm²). Dancers also had significantly greater mean femoral neck BMD (0.97±0.13 g/cm²) than controls (0.85±0.10 g/cm², p<0.01) but not runners (0.88±0.06 g/cm²). Groups were similar in BMD at the whole body.

CONCLUSION: Our research shows that despite similarly low EA, dancers exhibit greater BMD at the spine than runners and controls. This implies that perhaps the loading nature of dancing has a greater positive impact on bone than running.

2742 Board #14 June 1  9:30 AM - 11:00 AM
Effects Of Resistance Training And Dried Plum Consumption On Bone Health In Breast Cancer Survivors
Emily Simonavice1, Pei-Yang Liu2, Jas-mina Z. Ilich-Ernst1, Jeong-Su Kim3, Bahram H. Arjmandi1, Lynn B. Panton, FACSM4. 1Florida State University, Tallahassee, FL. 2Akron University, Akron, OH.

RESULTS: No baseline differences were found between groups for any of the variables. No group x time interaction was detected for any variables. BCS significantly increased upper body use (RT: 83.2±24.2 to 88.2±24.2 kg, p<0.001; RT+DP: 79.2±24.2 to 85.0±24.2 kg, p<0.001) and lower body (RT: 72.1±17.7 to 88.2±25.2 kg, p<0.001; RT+DP: 73.1±17.7 to 89.9±19.6 kg, p<0.001) strength. The RT+DP group lost BMD from baseline to 6M (0.47±0.059 vs 0.46±0.054 g/cm², p<0.05) and after 32 weeks, both men and women significantly increased trochanter (0.7±2.1%, p=0.001), intertrochanter (0.7±2.0%, p=0.001), total hip (0.6±1.7%), and LS BMD (1.7±2.3%, p=0.001). OC, CTX, OPG and RANKL remained unchanged. In addition, IFN-γ significantly decreased by 15.6% (p=0.002), while there were no significant group or time effects in TNF-α. A significant decrease in IL-6 was observed only in men (9.0%, p=0.002). The change in TNF-α was negatively correlated with the change in lumbar spine BMD (r=-0.30, p=0.047).

CONCLUSIONS: Despite the lack of a significant change on bone turnover markers, our combined impact protocol decreased inflammation, and increased BMD in older adults. Results further support the beneficial role of long-term exercise on bone mass and low-grade inflammation in older adults.

Granted by PTDC/DES/108780/2008 - FCOMP 01 0124, and SFRH/BDE/36319/2007
A simultaneous presence of muscle and bone weaknesses associated with frailty contributes to high fracture risk in the older population, however, the associations between sarcopenia, appendicular skeletal muscle mass (ASM), relative skeletal muscle mass index (RSMI), bone free lean body mass (BFLBM), muscle strength, and osteoporosis are not as well known.

PURPOSE: To examine the association between sarcopenia status and bone mineral density (BMD) classification and to determine relationships between ASM, RSMI, BFLBM, and BMD at total body, trochanter, femoral neck, total hip, lumbar spine sites in older men (n=27) and women (n=33) (55-75 years).

METHODS: BMD at total body, dual proximal femur (trochanter, femoral neck, total hip) and lumbar spine sites, ASM, BFLBM, and RSMI were measured using DXA. Subjects were classified as sarcopenic if they had a RSMI < 7.26 kg/h2 for men and < 5.45 kg/h2 for women. Calcium intake and physical activity levels were assessed by questionnaires. RESULTS: The prevalence of osteopenia/osteoporosis was 52% in men, and 67% in women. Sarcopenia was found in 24% of men and 14% of women. Chi-square analysis showed that sarcopenia status was not significantly associated with osteoporosis status (p=0.05). RSMI, ASM, and BFLBM had significant (p<0.01) positive correlations with BMD at total body, trochanter, femoral neck, total hip, and lumbar spine sites. Multiple regression analyses showed that RSMI was a significant predictor of BMD at total hip, femoral neck, and spine while ASM alone was a significant predictor (p<0.001) for trochanter BMD.

CONCLUSION: Sarcopenia status was not found to be associated with BMD classification in older individuals. Surrogate measures of muscle mass such as BFLBM and ASM were found to be the best predictors for BMD status at sites measured.

**References**

1. University of Oklahoma, Norman, OK. 2. University of Oklahoma Health Sciences Center, Oklahoma City, OK.

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### Free Communication/Poster - Bone Physiology and Mechanics

**June 1, 2012 7:30 AM - 11:00 AM**

**Board #15**

**June 1 9:30 AM - 11:00 AM**

**Association between Sarcopenia Status and Bone Density Classification in Older Men and Women**

Harshvardhan Singh1, Daeyeol Kim1, Michael Bemben, FACSM2, Mark Anderson2, Debra Bemben, FACSM1. 1University of Oklahoma, Norman, OK. 2University of Oklahoma Health Sciences Center, Oklahoma City, OK.

(No relationships reported)

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**Board #17**

**June 1 11:00 AM - 12:30 PM**

**The Effects of Dance Training on Children’s Foot Arch**

Jai-yuan Zhang, Kuo-Wei Tseng, Yu-Hua Tseng, Hung-Wen Cheng, Taipei physical education college, Taipei, Taiwan.

(No relationships reported)

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**Board #18**

**June 1 11:00 AM - 12:30 PM**

**Bone Blood Flow at Rest and During Exercise in Humans Measured with Positron Emission Tomography**

Kari Kalliokoski1, Kimmo Kaskinoro2, Jukka Kemppainen1, Juhani Knuutil1, Ilkka Heinonen1. 1University of Turku, Turku, Finland. 2Turku University Hospital, Turku, Finland.

(No relationships reported)

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**Board #16**

**June 1 9:30 AM - 11:00 AM**

**Predictors of Bone Mass Density in Older Chinese Children**

Chao Wang1, Peijie Chen1, Lu Zheng2, Shouyi Yan1, Gang He1. 1Shanghai University of Sport, Shanghai, China. 2Capital University of Physical Education and Sports, Beijing, China. The Chinese University of Hong Kong, Hong Kong, China.

(No relationships reported)
between exercise intensities). In men, resting femoral bone blood flow was similar as in women (1.5 ± 0.5 ml · 100 g⁻¹ · min⁻¹, p = 0.26) and dynamic one leg moderate-intensity exercise increased it to 4.2 ± 1.2 ml · 100 g⁻¹ · min⁻¹, p < 0.001. Breathing of hypoxic air did not change femoral bone blood flow at rest (1.5 ± 0.4 ml · 100 g⁻¹ · min⁻¹, p = 0.79) or during exercise (5.0 ± 1.4 ml · 100 g⁻¹ · min⁻¹, p = 0.14). Finally, intra-arterial infusion of adenosine increased bone blood flow to 5.7 ± 2.4 ml · 100 g⁻¹ · min⁻¹, to the level comparable with moderate intensity dynamic exercise (p = 0.09).

CONCLUSIONS: Resting femoral bone blood flow is similar in healthy young women and men and increases by physical exercise, but appears to level off with increasing exercise intensities, at least during intermittent isometric exercise. Moreover, while moderate systemic hypoxia does not change bone blood flow at rest or during exercise, intra-arterially administered pharmacological vasodilator adenosine is capable of enhancing bone blood flow in humans.

2747 Board #19 June 1 11:00 AM - 12:30 PM
Indices of Local Muscle Function Are Weak Predictors of Femoral Neck Bone Structure in Pediatric Females

Jodi N. Dowthwaite, Melissa E. Zajdel, Carol A. Sames, Paula F. Rosenbaum, Tamara A. Sercpella. SUNY Upstate Medical University, Syracuse, NY. *Princeton University, Princeton, NJ. +University of Wisconsin-Madison, Madison, WI. (Sponsor: Jill A. Kanaley, FACSM)

As hip fracture risk may be established during growth, pediatric screening and intervention may benefit public health.

PURPOSE: Muscle and physical activity indices were tested as predictors of femoral neck (FN) structure in young girls.

METHODS: Pre-menarcheal girls (46 gymnasts, 30 non-gymnasts) reported Tanner breast stage (TB) and prior year non-aquatic physical activity (PAL). Height and weight were measured. Hologic DXA scans (whole body, left FN) yielded total body non-bone lean mass (FFM) and bone metrics. Dynamometers assessed non-dominant hand grip (GR) and left hip flexion/extension (Takei; Biodes). Parsimonious regression models were developed to predict FN indices.

RESULTS: For all but buckling ratio (BR), TB + hip flexion peak torque (HFPT) and TB + GR predicted FN indices (model r² = 0.34 - 0.55; 0.40 - 0.64, respectively; p<0.001). However, FFM entry obliterated HFPT and GR explanatory value, also obliterating TB predictive value for all but cortical thickness. For all but BR, FN indices were well-predicted by FFM models. For all but across-tensor moment of inertia, models included PAL, gymnast status (GYM) or PAL + GYM. For all but BR, entry of GYM supplanted PAL; TB + PAL + GYM predicted BR.

CONCLUSIONS: Pre-menarche, FN indices are a function of maturity and size (FFM) and/or PAL; local muscle indices are inferior predictors to GR (remote muscle function index) and FFM. PAL predictive value provides evidence that non-aquatic exercise is osteogenic during growth. GYM predictive value supports high impact loading as an osteogenic model, but may simply reflect greater gymnast mean PAL. However, prediction of BR by both PAL and GYM suggests independent benefits of greater activity doses and high impact loading modalities.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Model Adjusted</th>
<th>Tanner Breast</th>
<th>Total Body</th>
<th>PAL (Physical activity Level)</th>
<th>GYM (Gymnast Status)</th>
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</thead>
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<td>0.73***</td>
<td>0.76***</td>
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8: standardized beta; PCC: partial correlation coefficient; FN: femoral neck; NN: narrow femoral neck; BMC: bone mineral content; BMD: areal bone mineral density; ACSA: bone cross-sectional area; CSMM: cross-sectional moment of inertia; CT: cortical thickness; Z: section modulus; BR: buckling ratio.

X: GYM not included in the model presented, but inclusion of GYM yielded a more significant model in which PAL was no longer significant.

2748 Board #20 June 1 11:00 AM - 12:30 PM
Effect of Treadmill Versus Elliptical Exercise on Calcaneal Stiffness Index Among College Age Females

Kelly T. Maloney, Sandie R. Walker, Stephanie M. Otto. Gustavus Adolphus College, St. Peter, MN.

(Opposite relationships reported)

Osteoporosis is a disease that affects many older individuals, resulting in a decrease in bone density. Yang, et al. (2005) concluded that involvement in impact loading sports was associated with greater stiffness index (SI) of the calcaneus when compared to nonimpact sports and abstinence from sports. However, between the effectiveness of impact and nonimpact exercise equipment on calcaneal SI is less clear.

PURPOSE: To examine the effect of treadmill versus elliptical exercise on calcaneal SI.

METHODS: Nine college-age females were recruited for this cross-sectional design study. The independent variables were the treadmill training group and the elliptical training group, and the dependent variable was the change in stiffness index (SI) of the calcaneus. Calcaneal SI was tested at the beginning and end of a 10-week training session. The Calcium Rapid Assessment Method was also used to assess dietary calcium intake among participants.

RESULTS: Pearson product correlation analysis did not indicate a significant relationship between dietary calcium intake and calcaneal SI and therefore calcium was eliminated as a covariate in subsequent analyses. Paired sample t-test for the entire sample indicated significant improvements in calcaneal SI over the 10-week training period (t = -3.01, p = .02). However, when the sample was split by exercise group, paired sample t-tests were not significant (p > .025). An independent sample t-test comparing the treadmill to the elliptical training group and using change in calcaneal SI as the dependent variable was also not significant (p > .025).

CONCLUSION: In conclusion both treadmill and elliptical training resulted in increases in calcaneal SI over a 10-week period but we were unable to detect significantly more benefit from treadmill training, which was counter to our hypothesis. According to this study, both treadmill and elliptical exercise can improve calcaneal SI among college age women.

2749 Board #21 June 1 11:00 AM - 12:30 PM
Predicting Skeletal Side Dominance From Functional Dominance: DXA, pQCT And QUS Findings

Belinda R. Beck, FACSM, Benjamin K. Weeks. Griffith University, Gold Coast, Australia.

(Opposite relationships reported)

PURPOSE: Bone densitometry is typically performed on the “non-dominant” limb. While upper extremity functional dominance (writing hand) reliably predicts upper limb skeletal dominance, our experience suggested the same did not apply to the lower limb. In fact, the determination of lower extremity functional dominance is not straightforward. Consequently, the upper extremity dominance assumption is routinely extrapolated to the lower limb and densitometers are designed primarily for left hip scanning to accommodate the preponderance of right-handed individuals in the population. The aim of the current work was to determine the true nature of the association between functional and skeletal dominance of the lower limb. The ultimate goal is to establish a simple and reliable determinant of lower extremity skeletal dominance.

710

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METHODS: 77 men (35.4±16.4 yrs) and 100 women (42.7±16.0 yrs) were recruited for bilateral femoral neck bone mineral density (FNBMID; XR-800, Norland), calcanean broadband ultrasound attenuation (BUA; QUS-2, Quidel), tubial peripheral quantitative computed tomography (XCT3000 Stratec) and limb anthropometry. Side dominance questionnaires and physical tasks were completed including the Waterloo Footedness Questionnaire, hop distance test, Pastor Day Marsden Test, handedness and footedness questions, and side preference for common postures (e.g. folding arms). Chi-square tests with crosstabs were run on all parameters using SPSS Version19.

RESULTS: No significant association was observed between writing hand and any measure of lower limb skeletal dominance. Significant negative associations were found for strongest arm (p<0.01) and kicking foot (p<0.04) with FNBMID dominance, and racquet hand with tubial cortical area at the 38% site (p<0.05). Strongest arm was positively associated with dominant BUA (p<0.04). A trend for lower limb skeletal dominance in the functionally non-dominant limb was observed for 85% of all bone parameters, excluding BUA.

CONCLUSIONS: Contrary to conventional thinking, skeletal dominance exists more commonly in the functionally non-dominant lower extremity. Findings bring into question the standard practice of densitometric scanning of the left lower extremity of right-dominant individuals when detection of minimum bone mass is desired.

2750 Board #22 June 1 11:00 AM - 12:30 PM
Estrogen is Required for Mechanical Loading Induced Restoration of Bone Following Disuse
Joshua F. Yarow1, Sean C. McCoy1, J Andries Ferrein2, Jennifer E. Pingel1, Bryan P. Conrad1, Thomas J. Wronski3, Alyssa A. Williams1, Stephen E. Borst1, Marybeth Brown2. 1VA Medical Center, Gainesville, FL; 2University of Missouri-Columbia, Columbia, MO; 3University of Florida, Gainesville, FL.

No relationships reported.

Both estrogen and mechanical loading regulate bone maintenance. For example, ovariectomy (OVX) reduces bone mineral density (BMD) and estradiol (E2) replacement fully prevents this loss. Similarly, hindlimb unloading (HLU), a model of disuse, induces BMD loss and re-ambulation (REAMB) reverses this loss. In addition, HLU worsens OVX-induced bone loss; however, it remains unknown whether REAMB and/or exercise (EX) after BMD following combined OVX+HLU.

PURPOSE: To determine whether E2 influences the REAMB-induced and/or EX-induced restoration of BMD following HLU of OVX rats.

METHODS: Eighty-one 5 month old female Sprague-Dawley rats were randomized into the following groups: 1) Baseline controls, 2) OVX controls, 3) OVX+E2 controls, 4) OVX+4 weeks HLU, 5) OVX+E2+HLU, 6) OVX+HLU+2 weeks REAMB, 7) OVX+E2+HLU+REAMB, 8) OVX+HLU+REAMB+2 weeks climbing, jumping, and balancing EX, or 9) OVX+E2+HLU+REAMB+EX. Serial DXA scans were performed to track total body bone characteristics throughout the study and peripheral quantitative computerized tomography (pQCT) was utilized to determine differences in distal femoral metaphysal bone mineral characteristics between groups.

RESULTS: Total body BMD increased 4-8% in all animals receiving supplemental E2, while BMD did not change in animals without E2. OVX reduced trabecular (tBMD) at the distal femoral metaphysis by 35% (p<0.01) and OVX+E2 exacerbated this loss by an additional 52% (p<0.001), while also reducing cortical (c)BMD by 11% compared with Baseline controls (p<0.01). E2 protected against the OVX+HLU induced bone loss at the femoral metaphysis. However, in the absence of E2, REAMB did not reverse the OVX+HLU induced bone loss. Surprisingly, REAMB+EX was severely detrimental to bone formation following OVX+HLU, resulting in loss in BMD and BMD measurements that were 91% and 7% below baseline controls (p<0.001). Conversely, the addition of E2 to REAMB or REAMB+EX protected against the OVX+HLU induced bone loss.

CONCLUSION: E2 influences the mechanical loading induced restoration of BMD and in the absence of estrogen, moderate-intensity exercise is severely detrimental to the restoration of BMD following disuse.

Supported by VA CDA-2 (JFY), VA Merit Award (SEB), NASA N46-12300 (MB), and NIH AG15796 (MB).

2751 Board #23 June 1 11:00 AM - 12:30 PM
Acute Bone Marker Responses to Whole-Body Vibration and Resistance Exercise in Postmenopausal Women
Debra Bemben, FACSM, Carmen Chrisman, Vanessa Sherk, Kaelin Young, Harshvardhan Singh, Jessica Smith, Michael Bemben, FACSM. University of Oklahoma, Norman, OK.

No relationships reported.

No studies to date have investigated the acute bone turnover marker (BTM) responses to resistance exercise and whole-body vibration (WBV) in postmenopausal women.

PURPOSE: To investigate the acute BTM responses to high-intensity resistance exercise with and without whole-body vibration exercise in postmenopausal women.

METHODS: Eight women (58 ± 2 years) participated in this randomized crossover control study. DXA was used to measure bone mineral density (BMD) of the total body, lumbar spine, and left and right hip. 1-RM testing was conducted for leg press, seated row, hip extension, shoulder press, hip abduction, and hip adduction isotonic resistance exercises. Subjects performed 3 blood draw sessions ordered in randomized order separated by 2-week washout periods: 1) WBV + resistance exercise (WBV); resistance exercise only (RES); and no exercise (CON). For WBV, subjects stood barefoot, knees slightly flexed on vibration plate for 5, 1-minute bouts at 20 Hz and 1.25 mm (amplitude) separated by 1-minute rest intervals, followed by the resistance exercise. For RES, subjects completed 3 sets of 10 repetitions 80% 1-RM. WBV and RES had blood draws before (Pre), and immediately post (IP) exercise and CON had 2 blood draws at baseline and after 60 minutes of sitting. WBV also included a blood draw between the whole-body vibration and resistance exercise (VibP). Serum samples were measured for bone-specific alkaline phosphatase (Bone APA) and tartrate-resistant acid phosphatase 5b (TRAP5b) with enzyme immunoassay (EIA) kits.

RESULTS: Bone ALP showed a significant time effect (p=0.05), increasing from Pre to IP. TRAP5b had a trend (p = 0.061) for condition × time interaction as it increased Pre to IP only for WBV (Pre: 2.433 ± 0.327 U/L vs. IP: 2.659 ± 0.347 U/L). Neither marker showed a significant response at VibP. There were trends for WBV (p = 0.062) and RES (p = 0.074) TRAP5b % increases Pre-IP to be greater than the CON condition (10.2 ± 2.8%; 6.4 ± 3.1%; -0.60 ± 2.8%, respectively). TRAP5b % change Pre to VibP was significantly related to total body BMD (r=0.82, p<0.05).

CONCLUSIONS: The addition of whole-body vibration did not alter bone formation markers responses to acute resistance exercise, however, it elevated bone resorption levels immediately post resistance exercise.

2752 Board #24 June 1 11:00 AM - 12:30 PM
Focused Extracorporeal Shockwave Therapy For Non-Invasive Bone Stimulation In Scaphoid Non-Unon
Karsten Knobloch1, Robert Kraemer1, Frank Baetje2, Juergen Kopp1, Peter M. Vogt1, 1Plastic, Hand and Reconstructive Surgery, Medical School Hannover, Hannover, Germany; 2Shockwave Center, Hannover, Germany; 3Plastic, Hand and Reconstructive Surgery, BG Frederikenstift, Hannover, Germany.

No relationships reported.

PURPOSE: Scaphoid non-union is a challenging problem. Bone stimulation using extracorporeal shockwave therapy (ESWT) has been traditionally applied on long bone pseudarthrosis only. We hypothesized that focused extracorporeal shockwave therapy is able to induce bony consolidation in scaphoid non-union both, after primary or secondary failed procedures.

METHODS: In a pilot case series a total number of 21 patients (76% males, mean age 36±15yrs, 30% active smokers) with persistent symptomatic scaphoid non-union were included in this pilot study. Distinct patterns of prior treatment were evident: a) no primary or secondary surgery (n=9), b) no primary surgery, secondary Matti Russe plasty with iliac bone grafting (n=9) or 1-ICSRA vascularized graft (n=1), c) primary Matti Russe plasty, secondary STT arthrodesis (n=1) or others (n=2). A total number of 2.1±0.8 ESWT sessions (range 1-3) of high-energy focused ESWT were applied (Storz Duolith, 5000 impulses) 5±4 months following the last surgery. Level of evidence: IV (Case series).

RESULTS: In 95% a radiological consolidation of the scaphoid non-union was achieved (20 out of 21 patients) at 22±10 months of follow-up. No adverse effects of focused ESWT were noted. Patients’ pain levels were considerably low with 2.0±2.2 (0=no pain, 10=severe pain) at 22±12months of follow-up. Only mild daily impairment with DASH scores at follow-up of 9±15 and a Michigan Hand Outcome Questionnaire (MHQ) with 85±19points at the affected side were noted in line with high patient satisfaction.

CONCLUSION: We conclude that focused ESWT is an effective non-invasive measure for scaphoid non-union both, in primary and in failed secondary cases in this pilot study.
Knee osteoarthritis (OA) is a debilitating disease that affects an estimated 27 million Americans. Physical activity may be a way to treat and prevent its occurrence.

METHODS: To examine the effect of lifelong physical activity on the development of knee OA.

METHODS: Fifteen C57Bl/6J mice (8 male and 7 female) were individually caged with a running wheel, magnetic sensor, and digital odometer, and fifteen mice (3 male and 2 female) individually housed without a running wheel. Each mouse was provided with standard chow and water ad libitum. Running wheel distance, duration, and speed were recorded daily. A diagnostic ultrasound (SONOS 5500 Ultrasound and 15-6L ultrasound probe) was used to measure medial and lateral knee joint space in both hind limbs every month until the end of mice’s lifespan.

CONCLUSIONS: Our findings suggest that E suppression results in increased uOCN and cOCN, which may be indicative of increased bone turnover; however, these data require support from measures of bone resorption. Interestingly, E add-back attenuated the increase in bone resorption during weight-bearing exercise. Indeed, β-CTX was significantly higher in runners than controls after 3 h of recovery. These findings suggest no benefit of pre-exercise feeding in modulating the bone metabolic response to exercise.

CONCLUSIONS: Effect of Estrogen Deficiency And Resistance Exercise On Serum Undercarboxylated And Carboxylated Osteocalcin

Effects Of Estrogen Deficiency And Exercise On Serum Undercarboxylated And Carboxylated Osteocalcin

Knee osteoarthritis (OA) is a debilitating disease that affects an estimated 27 million Americans. Physical activity may be a way to treat and prevent its occurrence.

METHODS: To examine the effect of lifelong physical activity on the development of knee OA.

METHODS: Fifteen C57Bl/6J mice (8 male and 7 female) were individually caged with a running wheel, magnetic sensor and digital odometer, and fifteen mice (7 male and 8 female) individually housed without a running wheel. Each mouse was provided with standard chow and water ad libitum. Running wheel distance, duration, and speed were recorded daily. A diagnostic ultrasound (SONOS 5500 Ultrasound and 15-6L ultrasound probe) was used to measure medial and lateral knee joint space in both hind limbs every month until the end of mice’s lifespan.
RESULTS: Right medial (p=0.002), right lateral (p=0.0001), left medial (p=0.01), and left lateral (p=0.007) knee joint spaces were significantly smaller from months three to nine in the physically active C57Bl/6J mice. However, there was no significant difference between all knee joint spaces of the running and sedentary C57Bl/6J mice throughout the remainder of the lifespan. All hindlimb knee joint spaces significantly declined with aging (p<0.0001).

Table 1: RM Joint Space (mm) in RUN and SED mice.

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<td>RUN</td>
<td>17.0±0.03</td>
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<td>SED</td>
<td>19.0±0.04</td>
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CONCLUSIONS: During the first 9 months of the lifespan, physical activity seemed to protect the joint from degeneration, however; after that there was no protective benefit. This may be due to the fact that C57Bl/6J mice are genetically known to develop OA at 9 months of age. Physical activity may have no impact on this genetic predisposition. But in those not genetically predisposed to develop OA, physical activity may be a method to reduce their risk of OA.

2757 Board #29  June 1  11:00 AM - 12:30 PM
The Effect Of Life-long Endurance Training On The Mechanical Properties Of The Human Patellar Tendon, In Vivo
Christian Couppe1, René Svensson1, Jean- Francois Grosset1, Anders Karlsen1, Morten Olsen1, Mette Hansen1, Per Aagaard2, Michael Kjaer1, S. Peter Magnusson1.
1University of Copenhagen, Faculty of Health Sciences, Copenhagen NV, Denmark. 2University of Southern Denmark, Copenhagen NV, Denmark.

PURPOSE: To evaluate bone changes during the detraining and retraining phases following FX injury.
METHODS: A prospective, case-control design assessed bone changes in 8 cases diagnosed with FX and 7 matched controls (C). BMD and content (lumbar spine and femoral neck), hip geometric properties (section modulus and cross sectional area) and body composition were assessed at baseline (within 14 days of FX) and after 6-8 weeks, and 6-8 months using dual energy x-ray absorptiometry. Bone changes were evaluated between baseline and 6-8 weeks (detraining phase) and 6-8 weeks and 6-8 months (retraining phase). Repeated measures analysis of variance with a between-subject group factor was used to determine whether changes differed between FX and control groups. Level of significance was defined as P<0.05.
RESULTS: Three sacral, 2 femoral and metatarsal and 1 tibia FX were diagnosed. At baseline, cases were significantly shorter (FX: 1.639(0.009), C: 1.701(0.016) m, p<0.007) and reported a higher prevalence of FX history than C (50% vs 0%), no other significant differences were found between groups. During the detraining phase, there were no statistically significant changes in menstrual function, body fat %, BMD or hip geometric properties in cases or controls. During the retraining phase, femoral neck BMD increased significantly in the injured leg of FX cases (mean (SE) 1.042(0.102) to 1.070(0.012) g/cm², p=0.004) with no significant change in the contra-lateral leg (1.036 (0.102) to 1.054(0.019) g/cm²). No significant bone gain was found in control subjects (healthy or “injured legs”). Changes in other bone parameters were small and not statistically significant in either group.
CONCLUSION: Six-to-eight weeks of reduced training following FX does not cause significant bone loss. Significant bone gain did occur in the injured leg of case athletes within 8-months.

CONCLUSIONS: During the first 9 months of the lifespan, physical activity seemed to protect the joint from degeneration, however; after that there was no protective benefit. This may be due to the fact that C57Bl/6J mice are genetically known to develop OA at 9 months of age. Physical activity may have no impact on this genetic predisposition. But in those not genetically predisposed to develop OA, physical activity may be a method to reduce their risk of OA.

2758 Board #30  June 1  11:00 AM - 12:30 PM
The Effect Of Post Pubertal Food Restriction On Bone Strength
Tiffany A. Butler, Amie L. Pole, Vanessa R. Yingling, FACSM. Temple University, Philadelphia, PA.
(No relationships reported)

Low body weight is a risk factor for osteoporosis and weight loss has been associated with bone loss in animal and human models. However food restriction has also been linked with an increased life span. Food restriction during growth may affect calcium, protein and hormone levels and reduce peak bone mass altering cortical and trabecular bone structure. Timing of weight loss may be a factor because the pubertal years are a major period for bone accrual.

PURPOSE: To determine the effect of 30% food restriction in post pubertal (day 65) female rats on bone strength.
METHODS: 34 female Sprague Dawley rats (day 23) were randomly assigned into two groups, control (C) and food restriction (FR). On day 65, FR animals were fed 70% of control ad lib food intake for 6 weeks with a food preparation that was replete in micronutrients. After 6 weeks, right femurs were dissected and mechanically tested using a3-point bend assay. Total fat from retroperitoneal and gonadal regions and triceps surae muscle were weighed.

RESULTS: 30% food restriction resulted in an 18% lower body weight compared to control. Statistical differences were found in total fat (13.14±0.00g vs. 15.44±0.05g, p<0.05) and percent meat to fat (21.39% vs. 15.44% vs. 61.95% vs. 47.02%, p<0.05). However, no significant differences were found in mechanical strength between groups, but normalized to body weight peak moment (470.44 Nm/Kg vs. 606.97 Nm/Kg vs. 617.02 Nm/Kg vs. 458.45 Nm/Kg, p<0.05) and stiffness (32736.90 Nmm/° vs. 51429.80 Nmm/° vs. 48979.51 Nmm/° vs. 52285.55 Nmm/°, p<0.05) were significantly greater in the FR group. Discussion: Food restriction did not have a negative effect on cortical bone strength in fact strength relative to body weight showed FR bones were stronger. FR fat pads were 72% lower with muscle weights equal between groups indicating that body weight significantly decreased by fat mass. Increased percent muscle to fat weight indicates that lean body mass was maintained in the FR group.

CONCLUSION: Lower body weight resulting from short-term food restriction in post pubertal female rats resulted in a significant decrease in fat mass and an increase in bone strength d relative to body weight. Food restriction post puberty has a positive effect on bone strength in the short term when micro nutrients are replete and muscle mass is maintained. Supported by NIAMS/NIH R01AR05755.

2759 Board #31  June 1  11:00 AM - 12:30 PM
Bone Density Changes Following Stress Fracture in Female Athletes
Rachel L. Duckham1, Nick Peirce2, Greg Summers3, Noel Cameron1, Katherine Brooke-Wavell1.
1Loughborough University, Loughborough, United Kingdom. 2Nottingham University Hospitals NHS Trust/England and Wales Cricket Board, Loughborough, United Kingdom. 3Derby Royal Hospital, Derby, United Kingdom.
(No relationships reported)

Athletes who sustain stress fractures (FX) typically reduce weight-bearing exercise for 6-8 weeks before returning to loading activities. This reduction in loading may cause bone loss increasing the risk for low bone mineral density (BMD) and FX recurrence.

PURPOSE: To evaluate bone changes during the detraining phase following FX injury.
METHODS: A prospective, case-control design assessed bone changes in 8 cases diagnosed with FX and 7 matched controls (C). BMD and content (lumbar spine and femoral neck), hip geometric properties (section modulus and cross sectional area) and body composition were assessed at baseline (within 14 days of FX) and after 6-8 weeks, and 6-8 months using dual energy x-ray absorptiometry. Bone changes were evaluated between baseline and 6-8 weeks (detraining phase) and 6-8 weeks and 6-8 months (retraining phase). Repeated measures analysis of variance with a between-subject group factor was used to determine whether changes differed between FX and control groups. Level of significance was defined as P<0.05.

RESULTS: Three sacral, 2 femoral and metatarsal and 1 tibia FX were diagnosed. At baseline, cases were significantly shorter (FX: 1.639(0.009), C: 1.701(0.016) m, p=0.007) and reported a higher prevalence of FX history than C (50% vs 0%), no other significant differences were found between groups. During the detraining phase, there were no statistically significant changes in menstrual function, body fat %, BMD or hip geometric properties in cases or controls. During the retraining phase, femoral neck BMD increased significantly in the injured leg of FX cases (mean (SE) 1.042(0.102) to 1.070(0.012) g/cm², p=0.004) with no significant change in the contra-lateral leg (1.036 (0.102) to 1.054(0.019) g/cm²). No significant bone gain was found in control subjects (healthy or “injured legs”). Changes in other bone parameters were small and not statistically significant in either group.

CONCLUSION: Six-to-eight weeks of reduced training following FX does not cause significant bone loss. Significant bone gain did occur in the injured leg of case athletes within 8-months.

713
following FX once training had resumed. It is not clear why BMD increased above baseline values during retraining but it does seem that factors other than BMD may be associated with FX recurrence.

**Board #32 June 1 11:00 AM - 12:30 PM**

**Mechanical Loading With Or Without Weight-bearing Activity: Influence On Bone Strength In Female Adolescent Athletes**

David A. Greene, Geraldine A. Naughton, Elizabeth J. Bradshaw, Mark Moresi, Gaele Ducher. **Australian Catholic University, Sydney, Australia.** (Sponsor: Giles Warrington, FACSM)

(No relationships reported)

Bone health is considered not to benefit from water-based sports due to their weight-supported nature, but available evidence primarily relies on DXA technology.

**PURPOSE:** The purpose was to investigate musculoskeletal health in the upper and lower body in well-trained adolescent female athletes using pQCT and compare these athletes with less active, age- and sex-matched peers.

**METHODS:** Bone mineral content, volumetric cortical and trabecular BMD, total and cortical area, and bone strength were assessed at the distal and proximal tibia and radius in four groups of adolescent females (mean age 14.9 years) comprising water polo players (n=30), gymnasts (n=25), track and field athletes (n=34), and non-active controls (n=28).

**RESULTS:** Water polo players did not show any benefit in bone strength or muscle size in the lower leg when compared with controls. In contrast, gymnasts showed 60.1% and 53.4% greater bone strength at the distal and proximal tibia, respectively, than non-active females (p<0.05). Similarly, track-and-field athletes displayed 33.9% and 14.7% greater bone strength at the distal and proximal tibia, respectively, compared with controls (p<0.05). In the upper body, water polo players had 31.9% greater bone strength at the distal radius, but not the radial shaft, and 15.2% larger forearm muscle cross-sectional area than controls (p<0.05). The greatest musculoskeletal benefits in the upper body were found in gymnasts.

**CONCLUSIONS:** Despite training at an elite level, female water polo players did not show any benefits in musculoskeletal health in the lower leg and only limited benefits in the upper body when compared with non-active girls.

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**Board #33 June 1 11:00 AM - 12:30 PM**

**Ultrasound Evaluation Of The Patellar Tendon Cross-sectional Area And Its Relation To Maximum Force**

Konstantina Intziegianni, Michael Cassel, Steffen Mueller, Frank Mayer. **University Outpatient Clinic Potsdam, Potsdam, Germany.**

(No relationships reported)

It is widely accepted that the maximal force which can be produced by a muscle is directly proportional to the cross-sectional area (CSA) of its accompanying tendon. Mainly in rehabilitation this relation has to be considered regarding tendon strain with respect to knee joint positioning and related output force. Nevertheless it is unclear, if the theoretical basis could be reproduced in humans in rehabilitation relevant positions of the knee joint.

**PURPOSE:** To measure patella tendon CSA in different angle positions and contraction modes related to maximum output muscle force.

**METHODS:** In this pilot study eight healthy CSA in different angle positions and contraction modes related to maximum output muscle force.

**RESULTS:** Higher maximum force was measured in 90° (127.46 ± 47.74 F[N]) compared to 30° (94.59 ± 36.10 F[N]). A statistical significant difference was found between 90° / 30° (73.51 ± 7.22 / 79.22 ± 17.89 mm² p<0.05) measuring CSA during rest. No statistical significant difference could be shown during contraction (78.34 ± 15.65 / 73.86 ± 19.70 mm² p>0.05). When normalizing CSA to output force (CSA/F[N]) and to CSA difference between rest and MVC (ΔT/F[N]) it could be shown that less force is related to a thicker tendon during rest and to a greater CSA reduction during contraction. No statistical significant correlation was found between CSA thickness during rest and maximum force in both angle positions (p>0.05) and between CSA reduction during contraction and maximum force (p>0.05).

**CONCLUSION:** Different angle positions can affect tendon thickness, while maximum muscle force production is depending on angle position. These findings might have impact in clinical practice due to the fact that patellar tendon has less strain in 30° in comparison to 90° and this might be related mainly to force and not to tendon CSA.

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**Board #34 June 1 11:00 AM - 12:30 PM**

**The Painful Shoulder: Ultrasonographic Measurements of Supraspinatus Thickness, Pain Scores and Treatment**

Marni Hillinger, Christopher Visco. **New York Presbyterian - Columbia and Cornell, New York, NY.**

(No relationships reported)

Shoulder injury and pain complaints are common in the primary care, orthopedic and physiatric outpatient setting. The supraspinatus tendon is a commonly involved tendon in rotator cuff injuries. Musculoskeletal ultrasound is becoming a popular tool to aid in the diagnosis of pathologic conditions of the supraspinatus tendon.

**PURPOSE:** To determine whether a relationship may exist between supraspinatus thickness and pain scores among patients who present with a primary complaint of shoulder pain. We hypothesize that a positive correlation exists and that this could aid clinical development of targeted treatment strategies and earlier identification of those who require a more aggressive therapeutic approach.

**METHODS:** A retrospective analysis of supraspinatus thickness was performed by analyzing ultrasonographic shoulder examinations of patients who presented to the Columbia University musculoskeletal clinic with a primary complaint of shoulder pain. This included 58 separate shoulder studies among 52 different patients. An average thickness was obtained by utilizing the DICOM ultrasonographic software tool. Outpatient records were reviewed including pertinent follow-up visits. Pain scores and treatment at the time of presentation and follow-up were recorded.

**RESULTS:** There was no correlation (Pearson correlation = 0.008) found between supraspinatus tendinous thickness and pain scores at the time of presentation. Average supraspinatus thickness was found to be 0.56cm ± 0.11 among women and 0.556cm ± 0.157 among men. Average pain score was found to be 5.42 ± 2.2 among women and 5.78 ± 2.8 among men on initial evaluation. Of those who followed-up, an average pain score at the time of re-assessment was 3.52 ± 2.63. 73% of patients were referred for physical therapy, 8% were referred for surgical evaluation and 27% underwent a steroid injection upon initial evaluation.

**CONCLUSIONS:** This study did not identify a correlation between ultrasonographically identified supraspinatus thickness and pain scores for patients who present with a primary complaint of shoulder pain. The majority of patients underwent conservative management. Future research should continue to distinguish ultrasonographically identifiable risk factors for the development of shoulder pathologies.

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**Board #35 June 1 11:00 AM - 12:30 PM**

**Protein Consumption And The Occurrence Of Osteoporosis**

Jung A Kim, Byung-Sung Kim, Hyeon-Rim Choi, Chang-Won Won. **KyuHye University Hospital, Seoul, Korea, Republic of.**

(No relationships reported)

**PURPOSE:** In many previous studies about amount of dietary protein effect on the risk of the osteoporosis, have showed conflicting results. In those studies, subjects and methods were inconsistent and study result from the Asian population was insufficient. Therefore we tried to investigate the relationship between risk of the osteoporosis and the dietary protein of the Korean adults.

**METHOD:** We used the data from Korean National Health and Nutrition Examination Survey 4 (KNHANES 4; 2008–2009) for analysis. Participant who were 19 year-old or over and had never been treated for osteoporosis were included for analysis. Assessment of dietary intake obtained by 24-hour recall method and participants were grouped by the tertile of the amount of protein intake. The diagnostic criteria for the osteoporosis was lumbar or femur neck bone mineral density T-score ≤ -2.5 for this study. To analyze the influence of the amount of daily protein intake to the occurrence of osteoporosis, logistic regression analysis was used and the associated factors were adjusted through 4 steps.

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714
RESULTS: Total 6,461 subjects were included in this study and 624 of among those were classified to the osteoporosis. For the lumbar osteoporosis, the highest tertile protein intake group has significantly lower odds compared to the lowest tertile group (OR 0.695, 95% CI 0.508–0.952) for women. But the significance was lost after associated factors were adjusted. For men, the highest tertile group has significantly lower odds compared to the lowest tertile group and it kept significance even after the associated factors were adjusted (OR 0.519, 95% CI 0.284–0.949).

CONCLUSION: In this study, we found that sufficient daily protein intake is related with low occurrence of osteoporosis in Korean adults. To confirm the preventive effect of sufficient protein intake, further prospective study might be needed.

### 2764 Board #36 June 1 11:00 AM - 12:30 PM

**Volumetric Bone Density, Bone Strength in Radius and Tibia in Healthy Chinese Population with Peripheral Quantitative Computed Tomography**

Chi Kei Li1, Abdulaziz Farooq1, Bruce Hamilton2, Hakim Chalabi3, Jean Woo Wong4, Aspektar, Doha, Qatar. 1Chinese University of Hong Kong, Hong Kong, SAR, China.

(No relationships reported)

Peripheral Quantitative Computed Tomography (pQCT) measure volumetric bone density (BMD) of cortical (Cort) and trabecular (Trab) compartments separately in addition to calculating torsional bone strength defined by Polar strength strain index (polar SSI). It is independent of rotation and better reproducible compared with axial SSI which defined as the bending strength with respect to X and Y axis. Since remodeling always occurs early in trab, unlike Dual Energy X-ray Densitometry which measure only areal bone mineral density, pQCT can monitor metabolic change quickly and precisely. However, baseline database is still limited especially in weight bearing sites (eg. lower limb).

PURPOSE: To provide a reference database of BMD and bone strength in radius (R) and tibia (T) for healthy Chinese population.

METHODS: A total of 183 males, 206 females aged between 20 - 70 y were scan with pQCT (Stratec XCT3000) on their non-dominant side distal (4%) and middle one third (33%) of R and T. BMD of Total, Cort and Trab region were assessed and polar SSI was calculated.

RESULTS: Males presented with significant higher values for all parameters (P<0.036) compared with females except Cort BMD at T4%. Total BMD at R4% were higher compared to T4% (P<0.001) and Cort BMD at R33% were higher compared to T33% (P<0.001) in both gender. However, Trab BMD at R4% were lower compared to T4% (P<0.001) in both gender. When all parameters were stratified by gender and studied by age, data showed that Total and Trab BMD at R4% and T4% declined significantly in females after 50y (P<0.05) while males declined significantly after 60y (P<0.05). Cort BMD at R33% in females declined significantly after 50y while males declined significantly after 60y (P<0.05). Cort BMD at T33% and Polar SSI in females declined significantly after 50y while in males were stable across age groups (P<0.05).

CONCLUSIONS: This information is important in providing reference data for monitoring change in bone mineral density and bone strength using pQCT within a Chinese population.

### 2765 Board #37 June 1 11:00 AM - 12:30 PM

**An Examination of Foot Parameters in Subjects with and without Chronic Ankle Instability**

Sara Naguib, Kathy Liu, Thomas W. Kaminski, FACSM, University of Delaware, Newark, DE.

(No relationships reported)

The foot is the base of the body’s kinetic chain; therefore structure and function are essential in providing stability. Even minor differences in intrinsic foot structure can affect the proximal joints in the body and play a role in ankle sprains.

PURPOSE: To determine if differences in measurements of intrinsic foot structures exist in subjects with and without chronic ankle instability.

METHODS: A total of 47 physically active subjects participated in this study (30 females, 17 males, age=21.9±2.7 yrs., height=168.2±9.1 cm, mass=64.9±13.0 kg). All participants completed the Cumberland Ankle Instability Tool, resulting in 50 ankles in the stable group and 35 ankles in the unstable group. Measurements included: navicular height (NH), plantar fascia thickness (PFT), medial longitudinal arch angle (MLAA), and forefoot to rearfoot ratio (FR). NH was measured as the height of the navicular in a non-weight bearing stance. PFT was quantified using musculoskeletal ultrasound. MA was the angle of medial malleolus to the navicular to the base of the first metatarsal. FR was measured as the ratio of the width of the forefoot to rearfoot. All data were analyzed using an independent t-test (p<0.05).

<table>
<thead>
<tr>
<th>Foot Parameter</th>
<th>Stable (mean±SD)</th>
<th>Unstable (mean±SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH (mm)</td>
<td>4.10±0.63</td>
<td>3.95±0.59</td>
<td>0.156</td>
</tr>
<tr>
<td>PFT (mm)</td>
<td>0.99±0.16</td>
<td>1.05±0.15</td>
<td>0.216</td>
</tr>
<tr>
<td>MLAA (o)</td>
<td>249.48±8.70</td>
<td>247.08±6.51</td>
<td>0.151</td>
</tr>
<tr>
<td>FR</td>
<td>1.92±0.17</td>
<td>1.85±0.16</td>
<td>0.114</td>
</tr>
</tbody>
</table>

CONCLUSION: Although no significant differences between the two groups were observed, all variables were trending towards statistical significance. Further research examining other characteristics and structures is necessary for a full understanding of the foot. A better understanding of the changes that occur in the foot after ankle sprains are essential to the prevention of ankle instability. Supported by NIH Delaware INBRE Grant P20RR016472-11.

### 2766 Board #38 June 1 11:00 AM - 12:30 PM

**Site-Specific Increasing Bone Mass by Resistance Exercise**

Chang-Sun Kim1, Jin-Hwan Yoon2, Dong-Ho Park3, Soon-Gil Lim4, Nam-Sub Back4. 1Dongguk Women’s University, Seoul, Korea, Republic of. 2Hannam University, Daejeon, Korea, Republic of. 3Inha University, Incheon, Korea, Republic of. 4Yongin University, Gyeonggi, Korea, Republic of. (No relationships reported)

PURPOSE: It is now established that mechanical load such as exercise is important for increase and consequently maintenance of bone mass. However, site differences in change of bone mineral density (BMD) by resistance exercise are unclear. The aim of this study was to evaluate the changes of BMD between the fore- and hind-limb induced by resistance exercise. This study was investigated effects of 12 weeks resistance exercise by climbing an inclined on the changes of BMD and serum bone metabolic markers in growing rats.

METHODS: Twelve male F344 rats(203±12.4g), aged 8 weeks, were randomly divided into two groups: control rats(CON, n=6) and resistance exercise rats(EXE, n=6). EXE group performed training that climbed the ladder at 8 times a day, 5day a week for 12 weeks. After experimental period, rats were sacrificed and femur and humerus were removed for analysis of BMD and bone mineral content (BMC) by dual energy X-ray absorptiometry (DEXA, Lunar DPXL, USA). Serum calcium (Ca), phosphate (P) and osteocalcin (OC) were determined by biochemical markers of bone metabolism. The statistical difference on the results was analyzed by independent t-test.

RESULTS: There were significant differences for femoral BMC(CON 0.508±0.023 vs EXE 0.531±0.033 g, p<0.05) and femoral BMC(CON 0.058±0.005 vs EXE 0.065±0.004 g/cm2, p<0.001) between groups, respectively. There were no significant differences for humerus BMC(CON 0.228±0.016 vs EXE 0.239±0.015 g, p>0.05) and humerus BMC(CON 0.033±0.006 vs EXE 0.038±0.006 g/cm2, p>0.05) between groups, respectively. The serum Ca(CON 10.18±0.20 vs EXE 10.13±0.39 mg/dl, p>0.05), P(EXE 6.67±1.48 vs EXE 6.70±1.26 mg/dl, p>0.05) and OC(CON 6.48±0.79 vs EXE 7.08±1.05 ng/ml, p>0.05) showed no significantly difference between groups.

CONCLUSIONS: These results suggest that increase of BMD by resistance exercise with climbing the ladder was appeared in only weight-bearing hind-limb, namely this change of BMD might occur by site-specific.
**2676 Board #39 June 1 11:00 AM - 12:30 PM**

**The Effect of Caloric Restriction and Hypothalamic Suppression on Bone Strength during Puberty**

Kathryn A. Mitchell, Ann L. McCoy, Megan E. Lunny, Vanessa Yingling, FACSM. Temple University, Philadelphia, PA.

*(No relationships reported)*

Low energy availability and hypothalamic amenorrhea are both risk factors for developing insufficient bone mineral density (BMD) in young physically active women. The prevalence of osteopenia in women athletes is estimated to be between 22-50%.

**PURPOSE:** Determine the effect of caloric restriction and hypothalamic suppression on bone strength.

**METHODS:** 16 female Sprague-Dawley rat pups, age day 23, were randomly assigned to one of four groups: sedentary control, SED+C; sedentary DOX, SED+DOX; voluntary wheel run control, WR+C; and voluntary wheel run DOX, WR+DOX. Animals received 2 mg/kg DOX i.p. or an equivalent volume of saline (1 mL) over 7 successive days. Beginning with the first day of injections, SED animals did not exercise while animals in WR groups were allowed free access to cage-mounted running wheels for a total of 10 weeks. Upon completion of the protocol, animals were sacrificed and tibia and femur excised for assessment of bone mineral content and density (tibia) via dual energy x-ray absorptiometry and cancellous and cortical bone architecture (femur) via micro computed tomography.

**RESULTS:** WR+C animals ran an average of 23 ± 3 km/kw while WR+DOX animals ran an average of 12 ± 3 km/kw. Treatment with DOX resulted in significantly lower tibia length and tibia bone mineral content and density (p < 0.05) compared to SED+C. The negative effects of DOX were observed in both the cortical and cancellous envelopes. Midshaft femur cortical cross-sectional area, cortical volume, and polar moment of inertia were significantly lower in DOX-treated rats compared to SED+C. Distal femur metaphysis cancellous bone volume/tissue volume was also lower in DOX-treated compared to SED+C rats. Voluntary wheel running did not protect against the detrimental effects of DOX treatment on the skeleton in developing rats.

**CONCLUSIONS:** DOX treatment in male rat pups suppressed bone growth and resulted in cancellous and cortical osteopenia. Voluntary wheel running during this time did not protect the growing skeleton against the negative effects of DOX treatment.

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**2678 Board #40 June 1 11:00 AM - 12:30 PM**

**Voluntary Wheel Running Does Not Protect Against Doxorubicin-Induced Osteopenia in the Growing Rat**

Traci L. Parry1, Urszula T. Iwaniec2, Russell T. Turner1, Chia-Ying Lien1, Brock T. Jensen1, David S. Hydock1, Carole M. Schneider, FACSM1, Reid Hayward1, 1University of Northern Colorado, Greeley, CO. 2Oregon State University, Corvallis, OR. 3National Taiwan University, Taipei, Taiwan. 4Slippery Rock University, Slippery Rock, PA.

*(No relationships reported)*

Despite numerous negative side effects, including osteopenia, doxorubicin (DOX) continues to be used clinically because of its high success rate in the treatment of an array of cancers. At this time it is unclear whether exercise can attenuate the deleterious effects of DOX on bone architecture.

**PURPOSE:** To determine whether voluntary wheel running attenuates the negative effects of DOX on bone in growing male rats.

**METHODS:** Male Sprague-Dawley rat pups (25 days old) were randomly assigned to one of four groups: sedentary control, SED+C; sedentary DOX, SED+DOX; voluntary wheel run control, WR+C; and voluntary wheel run DOX, WR+DOX. Animals received 2 mg/kg DOX i.p. or an equivalent volume of saline (1 mL) over 7 successive days. Beginning with the first day of injections, SED animals did not exercise while animals in WR groups were allowed free access to cage-mounted running wheels for a total of 10 weeks. Upon completion of the protocol, animals were sacrificed and tibia and fibula excised for assessment of bone mineral content and density (tibia) via dual energy x-ray absorptiometry and cancellous and cortical bone architecture (femur) via micro computed tomography.

**RESULTS:** WR+C animals ran an average of 23 ± 3 km/kw while WR+DOX animals ran an average of 12 ± 3 km/kw. Treatment with DOX resulted in significantly lower tibia length and tibia bone mineral content and density (p < 0.05) compared to SED+C. The negative effects of DOX were observed in both the cortical and cancellous envelopes. Midshaft femur cortical cross-sectional area, cortical volume, and polar moment of inertia were significantly lower in DOX-treated rats compared to SED+C. Distal femur metaphysis cancellous bone volume/tissue volume was also lower in DOX-treated compared to SED+C rats. Voluntary wheel running did not protect against the detrimental effects of DOX treatment on the skeleton in developing rats.

**CONCLUSIONS:** DOX treatment in male rat pups suppressed bone growth and resulted in cancellous and cortical osteopenia. Voluntary wheel running during this time did not protect the growing skeleton against the negative effects of DOX treatment.

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**2679 Board #41 June 1 11:00 AM - 12:30 PM**

**The Bone-specific Physical Activity Questionnaire (BPAQ) Predicts pQCT-derived Tibial Bone Strength**

Benjamin K. Weeks, Belinda R. Beck, FACSM. Griffith University, Gold Coast, Australia.

*(No relationships reported)*

The bone-specific physical activity questionnaire (BPAQ) was developed to account for the influence of habitual mechanical loading on the skeleton. A simple questionnaire is scored using algorithms incorporating load data for common activities. We have previously shown that the BPAQ predicts DXA-derived bone mass at clinically important sites in young adults better than other more generic measures of physical activity. The ability of the BPAQ to predict important indices of bone strength such as peripheral quantitative computed tomography (pQCT)-derived volumetric, geometric or composite strength parameters, however, was unknown.

**PURPOSE:** The aim of the current study was to determine the ability of the BPAQ to predict pQCT-derived bone strength parameters of the tibia.

**METHODS:** We recruited 427 healthy males and females between the ages of 5 and 77 years. Participants completed the BPAQ and a current (previous 12 months), past (birth to 12 months prior) and total physical activity score was calculated. Dominant tibiae were scanned using pQCT (XCT-3000, Stratec, Germany) at the 4% and 38% sites. Total density, cortical density, and trabecular density were calculated using host software. Additional composite and density-weighted strength parameters including strength-strain index (SSI) and fracture load were derived. Correlation and regression analyses were performed to determine relationships between BPAQ scores and parameters of tibial bone strength. Additionally, BPAQ predictors of bone strength were determined for young, middle, and older age groups.

**RESULTS:** Positive relationships were found between BPAQ scores and fracture load and SSI at the 38% sites for bending and torsional loads (r = 0.17-0.36, p<0.05). Current and past BPAQ scores predicted 4-19% of the variance in strength parameters (p<0.05). Alone, past BPAQ score predicted around 12% of the variance in bone strength parameters, and current BPAQ score added an additional 6% predictive ability to the model. Stratified by age group, the ability of the BPAQ to predict strength was greater for older subjects (R² = 0.20-0.53; p<0.05) than younger subjects (R² = 0.04-0.06; p<0.05).

**CONCLUSIONS:** Lifetime habitual mechanical loading determined by BPAQ predicts pQCT-derived bone strength indices of the tibia, and predictions strengthen with age.
PURPOSE: This study investigated the hypothesis that moderate alcohol attenuates bone turnover following menopause.

METHODS: Serum levels of the formation marker osteocalcin and resorption marker CTx were measured following alcohol withdrawal for 14 days in 40 healthy postmenopausal women (56.3 ± 0.5 years of age, mean ± SE) who consumed 19 ± 1 g alcohol/day. Participants then consumed alcohol and were assayed the following morning.

RESULTS: Simple linear regression model was used to assess the relationship between alcohol intake and BMD, osteocalcin, and CTx at baseline. The correlation between serum osteocalcin and CTx was evaluated by linear regression using log-transformed data. To determine whether osteocalcin and CTx increased after abstinence from alcohol as predicted, a one-sided paired t-test was performed. One-sided paired t-tests were also used to determine if osteocalcin and CTx decreased on day 15 as predicted after participants consumed alcohol on the evening of day 14. At study initiation, bone mineral density at the trochanter and total hip were positively correlated to level of alcohol consumption. Serum osteocalcin and CTx increased following alcohol consumption (4.1 ± 1.6%; p = 0.01 and 5.8 ± 2.6%; p = 0.02 compared to baseline, respectively). Osteocalcin and CTx decreased following alcohol re-administration compared to the previous day (-3.4 ± 1.4%; p = 0.01 and -3.5 ± 2.1%; p = 0.05, respectively), to values that did not differ from baseline (p>0.05).

CONCLUSIONS: Absence from alcohol intake resulted in increased markers of bone turnover whereas resumption of alcohol reduced bone turnover markers. These results suggest a cellular mechanism for the increased bone density observed in postmenopausal moderate alcohol consumers. Specifically, the inhibitory effect of alcohol on bone turnover attenuates the detrimental skeletal consequences of excessive bone turnover associated with menopause.

E-22 Free Communication/Poster - Caffeine, Energy Drinks, and Performance

JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2771 Board #43 June 1 11:00 AM - 12:30 PM
Moderate Alcohol Intake Lowers Biochemical Markers Of Bone Turnover In Postmenopausal Women.
Gianni F. Maddalozzo, FACSM1, Jill A. Marrone1, Adam Branscum2, Karin Hardin1, Lynn Ciadella-Kami1, Kenneth A. Philbrick1, Anne C. Breggia2, Clifford J. Rosen2, Russel T. Turner1, Urszula T. Iwaniec1, 1Oregon State University, Corvallis, OR. 2Maine Medical Center Research Institute, Scarborough, ME.

Epidemiological studies indicate that higher bone mass is associated with moderate alcohol consumption in postmenopausal women. However, the mechanisms for the putative beneficial effects of alcohol on bone are unknown. Excessive bone turnover, combined with an imbalance whereby bone resorption exceeds bone formation, is the principal cause for postmenopausal bone loss.

PURPOSE: This study investigated the hypothesis that moderate alcohol attenuates bone turnover following menopause.

METHODS: Serum levels of the formation marker osteocalcin and resorption marker CTx were measured following alcohol withdrawal for 14 days in 40 healthy postmenopausal women (56.3 ± 0.5 years of age, mean ± SE) who consumed 19 ± 1 g alcohol/day. Participants then consumed alcohol and were assayed the following morning.

RESULTS: Simple linear regression model was used to assess the relationship between alcohol intake and BMD, osteocalcin, and CTx at baseline. The correlation between serum osteocalcin and CTx was evaluated by linear regression using log-transformed data. To determine whether osteocalcin and CTx increased after abstinence from alcohol as predicted, a one-sided paired t-test was performed. One-sided paired t-tests were also used to determine if osteocalcin and CTx decreased on day 15 as predicted after participants consumed alcohol on the evening of day 14. At study initiation, bone mineral density at the trochanter and total hip were positively correlated to level of alcohol consumption. Serum osteocalcin and CTx increased following alcohol consumption (4.1 ± 1.6%; p = 0.01 and 5.8 ± 2.6%; p = 0.02 compared to baseline, respectively). Osteocalcin and CTx decreased following alcohol re-administration compared to the previous day (-3.4 ± 1.4%; p = 0.01 and -3.5 ± 2.1%; p = 0.05, respectively), to values that did not differ from baseline (p>0.05).

CONCLUSIONS: Absence from alcohol intake resulted in increased markers of bone turnover whereas resumption of alcohol reduced bone turnover markers. These results suggest a cellular mechanism for the increased bone density observed in postmenopausal moderate alcohol consumers. Specifically, the inhibitory effect of alcohol on bone turnover attenuates the detrimental skeletal consequences of excessive bone turnover associated with menopause.

2772 Board #44 June 1 9:30 AM - 11:00 AM
Effects Of Caffeine Gum Use On Supramaximal Cycle Time To Exhaustion
Kelly E. Johnson, Ken R. Dragoo, Eliseo A. Gonzalez, Wendy E.S. Repovich, FACSM, Eastern Washington University, Cheney, WA.

PURPOSE: This study examined the ergogenic effects of caffeine gum (CG) providing 120 mg of caffeine on total time to exhaustion (TTE) via a supramaximal cycle time to exhaustion test (STTE) at 120% of VO2peak.

METHODS: Seventeen, moderately active college students (23.2 ± 3.3 yrs old) volunteered for participation. To determine the 120% supramaximal test intensity subjects underwent three exercise bouts. First they completed a VO2peak test on an AB 839e cycle ergometer, which consisted of 2 min stages with increases of 50 Watts (W) per stage to volitional exhaustion. Both the respiratory exchange ratio (RER) and VO2 were averaged over the last 30-s of each stage. The RER and VO2 were then interpolated to calculate intensities corresponding to 15% and 30% of VO2peak. Subjects then cycled at these two intensities for 10 minutes each. The last 1min VO2 average for each sub maximal test was plotted against their intensity of their VO2Peak to extrapolate the workload at 120% VO2peak. Three STTE sessions were done using the Monark AB 839e cycle ergometer, a familiarization session, followed by two double-blind randomly assigned tests with CG or a placebo (PG). Subjects received and chewed either six pieces of CG or six pieces of PG for 5 minutes followed by 20 minutes of rest and a 10-minute warm up. To start the test subjects consumed 5 mg/kg body mass of caffeine 60 min prior to exercise may narrow the gender differences in time to exhaustion during maximal anaerobic exercise.

RESULTS: Though TTE in seconds was longer with CG - 311.82 ± 119.28 vs. ± 119.28 using a paired t-test (p=0.268, gender p=0.112, habituation p=0.873, condition by gender p=0.894, condition by habituation p=0.736, and condition by gender by habituation p=0.494).

CONCLUSIONS: The results of this study via CG revealed no significant differences for any variables measured. Therefore, this suggests that CG is no different than any other delivery method (patch or pills) for affecting supramaximal exercise.

2773 Board #45 June 1 9:30 AM - 11:00 AM
The Effect of Caffeine on Anaerobic Performance: A Preliminary Study
Steven R. Cherekos, Jonathan M. Engholm, Marie Boo, Anthony Bozzo, Mary C. Stenson. College of Saint Benedict and Saint John’s University, Saint Joseph, MN.
(Sponsor: Vincent J. Paolone, FACSM)

The ergogenic effects of caffeine on endurance exercise have been well documented; however, the effects of caffeine on maximal anaerobic exercise are not as well researched.

PURPOSE: To determine the effects of caffeine ingestion on anaerobic run test performance in college aged male and female club-sport athletes.

METHODS: A randomized, double-blind study was conducted on 4 healthy, active women and 4 healthy, active men (n=8). Subjects performed a maximal anaerobic run test (treadmill set at 7 mph at a 20% grade) 60 minutes after ingestion of 6 oz. sugar-free lemonade (placebo) or 6 oz. sugar-free lemonade with caffeine (5 mg/kg body mass). Heart rate, run time, and rating of perceived exertion (RPE) were recorded immediately at the end of the test. A series of 2x2 repeated measures ANOVAs were used to identify the influence of treatment and gender on time, work, power, and RPE.

RESULTS: No significant interaction was found between gender and treatment for run time with caffeine (Females (F): 40.25 ± 6.4s, Males (M): 57.3 ± 6.4s p> .05) and without caffeine (F: 34.0 ± 5.8s, M: 61.8 ± 5.8 s, p< .05).Three of the four females increased performance during the caffeine trial by an average of 8.7 ± 8.96s, while three of the four males decreased performance during the caffeine trial by an average of 7.3 ± 5.13s. No significant differences (p<0.05) were found for RPE, power, or work between trial and gender.

CONCLUSIONS: Ingestion of 5 mg/kg body mass of caffeine 60 min prior to exercise may narrow the gender differences in time to exhaustion during maximal anaerobic exercise.
The Effect of Caffeine on Tennis Skill Performance in Collegiate Tennis Players

Courtney S. Klein, Adam Clawson, Michael Martin, Michael J. Saunders, FACSM, Judith A. Flehr, Christopher J. Womack, FACSM, Marta K. Bechtel, Wade Dunham, Mellyssa Hancock. James Madison University, Harrisonburg, VA.

(Purpose not reported)

Several prior studies confirm the efficacy of caffeine supplementation on endurance performance, yet there exists a paucity of data on the effect of caffeine on tennis performance. Pilot data from our lab suggest that a polymorphism of the CYP1A2 gene is associated with ergogenic caffeine response in cycling but this association is unknown for other athletic events.

Purpose: This study examined the efficacy of caffeine supplementation on tennis performance and whether a polymorphism of the CYP1A2 gene influenced the ergogenic response to caffeine.

Methods: 18 (nine males, nine females) NCAA Division-I collegiate tennis players (Ht = 176.0 ± 11.1 cm, Wt = 69.8 ± 12.0 kg; VO2max = 51.7 ± 5.9 mL/kg/min) completed two separate trials one hour after the ingestion of either 6 mg/kg of caffeine or a placebo, in double-blind fashion. The trials consisted of both 45 minutes of intermittent treadmill work (TW) and a tennis performance test (TPT). Average RPE and HR were recorded for both the TW and TPT. TPT involved nine repeated sessions in which a 6-ball drill (4 groundstrokes, 1 approach shot and 1 volley) was repeated 6 times. The total number of successful shots that they accrued (out of a possible 324) was recorded. DNA was obtained from whole blood samples and analyzed for the presence of the C variant using polymerase chain reaction with allele-specific primers. Subjects were classified as AA homozygotes (N=7) or C allele carriers (N=9). Data were analyzed via a repeated measures ANOVA with treatment (caffeine, placebo) as the within-subjects factor and genotype as the between-subjects factor.

Results: There was a main effect for treatment whereby caffeine significantly (P < 0.05) improved the number of successful shots during the TPT (Caffeine = 295 ± 11 shots, Placebo = 289 ± 10 shots). There was also a strong trend (P = 0.052) for a genotype x treatment interaction for HR during the TPT as caffeine raised HR in the AA homozygotes (Caffeine = 155 ± 17 beats/min, Placebo = 149 ± 13 beats/min) but not the C allele carriers (Caffeine = 150 ± 16 beats/min, Placebo = 153 ± 16 beats/min).

Conclusion: Caffeine supplementation positively impacts tennis performance in collegiate tennis players. There may be preliminary support for a greater physiological effect of caffeine in AA homozygotes.
of the caffeine trials subjects undertook a deception trial whereby PL was provided instead. During each trial, expired air analysis (VO2; L·min−1), power: weight ratio (P/W; W·kg−1), cycling speed (kph), heart rate (HR; bpm), perceived exertion (RPE) and performance times were assessed.

RESULTS: Performance times significantly improved in CA9 compared to PL only (1708.40±21.53 and 1820±26.47 seconds respectively, P<0.05). No significant differences were observed across deception trials for performance times in comparison to PL, despite improvements perceived CA3 or CA9 trials (1759.60±19.06 and 1745.00±15.51 seconds respectively, P=0.09). No significant differences were observed across trials for VO2, HR or RPE indicating comparable intensity. No significant differences were observed for P/W, although higher ratios were observed in the perceived CA9 (2.58±0.16 W·kg−1) and CA9 (2.56±0.37 W·kg−1) trials compared to PL (2.26±0.10 W·kg−1). Average speed was significantly greater in CA9 compared to PL only (31.63±0.40 kph and 29.72±0.42 kph respectively, P=0.04).

CONCLUSION: Whilst ‘perceived’ benefits of caffeine ingestion may support exercise performance, significant effects may only be observed following consumption of higher dosages of actual caffeine. As perceived effort was not reduced, ergogenic benefits may be explained through increased myofibrillar recruitment.

2778  Board #50  June 1  9:30 AM - 11:00 AM
Dose-dependence Of Caffeine Supplementation On Cycling Performance
Michael Martin, Nicholas D. Luden, Courtney S. Klein, Michael J. Saunders, FACSM, Marta K. Bechtel, Wade Dunham, Melyssa Hancock, Christopher J. Womack, FACSM. James Madison University, Harrisonburg, VA.

Prior data on the dose-dependence of caffeine supplementation for cycling performance is equivocal. The mechanisms influencing the variability of caffeine response are not fully known, although our lab has observed that a polymorphism of the CYP1A2 gene influences the ergogenic effect of caffeine.

PURPOSE: This study examined the effect of caffeine supplementation at two different dosages (3 and 6 mg/kg body weight) on a 40-km cycling time trial. We further sought to obtain initial data on whether the CYP1A2 polymorphism influenced the response at both a lower and high caffeine dose.

METHODS: 16 male cyclists (Ht = 176.4 ± 6.8 cm, Wt = 71.8 ± 7.8 kg, VO2max = 64.7 ± 9.1 mL/kg/min) completed three separate computer-simulated 40-km cycling time trials one hour after the ingestion of 3 mg/kg caffeine, 6 mg/kg caffeine and a placebo. Subjects were genotyped for the polymorphism of the CYP1A2 gene and classified as AA homozygotes (N=6) or C allele carriers (N=10). Data were analyzed via a repeated measures ANOVA with treatment as the within-subjects factor and genotype as the between-subjects factor.

RESULTS: There was a main effect for treatment whereby both doses of caffeine significantly (P < 0.05) improved 40-km time (Placebo = 74.1 ± 5.4 min, 3 mg/kg = 72.7 ± 4.6 min, 6 mg/kg = 71.6 ± 4.7 min). There were no significant differences between 40-km time at the different caffeine doses. There was a trend (P = 0.10) for a genotype x treatment interaction, whereby a greater magnitude of decrease in 40-km time was evident in the AA homozygotes (4.6% improvement at the 6 mg/kg dose) as compared to the C allele carriers (2.6% improvement at the 6 mg/kg dose).

CONCLUSION: Both a 3 mg/kg and a 6 mg/kg of caffeine improve 40-km cycling time. The magnitude of the effect was not significantly different between the two doses although the higher dose resulted in a performance one minute faster than the lower dose. Preliminary data support previous results, in that the effect of caffeine may be larger in AA homozygotes.

2779  Board #51  June 1  9:30 AM - 11:00 AM
Caffeine Does Not Affect Improvements In Cognition During Prolonged High-Intensity Exercise In Alert, Well-Trained Individuals
Dennis P. Pollow, Jr, Brian T. Williams, Donald A. Joyce, Guogen Shan, Jennifer L. Temple, Luc E. Gosselin, FACSM, Peter J. Horvath. State University of New York at Buffalo, Buffalo, NY.

Evidence suggests that caffeine can act as an ergogenic aid during endurance exercise. While caffeine ingestion has been shown to improve cycling performance times in time trial races and exhaustive exercise, few studies have tested for cognitive function improvements during these tests.

PURPOSE: 1) To determine if caffeine ingestion can affect cognitive function and exercise performance outcomes during prolonged intense cycling and 2) To determine if the type of exercise trial can alter the effects of caffeine.

METHODS: Seven well-trained cyclists and triathletes (26.9 ± 3.9 y, VO2max = 67.7 ± 10.3 mL·kg−1·h−1) completed two trials to exhaustion at 90% VO2peak and two 50% time trials, one hour after consuming a carbohydrate-electrolyte beverage (5ml/kg, 6.3% CHO, 18mmol/l sodium) and a capsule containing either 6 mg/kg caffeine or placebo (double-blind crossover design). Cognitive function was measured before and after exercise using a computerized ANAM® test and Stroop word-color test (also conducted during exercise).

RESULTS: Average wakefulness scores at baseline were 1.9 ± 0.5, indicating that subjects were at near peak alertness. After either exercise trial type, ANAM® throughput scores increased by 9.4% compared to baseline (P <0.0001), while Stroop word-color test response time improved by 17.8% (P <0.0001). Neither cognitive test result was altered by the addition of caffeine. Caffeine did not significantly change exercise performance in either trial type. However, subjects were able to cycle an average of 65% longer during their second time to exhaustion trial compared to the first, regardless of supplementation (mean time = 78.4 and 51.5 min. respectively, P <0.001).

CONCLUSION: In alert, well trained athletes, high intensity endurance exercise can significantly improve simple and complex cognitive function, but is not enhanced with the addition of caffeine. The type of exercise trial does not alter the exercise-induced changes in cognitive function.

2780  Board #52  June 1  9:30 AM - 11:00 AM
Increased Time-trial Performance with Caffeine Ingestion is Independent of Fitness Level
Jessica Duhon, Trisha Cottrell, Andrea Talhani Lozano, Kylan Aburto-Pratt, Todd A. Astorino. CSU- San Marcos, San Marcos, CA.

Previous data show that caffeine is an ergogenic aid for endurance exercise; however, the exact mechanism explaining its performance-enhancing effect is unidentified. Some speculate that it is only ergogenic in trained muscle.

PURPOSE: To examine the effects of caffeine intake on cycling performance in both endurance trained and recreationally active individuals.

METHODS: Eight endurance trained and 8 active men completed five trials of cycling on an electrically-braked cycle ergometer, with each bout separated by at least 48 h. VO2max was higher (P < 0.05) in trained (57.5 ± 3.9 mL·kg·min−1) versus active men (46.5 ± 6.3 mL·kg·min). Subjects completed two familiarization trials and three experimental trials over a 2 - 3 week period, with sessions consisting of a 10 km time trial simulating competitive cycling, characterized by changes in terrain. Drinks administered included two boluses of 5 mg/kg caffeine (C1 and C2) or placebo (PL = 5 mg/kg of glucose), which were mixed with 255 mL of cold water, diet 7-Up, and 1 package of Crystal Light and ingested 1 h pre-exercise. Subjects were blinded to the order of drink assignment, which was randomized, and were told that drinks contained carbohydrate to minimize placebo effects of caffeine. Heart rate (HR), Rating of Perceived Exertion (RPE), and time were recorded every 1.6 km. Repeated measures analysis of variance was used to evaluate differences in variables across distance and treatment.

RESULTS: Time trial performance was significantly increased (P < 0.05) in both caffeine trials versus placebo for trained (C1 = 17.07 ± 0.99 min; C2 = 17.01 ± 1.0 min; PL = 17.35 ± 0.98 min) and active men (C1= 18.50 ± 0.61 min; C2 = 18.65 ± 0.80 min; PL = 18.71 ± 0.68 min); however, there was no difference observed across fitness level (treatment X group interaction p > 0.05). In both groups, 6 of 8 men revealed improved performance in C1 (-0.21 min) and C2 (-0.23 min) compared to placebo. HR and RPE increased during exercise (p < 0.05) but were unaltered across treatment (p > 0.05).

CONCLUSIONS: Caffeine was ergogenic for brief (< 20 min) “all-out” cycling performance in highly trained and moderately active individuals. Additional research is merited to confirm these findings in men and women varying in fitness level during other modalities of exercise.
The Metabolic And Performance Effects Of Caffeine Compared To Coffee During Exercise

Rebecca Randell, Adrian B. Hodgson, Asker E. Jeukendrup. University of Birmingham, Birmingham, United Kingdom.

(No relationships reported)

BACKGROUND: There is consistent evidence supporting the ergogenic effects following caffeine ingestion during exercise. Whether caffeine delivered through coffee has the same effects is still subject to debate.

PURPOSE: 1) To investigate the metabolic effects of caffeine and coffee during moderate intensity exercise. 2) To compare the performance enhancing effects of caffeine and coffee.

METHODS: In a single-blind, crossover study design, eight trained male cyclists/triathletes (Mean ± SD: Age 36±6y, Height 1.80±0.04m, Weight 76±3.72kg, VO₂ max 56±1.99 ml/kg/min) completed 30 min of steady-state (SS) cycling at approximately 55% VO₂ max followed by a time trial (TT) lasting approximately 45 min. One hour prior to exercise each athlete consumed drinks consisting of either caffeine (5mg/kg), instant coffee (5mg/kg), instant decaf coffee or placebo.

RESULTS: The net workloads produced similar relative exercise intensities during the SS of 54.6±0.7%, 55.4±2.4%, 54.7±2.7%, 55.0±2.0% VO₂ max for caffeine, coffee, decaf and placebo respectively. There was no observed difference in carbohydrate or fat oxidation during SS for any of the ingested supplements. Performance times during the TT were significantly faster (~4.0%) for both caffeine and coffee when compared to placebo and decaf (39.5±2.70, 39.4±2.48, 41.3±1.10, 40.1±1.31 min respectively, p<0.05). The improvements in performance time were similar for both caffeine and coffee. Average power for caffeine and coffee during the TT was significantly greater when compared to placebo and decaf (267±24W, 269±24W, 260±23W, 257±16W respectively, p<0.05). No significant differences were observed between placebo and decaf during the TT.

CONCLUSION: The present study illustrates that both caffeine (5mg/kg) and coffee (5mg/kg) consumed 1 hour prior to exercise can improve endurance exercise performance. These improvements cannot be attributed to alterations in substrate metabolism as no change in fat oxidation was observed during the SS.

The Metabolic And Performance Effects Of Caffeine Compared To Coffee During Exercise

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1Chinese Culture University, Taipei, Taiwan.

(No relationships reported)

Caffeine ingestion has been shown to affect hormonal responses to exercise. However, few studies examined the dose effect of caffeine ingestion on acute hormonal responses to a single bout of resistance exercise.

PURPOSE: The purpose of this study was to investigate the dose effect of caffeine ingestion on acute hormonal responses to resistance exercise (RE).

METHODS: Twelve well-trained college male students (age, 21±1 yr; mass, 72.8±2.1 kg) who regularly perform RE participated in this study. All subjects performed 1RM test, then perform four treatments: high dose (HD, 6mg/kg), medium dose (MD, 4mg/kg), low dose (LD, 2mg/kg) and control (CON) in counter balance order. All subject intake caffeine 1 hour prior to RE, then, the subjects perform RE (2 exercises, 3 sets of 10 repetitions at 75% of 1RM). Blood samples collect prior to caffeine intake (pre-60), immediately prior to RE (pre-exe), and 0, 15, 30 min after RE (P0, P15, P30) for analysis of testosterone, cortisol, insulin, growth hormone, glucose, lactate and free fatty acid. Each experiment separated by 7 days. In this study, statistical analysis of a two-way analysis of variance (treatment by time) with repeated measures is applied. Statistical significance set at α=0.05.

RESULTS: After ingesting caffeine, the concentrations of free fatty acid (pre-exe) in HD, MD, and LD (0.76±0.12, 0.67±0.17 and 0.46±0.11 mM/L) were significantly higher than CON (0.36±0.05 mM/L) (p<0.05). The responses of growth hormone, glucose, lactate and free fatty acid significantly different for HD and MD (p<0.05). The responses of GH (P0, P15, P30) (43.8±10.46, 52.5±10.68 and 37.72±11.80 ng/ml, p<0.05) were significantly higher than CON in HD and MD. In addition, the responses of GH (P0, P15, P30) (32.9±20.19, 32.0±19.09) and P30. 29.9±12.78 μmol/ml were significantly lower than CON in HD and MD.

CONCLUSION: The results of this study indicated that moderate dose (~2mg/kg) of caffeine ingestion prior to RE will significantly affect the responses of anabolic and catabolic hormones around RE.
RESULTS: There were no significant differences in time to complete the RAT among baseline (M = 1.83 s), caffeine (M = 1.78 s), and placebo (M = 1.85 s) run-throughs to the dominant side, Wilks’ Lambda F (2, 10) = 1.214, p = .337, n² = .195. Also, there were no significant differences in time to complete the RAT between baseline (M = 1.85 s), caffeine (M = 1.83 s), and placebo (M = 1.92 s) run-throughs to the non-dominant side, Wilks’ Lambda F (2, 10) = 3.795, p = .059, n² = .431.

CONCLUSIONS: There was a trend toward caffeine improving the time to complete the RAT to the players non-dominant side indicated by the approaching significance value and the effect size. Caffeine may provide ergogenic benefit to elite male youth soccer players on a RAT, and continued research is recommended with a larger sample.

2786 Board #58 June 1  9:30 AM - 11:00 AM

Even if Plasma Caffeine is Initially Elevated, Energy Drink Consumption Improves Cycling Performance

David G. Lassiter, Lynne Kammer, Zhenping Ding, James Burns, Heontae Kim, Joowon Lee, John L. Ivy, FACSM. University of Texas at Austin, Austin, TX.

Energy drinks have been shown to improve aerobic exercise performance when participants have fasted from caffeine ingestion for 24 hours. The improvement in aerobic exercise performance due to energy drink consumption may be due to low baseline plasma caffeine becoming elevated to a high level.

PURPOSE: To compare the effects of an energy drink on time-trial performance in athletes following a 24-hour caffeine abstinence.

METHODS: In a randomized crossover design 15 trained cyclists aged 20-45 (7 women, VO2max=45 mL/kg/min; 8 men VO2max=55 mL/kg/min) received either an energy drink (ED) (containing caffeine, glucose, taurine, panax ginseng root extract, l-carnitine, caffeine, glucuronolactone, inositol, guarana seed extract, and B vitamins) or a flavor-matched placebo (P) after a 24-hour caffeine abstinence. One hour later, participants completed a 35-kilometer time-trial ride on a cycle ergometer; time-to-finish (TTF) was recorded. Blood was drawn and analyzed for caffeine (CAFF) at three times; before drink ingestion, 40 minutes later, and during the final kilometer of the time-trial ride. Participants whose baseline CAFF was below 1000 ng/mL (n=10) were categorized as LO and those with baseline levels above 1000 ng/mL (n=5) were categorized as HI.

RESULTS: TTF improved in all participants after receiving ED as compared to P (64.1±1.3 minutes vs. 66.1±1.3, p <.001). Improvement in cycling performance due to ED was seen in both LO (66.1 to 64.0 minutes, a decrease of 2.1±0.5 minutes, p=.001) and HI (66.2 to 64.3 minutes, a decrease of 1.9±0.5 minutes, p=.014) groups.

CONCLUSIONS: Caffeine was ergogenic during leg, but not arm cycling and this effect may be attributable to preserved muscle activation in the KE.
PURPOSE: To examine the effects of two commercial energy shots on 5-km treadmill running performance in well-trained runners.

METHODS: Six highly trained male runners (VO_{2max}: 69.1±5.7 mL·kg^{-1}·min^{-1}; 5.4±0.9 kg·m·kg^{-1}·min^{-1}; 1.5±0.5 min) completed three trials separated by a minimum of 5 d, during which 59 mL of placebo (PLA: 0 mg caffeine), Guayakí Yerba Mate Organic Energy Shot™ (YM: 140 mg caffeine), or Red Bull Energy Shot™ (RB: 80 mg caffeine) were ingested 45 minutes before exercise. This was a randomized, single-blind, placebo-controlled crossover research design. During each trial, subjects performed a self-paced 5-kilometer time trial on a motorized treadmill. Subjects were able to control their pace via the treadmill interface, but were unaware of speed, elapsed time, and distance until the final 800 m.

RESULTS: Results demonstrated no significant effect of energy shot intake on performance compared to placebo (Mean ± SD: PLA=1046.7±74.8 s; YM=1071.7±95.2 s; RB=1053.2±60.8 s, p≤0.05). However, magnitude-based inferences revealed that performance in the PLA condition was 2.3% faster than the YM condition, yielding a likely substantial benefit in performance, while the difference in 5-km performance between PLA and RB and RB and YM was unclear.

CONCLUSIONS: At the dosages used in this study, energy shot ingestion did not improve high-intensity (~96% VO_{2max}) moderate duration (<18 minutes) running performance in trained runners in a laboratory setting compared to a placebo. Though further research is warranted, these findings do not support use of energy shots as potential ergogenic aids in trained runners.

2791 Board #61 June 1 9:30 AM - 11:00 AM
Red Bull Energy Drink and Anhydrous Caffeine have Similar Benefits for Cycling Time Trial Performance
Michael D. Leverit1, Alannah Quinlivan1, Chris Irwin1, Gary D. Grant1, Sheilandra Duke1, Ben Desbrow1,2. 1Griffith University, Gold Coast, Australia. 2University of Melbourne, Melbourne, Australia. (Sponsor: David Bishop, FACSM)

No relationships reported

PURPOSE: To investigate the ergogenic effects of a commercial energy drink (Red Bull) compared with an equivalent dose of caffeine provided in capsules.

METHODS: Eleven well-trained male cyclists (31.7±5.9 yrs, 82.3±6.1 kg; VO_{2max}=60.3±7.8 mL·kg^{-1}·min^{-1}) participated in this study which employed a double-blind, placebo-controlled and cross-over design. On three occasions participants were provided with an “energy drink” and some capsules 90 minutes before commencing a time trial equivalent to one hour cycling at 75% peak power output. All treatments were randomly administered and included Red Bull (~9 mL·kg^{-1} body mass, containing 3 mg·kg^{-1} body mass caffeine + placebo capsules), encapsulated anhydrous caffeine (placebo energy drink + 3 mg·kg^{-1} body mass caffeine capsules) or a placebo (placebo energy drink + placebo capsules). Throughout each trial, exercise time, heart rate (HR), blood lactate and rating of perceived exertion (RPE) were recorded.

RESULTS: Performance times improved with Caffeine (120±25% or 3.1%) and Red Bull treatments (110±27% or 2.9%), compared to the placebo (p≤0.05), with no significant difference detected between the two caffeinated treatments (p>0.05). Average HR and RPE were not significantly different across the three treatments, although there was a trend towards increased HR in the both the Red Bull and Caffeine trials (P=0.086 and P=0.068 respectively). Blood lactate concentrations were greater in both the Caffeine and Red Bull trials after exercise, in comparison with the placebo condition.

CONCLUSIONS: Red Bull significantly improves endurance cycling performance to the same degree as the equivalent dose of anhydrous caffeine. Therefore the ergogenic benefits of red bull energy drink are most likely due to caffeine, with the other ingredients offering no observable additional benefit.

2790 Board #62 June 1 9:30 AM - 11:00 AM
Examining Football Players Energy Drink Use and Motivations for Combining Energy Drinks with Alcohol
Conrad L. Woolsey1, Bert H. Jacobsen2, Weston S. Kensing2, Niels C. Beck3, Alex Waisgand4, 1Ohio State University, Columbus, OH. 2Ohio State University, Stillwater, OK. 3Oswego State University, Oswego, NY. 4University of Missouri Medical School, Columbia, MO. 5University of Missouri, Columbia, MO. (No relationships reported)

Research suggests football players may be a subgroup of the population that is particularly attracted to the stimulating effects of energy drinks (EDs) both on and off the field. Evidence suggests ED consumption in combination with alcohol has become increasingly prevalent.

PURPOSE: To investigate the use of energy drinks among NCAA Division I football players and motivations for combining EDs with alcohol.

METHODS: Following IRB approval 41 football players from a large Midwestern NCAA D-I university voluntarily completed the Quick Drink Screen (QDS) quantity-frequency measure for alcohol, combined-use (EDs+alcohol), and ED use without alcohol. To measure motivations for combining EDs with alcohol, participants also completed the Brief Comprehensive Effects of Alcohol and Combined-Use Questionnaires.

RESULTS: Nearly half (42.5%) of participants consumed EDs without alcohol and 27.5% used EDs 2 or more days/wk during the previous year. Additionally, 20% reported ED-binge drinking (having 3 or more EDs on one occasion). Among alcohol drinkers (n=33), 39.4% mixed EDs with alcohol and 69% of those combined-users reported ED-binge drinking with alcohol. An ANOVA on age and combined-use indicated older players were significantly more likely to combine EDs with alcohol than younger players F(4,23)=5.006, p=0.003. An ANOVA on race (white/black) and combined-use indicated significant differences on the number of alcoholic drinks when combining F(1,39)= 4.146, p<0.05, and greatest number of alcoholic drinks when mixing EDs with alcohol.

CONCLUSIONS: Mixing EDs with alcohol appears to be a common trend which may contribute to the increased risk for ED-binge drinking. ED use has previously been reported as a predominantly white male behavior. In this sample, ED use was proportionate with 42% of white and 45% of black players using EDs; however, results did indicate white players had a higher prevalence of combining EDs with alcohol. The use of EDs among athletes and their motivations for using EDs needs further study.

2791 Board #63 June 1 9:30 AM - 11:00 AM
High But Not Low Caffeine Ingestion Has An Acute Diuretic Effect At Rest
Stavros A. Kavouras1, FACSM, Costas N. Bardis2, Petros Gregorakis3, Anna Gavrieli4, Mary Yannakouilia5, Labros S. Sidossis5, Harokopio University, Athens, Greece. (S.A. Kavouras Consulting Fee: Gatorade Sports Science Institute.)

It is documented that low levels of caffeine ingestion does not induce chronic dehydration at rest, while it not clear if larger doses do have an acute diuretic effect.

PURPOSE: The aim of the present investigation was to determine the effect of low and high level of caffeine on fluid balance in habitual coffee drinkers at rest.

METHODS: Twenty-five healthy male and female adults (age: 28±5 y, body mass index: 28±5, weight: 84.6±7.7 kg, height: 1.79±0.01 m) ingested 200 ml of water (W) or coffee with low caffeine (3 mg·kg^{-1}, LCAF), on two separate occasions. Nine subjects of them participated once a third trial ingesting coffee with high caffeine (6 mg·kg^{-1}, HCAF). All subjects remained in the laboratory while urine samples were collected every 60 min for three hours. Mean caffeine consumption for LCAF was 254 mg and 552 mg for the LCAF and HCAF, respectively. The subjects were habitual coffee drinkers (2-3 cups per day) who abstained from foods and drinks containing caffeine or other methylxanthines 24 h before each study. All sessions were performed at 09:00 in the morning in a counterbalance, crossover manner, at least 5 days apart.

RESULTS: Cumulative urine volume during the 3 h period after caffeine ingestion induced greater diuresis in the HCAF trial (630±391 ml) when compared to W (292±165 ml) and LCAF (316±194 ml). No differences were found between the W and LCAF trials. Urine specific gravity was lower during the HCAF trial (1.011±0.006 g/ml) when compared to W (1.016±0.007 g/ml) and LCAF (1.016±0.006 g/ml).

CONCLUSIONS: The data suggest that high caffeine intake in the form of coffee can induce an acute diuretic effect, while low levels do not disturb fluid balance in healthy casual coffee drinking adults at rest.
Caffeine is a mild stimulant that acts on the central nervous system and skeletal muscles, overriding fatigue signals, increasing heart rate at rest, and eliciting greater motor unit recruitment. Caffeine also positively affects performance by increasing endurance and increasing performance at high altitude. Other research has suggested that caffeine can decrease heart rate (HR) during submaximal exercise. Several submaximal exercise tests use heart rate to predict VO2max. Therefore, due to the varying response of heart rate to caffeine, the response of the predicted VO2max to caffeine is unknown.

**PURPOSE:** The purpose of this study was to determine the effect of caffeine ingestion on heart rate during submaximal exercise and on the subsequent predicted VO2max of active college age males.

**METHODS:** 12 moderately trained males (age 18-30 yrs) completed four testing procedures on four separate days: 1) VO2max test; 2-4) single-blind dosage of caffeine (0 A), 3.5 (B) or 7 (C) mg/kg) administered orally 1 hour before testing. Participants completed the Forestry Step test and the Astrand Cycling test. Relative and absolute predicted VO2 max values were recorded and comparisons between caffeine dosages were made using repeated measures ANOVA.

**RESULTS:** There were no significant differences in mean predicted VO2 max following any of the caffeine trials for either the Forestry or Astrand test as compared to the placebo (p > .05). However, according to Bland-Altman plots, Absolute Astrand (C-A) and the Relative Forestry (B-A) have trend lines with significant slope, which is indicative of some systematic variability and thus poor agreement and bias in the data.

**CONCLUSIONS:** These results suggest that consumption of caffeine does not have a measurable effect in moderately trained males on predicted VO2 Max from the Forestry or the Astrand tests. This also suggests that it may not be necessary to restrict participant’s caffeine intake before clinical submaximal testing.

**Board #65 June 1  9:30 AM - 11:00 AM**

**Caffeine Ingestion Reverses the Circadian Rhythm Effects on Neuromuscular Performance in Highly Resistance-Trained Men**

Alvaro Lopez-Samanes, Jesus Garcia-Pallares, Juan F. Ortega, Valentin E. Fernandez-Elias, Ricardo Mora-Rodriguez. *University of Castilla La Mancha, Toledo, Spain.

*No relationships reported*

Following a circadian rhythm pattern, neuromuscular performance declines in early mornings and late nights while peaks during midday. In turn, caffeine ingestion, an adenosine receptor stimulator, has been accepted as an ergogenic aid with potential to improve neuromuscular performance (i.e., muscle strength and power).

**PURPOSE:** Investigate whether caffeine ingestion counteracts the morning reduction in neuromuscular performance associated with circadian rhythm.

**METHODS:** Twelve highly resistance-trained men underwent a battery of neuromuscular tests under three different conditions: i) morning (10:00 a.m.) with caffeine ingestion (i.e., 6 mg · kg$^{-1}$ AMCAFT trial); ii) morning (10:00 a.m.) with placebo ingestion (AMPLAC trial); and iii) afternoon (18:00 p.m.) with placebo ingestion (PMPLAC trial). A randomized, double-blind, placebo controlled experimental design was used, with all subjects serving as their own controls. The test battery consisted in the measure of bar displacement velocity during free-weight full-squat (SQ) and bench press (BP) exercises against loads that elicit maximum strength (75% 1RM load) and muscle power adaptations (1 m·s$^{-1}$ load). In addition, maximum voluntary and electrically evoked (EVOCLED) isometric leg extension strength were measured to identify the caffeine’s action mechanisms. Plasma norepinephrine concentration (NE) was measured after a standardized SQ intense bout (6 x 85% 1RM) as surrogate of maximal muscle sympathetic nerve activity since plasma NE is mostly derived from the spillover of the terminal nerve endings of the motoneurons.

**RESULTS:** In the PMPLAC trial, dynamic muscle strength and power output were significantly enhanced compared with AMPLAC (4.7%–7.5%; P<0.05). During the AMCAFT trial, strength and power increased above AMPLAC levels (4.6%–5.7%; P<0.05) except for BP velocity with 1 m·s$^{-1}$ load. Lastly, during AMCAFT, EVOCLED and NE were increased above AMPLAC trial (14.6% and 96.8%, respectively; P<0.05).

**CONCLUSIONS:** Overall, caffeine ingestion reversed the morning decreases in muscle strength and power output, raising performance to levels of the afternoon trial. The electrical stimulation data, along with NE, suggests that caffeine increases the neuromuscular performance via a direct effect in the muscle.

**Board #66 June 1  9:30 AM - 11:00 AM**

**The Effects of Caffeine on Long-Term Anaerobic Exercise**


*No relationships reported*

**PURPOSE:** The purpose of this study was to examine effects of caffeine on a long-term anaerobic exercise protocol using the 90-second Wingate Test (WAnT90).

**METHODS:** Thirteen (5 males and 8 female, Age = 20.15±0.99 years) anaerobically trained athletes who were habitual caffeine consumers participated in a double-blind study that was randomized and counterbalanced using caffeine (5 mg/kg) and a placebo (equivalent mg of rice flour). One hour after ingesting the caffeine or placebo capsule, the subjects underwent a 2-minute prescribed warm-up on Monarch bicycle ergometer. The participant then performed a WAnT90 protocol using 0.05 kg per body weight as a constant resistance. Paired t-tests were conducted between the caffeine and placebo for peak power (PP), total power (TP), total power 30-s (TP30), total power 60-s (TP60), total power 90-s (TP90), and power decline for total work, 30-s, 60-s, and 90-s (PDT, PD 30, 60, and 90, respectively). The significance was set at p<0.05.

**RESULTS:** The caffeine did not show a difference in PP; however, the caffeine trial did improve performance for TP, TP30 and TP60. In addition, TPD was improved with caffeine however; the rate of decline did not change across the 30-s intervals.

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<thead>
<tr>
<th></th>
<th>TP (Watts)</th>
<th>TP60 (Watts)</th>
<th>TP90 (Watts)</th>
<th>TPD (% decline)</th>
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<tr>
<td>Caffeine</td>
<td>350.47</td>
<td>1733.53#</td>
<td>1566.36#</td>
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<tr>
<td>Placebo</td>
<td>593.26</td>
<td>617.33</td>
<td>242.66</td>
<td>67.29%</td>
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* p<0.05, *p<.01, p<0.001

**CONCLUSIONS:** As with other studies, peak power did not change following the ingestion of caffeine; however, caffeine did have a significant effect on long-term anaerobic performance. The increased power output with caffeine could be due adenosine antagonism and a decrease in pain perception and fatigue.
**REGION: Exhibit Hall**

**E-23  Free Communication/Poster - Cardiovascular II**

**2795  Board #67  June 1  11:00 AM - 12:30 PM**

**A Moderate Exercise Protocol that Produces Significant Cardiac Hypertrophy in Rats**


**Purpose: To determine whether hypertrophy following moderate exercise training in the cold environment is associated with enhanced function consistent with exercise-induced hypertrophy following intense exercise training.**

**METHODS:** Male, 10-week-old Sprague-Dawley rats were divided into sedentary (S) and exercised (E) groups. E ran on a treadmill 5 days/week up a 6° incline for 4-9 wks. During wk 1, running time and speed was gradually increased to 30 minutes at 20 m/min (~70% VO₂max). During wk 2 rats began running in a refrigerated room (6-8°C) with fur dampened and running time gradually increased to one hour per day, then held constant for the remaining wks. Animals were housed at 23°C when not running. Twenty-four hrs after the last exercise bout, hearts were weighed and connected to an isolated perfused working heart apparatus for evaluation of cardiac functional performance. Ventricular gene expression of α- and β-MHC (myosin heavy chain) was determined in the 9-week group.

**RESULTS:** E displayed an increase in heart wt (P<0.05) compared to S of 9% and 23% after 4 and 9 wks, respectively. Cardiac function improved in E vs S as indicated by increases (P<0.05) of 24% in external work performed (Cardiac output x Systolic pressure, normalized for wt) and 20% in efficiency of external work (work/VO₂). Gene expression was not different from sedentary values consistent with physiological hypertrophy.

**CONCLUSION:** Compared to exercise at ambient temperature, the cold-room exercise protocol is a more humane way to produce exercise-induced hypertrophy and improvement in function.

**2796  Board #68  June 1  11:00 AM - 12:30 PM**

**Prevalence Of Cardiac Abnormalities In College Athletes When Exposed To Physiological And Thermal Stressors**

James D. Kingsley, Matt Tucker, Susan Yeargin. Indiana State University, Terre Haute, IN. (Sponsor: Lynn Panton, FACSM)

Cardiovascular pre-participation screening of collegiate student athletes is underutilized according to the American Heart Association. Physiological stress in the form of submaximal exercise and heat exposure can both alter cardiovascular function, possibly elucidating an abnormality via electrocardiogram (ECG).

**PURPOSE:** To investigate prevalence of cardiac abnormalities in college athletes when exposed to physiological and thermal stress.

**METHODS:** Eleven participants (males n=5; females n=6; 21 ± 1 yrs; 1.68 ± 0.05m; 60.0 ± 4.5kg; 56.1 ± 12.6 ml/kg/min) currently participating at the NCAA Division I level (track and field as well as cross country) volunteered for this study. Participants completed one maximal treadmill test and two submaximal treadmill tests (70% of VO₂ max) in two different environmental conditions: thermoneutral (TN: 24.8 ± 1.6°C) and hyperthermic (HT: 38.0 ± 2.2 °C) for 30 minutes. ECGs were recorded over 15 seconds at five minute intervals. PR interval duration, ST segment elevation/depression, and R and S wave amplitude were measured; ECGs were further analyzed for abnormalities. A repeated measures ANOVA was used to test the effects of condition by time.

**RESULTS:** No significant condition by time interactions were found for any variable (p>0.05). There were also no main effects (p>0.05) of condition. However, there were significant differences across time (p<0.05) manifested as a decreased PR interval (-19.1 ± 18.2%), R wave amplitude (-15.1 ± 12.3%), and increased S wave amplitude (+34.8 ± 29.1%). No main effects (p>0.05) were found for ECG abnormalities. However, high occurrences (56%) of incomplete left bundle branch block (ILBBB) were found.

**CONCLUSION:** Submaximal exercise in the hyperthermic condition did not significantly alter cardiovascular function in the parameters measured. In addition, the total number of ECG readings with abnormalities was higher in the hyperthermic condition compared to thermoneutral, most notable in incidences of ILBBB. Supported by funding from the College of Graduate and Professional Studies at Indiana State University.

**2797  Board #69  June 1  11:00 AM - 12:30 PM**

**Influence of the Menstrual Cycle on Resting and Exercise Left Ventricular Volumes and Twist Mechanics**

Amanda Q.X. Nio, Eric J. Stöhr, Michael Stembridge, Rob Shave. University of Wales Institute, Cardiff, Cardiff, United Kingdom. (Sponsor: Keith George, FACSM)

Currently, there is no consensus on the impact of cyclical changes in circulating female sex hormones across the menstrual cycle, on cardiac function at rest or during exercise.

**PURPOSE:** To compare left ventricular (LV) function at rest and during exercise across the early-follicular (EF) and mid-luteal (ML) phases of the menstrual cycle.

**METHODS:** Eight healthy females (mean±standard deviation; age 26±2 years; height 164.9±8.0 cm; body mass 58.5±7.6 kg; body fat 29±4%), with regular menstrual cycles (25-33 days), completed progressive supine cycling exercise during EF (Day 3-5) and ML (Day 19-27) phases. Participants completed four 4-min exercise stages at 10, 30, 50 and 70% peak power (151±52 W). LV volumes, septal wall velocity, isotropic relaxation time and twist mechanics were assessed using cardiac ultrasound (Vividq, GE Healthcare), at rest and during each stage of exercise. Statistical analysis was performed using t-test for resting measures and two-way ANOVA for exercise measures. Alpha was set at 0.1.

**RESULTS:** At rest and during incremental exercise, diastolic blood pressure, cardiac output, heart rate, stroke volume, ejection fraction, end-systolic volume and peak systolic septal wall velocity at the level of the mitral annulus were similar between menstrual cycle phases. However, resting systolic blood pressure (ML 112±12 vs. EF 125±9 mmHg; p=0.05), peak apical rotation (ML 9.1±4.8 vs. EF 10.2±4.7 deg; p=0.01) and peak apical rotation velocity during diastole (ML -68±15 vs. EF -80±13 deg/s; p=0.03) were reduced during the ML phase. End-diastolic volume was influenced by the interaction between menstrual cycle phase and exercise intensity (p=0.06), with a larger volume at 70% exercise during the ML phase (ML 103±18 vs. EF 95±24 mL; p=0.09). Isotropic relaxation time differed between menstrual cycle phase (p=0.001), and was shorter during the ML phase at 30% peak power (ML 53±7 vs. EF 64±10 ms; p=0.01) and 70% peak power (ML 44±8 vs. EF 49±9 ms; p=0.07).

**CONCLUSION:** Although global parameters of resting cardiac function were similar between the EF and ML phases, greater increases in apical rotation and diastolic rotation velocity with exercise in the ML phase likely result in greater LV suction during diastole. This might explain the enhanced EDV observed during moderate intensity exercise.
2798  Board #70  June 1  11:00 AM - 12:30 PM  
**Exercise Training Does Not Enhance Diastolic Function In Non-alcoholic Fatty Liver Disease Patients**

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(No relationships reported)

**PURPOSE:** Non-Alcoholic Fatty Liver Disease (NAFLD), the accumulation of triglycerides in the liver, is the hepatic manifestation of the metabolic syndrome. NAFLD is associated with an increased risk of chronic liver disease including cirrhosis, liver failure and hepatocellular carcinoma although cardiovascular disease (CVD) remains the leading cause of mortality. We have recently shown diastolic dysfunction in NAFLD patients when compared to age and BMI matched controls. The aim of this study was to examine the effect of exercise training on diastolic dysfunction in patients with NAFLD.

**METHODS:** Twelve sedentary patients with NAFLD, aged 50.9±11.7y, underwent a 16-week supervised exercise training program (30-45min, 3-5 times per week). Each patient underwent transthoracic echocardiography to determine left ventricular (LV) mass index, peak early (E) and atrial (A) diastolic flow velocities, the E/A ratio, peak early (E') diastolic tissue velocity at the septal mitral annulus and the E/E' ratio. Proton Magnetic Resonance (MR) Spectroscopy was used to determine liver fat and whole body MR imaging quantified abdominal visceral (VAT) and subcutaneous (SAT) adipose tissue. Fasting glucose, lipids, liver enzymes and VO2max were assessed prior to and following training. Differences between baseline and post-training were analysed using paired t-tests.

**RESULTS:** Exercise training resulted in a significant improvement in VO2 max from 24.9±6.2 to 31.3±8.4 ml kg^{-1}min^{-1}; liver fat significantly reduced (25±4% vs 16±1%); there was a significant reduction in BMI (30.1±2.4 vs 29.4±2.8 kg/m^2) and abdominal SAT (8.6±2.5 vs 8.0±2.5 L, P<0.05) but abdominal VAT was not different following exercise training. Despite these reductions in body composition and liver fat, there were no significant changes in any variable of myocardial performance: differences in LV mass (73.4±16.7 vs 82.7±18.2 g/m^3), diastolic flow velocities (E/A ratio 1.10±0.30 vs 1.03±0.26) or diastolic tissue velocity (E/E' ratio 6.6±1.4 vs 7.1±3.3 cm/s and E/E' 11.1±2.9 vs 11.0±3.0 cm/s).

**CONCLUSIONS:** These data indicate that exercise training did not improve diastolic function in NAFLD patients. Given that LV function is partially mediated by visceral adiposity the lack of improvement in diastolic function could be due to a lack of change in VAT volume.

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2799  Board #71  June 1  11:00 AM - 12:30 PM  
**Influence of Sex on Cardiotid Baroreflex Function and Performance During Dynamic Exercise in Humans**

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(No relationships reported)

Young men tend to exhibit greater pressor responses to exercise compared to age-matched women; however, the reason for these differences remains unclear. Appropriate baroreflex resetting and function are requisite for normal blood pressure responses to dynamic exercise. However, to date, no studies have examined whether there are sex differences in arterial baroreflex resetting and function during dynamic exercise.

**PURPOSE:** To compare arterial baroreflex (CBR) resetting and function during dynamic exercise between young men and women.

**METHODS:** We studied 16 young men and 18 young women at rest and during leg cycling at 50% heart rate (HR) reserve. All women were studied during the early follicular phase of the menstrual cycle (days 2-5). Beat-to-beat HR (ECG) and mean arterial pressure (MAP, finger photoplethysmography) were measured. Five second pulses of neck pressure and neck suction (NS) from +40 to -80 Torr were applied to determine full CBR stimulus response curves for MAP and HR. In order to estimate the magnitude of exercise-induced baroreflex resetting, differences in the sum of the changes in centering point (CP), minimum response, threshold, and saturation from rest to exercise were calculated.

**RESULTS:** An upward and rightward resetting of the CBR function curve was observed during exercise in both men and women with a similar magnitude of CBR resetting for MAP (+68±10 vs +57±13 mmHg; P<0.05) and HR (+38±13 vs +15±13 bpm; P<0.05) between sexes. However, for CBR control of MAP, young women exhibited significantly greater depressor responses to NS at rest that were not present during exercise. For CBR control of HR, there was a greater bradycardic response to NS in young women with the operating point (OP) located further away from CP on the CBR-HR curve during rest (OP-CP: -13±3 vs -3±3 mmHg; P<0.05) and exercise (-31±2 vs -41±3 mmHg; P<0.05).

**CONCLUSION:** Collectively, these findings suggest that exercise does not influence exercise resetting of the arterial baroreflex. However, young women exhibit greater CBR control of HR during dynamic exercise, specifically against acute hypertension.

Supported by R01HL093167

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2800  Board #72  June 1  11:00 AM - 12:30 PM  
**The Effects Of A Multi-flavonoid Supplement On Vascular And Hemodynamic Parameters In Older Prehypertensives**

Chelse D. Curry1, Steven R. McAnulty1, Lisa S. McAnulty1, Hannah E. Wheeler1, Janice Welsh1, Rebecca M. Kappos2, Martin Hubner1, Scott R. Collier, FACSM1, 1Appalachian State University, Boone, NC. 2University of Illinois at Urbana-Champaign, Urbana, IL.  

(No relationships reported)

Antioxidants have been shown to increase vasodilation leading to increases in vascular distensibility, which would be of great benefit to individuals with elevated blood pressure. However, to date, no studies have examined whether there are sex differences in arterial baroreflex resetting and function during dynamic exercise.

**PURPOSE:** To compare arterial baroreflex (CBR) resetting and function during dynamic exercise between young men and women.

**METHODS:** We studied 16 young men and 18 young women at rest and during leg cycling at 50% heart rate (HR) reserve. All women were studied during the early follicular phase of the menstrual cycle (days 2-5). Beat-to-beat HR (ECG) and mean arterial pressure (MAP, finger photoplethysmography) were measured. Five second pulses of neck pressure and neck suction (NS) from +40 to -80 Torr were applied to determine full CBR stimulus response curves for MAP and HR. In order to estimate the magnitude of exercise-induced baroreflex resetting, differences in the sum of the changes in centering point (CP), minimum response, threshold, and saturation from rest to exercise were calculated.

**RESULTS:** An upward and rightward resetting of the CBR function curve was observed during exercise in both men and women with a similar magnitude of CBR resetting for MAP (+68±10 mmHg; P<0.05) and HR (+38±13 bpm; P<0.05) between sexes. However, for CBR control of MAP, young women exhibited significantly greater depressor responses to NS at rest that were not present during exercise. For CBR control of HR, there was a greater bradycardic response to NS in young women with the operating point (OP) located further away from CP on the CBR-HR curve during rest (OP-CP: 13±3 vs -3±3 mmHg; P<0.05) and exercise (-31±2 vs -41±3 mmHg; P<0.05).

**CONCLUSION:** Collectively, these findings suggest that exercise does not influence exercise resetting of the arterial baroreflex. However, young women exhibit greater CBR control of HR during dynamic exercise, specifically against acute hypertension.

Supported by R01HL093167

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2801  Board #73  June 1  11:00 AM - 12:30 PM  
**The Influences Of Protecatocheaic Acid On Blood Pressure And Insulin-mediated Vascular Function In Hypertension**

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(No relationships reported)

**PURPOSE:** Hypertension has been known to induce vascular impairments with the decrease of nitric oxide (NO) bioavailability. Moreover, oxidative stress has been recognized as an important factor for the pathogenesis of endothelial dysfunction and hypertension. Recently, protocatechuic acid (PCA; 3,4-dihydroxybenzoic acid), a simple phenolic acid, has been found to be a strong antioxidant. However, whether PCA induces beneficial effects on cardiovascular function in hypertensive status remains unknown. Therefore, we investigated the influences of PCA on blood pressure and vascular function in hypertension.

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METHODS: Male spontaneously hypertensive rats were randomly divided into control (SHR) and PCA supplement (SHR+PCA) groups. Wistar-Kyoto (WKY) rats were used as the normotensive control group. The SHR+PCA group was supplemented with PCA adjusted from their daily water consumption for 8 weeks. At the end of experiments, resting blood pressure, glucose, and insulin level were measured and compared among three groups. In addition, the insulin-mediated vasorelaxation was evaluated in rat aortas using the organ bath system. The aortic protein expression, such as insulin receptor and endothelial nitric oxide synthase (eNOS), was also examined by Western blot analysis. This study was approved by the Institutional Animal Care and Use Committee of Taipei Physical Education College (Taipei, Taiwan).

RESULTS: We found that the PCA supplement significantly reduced the systolic blood pressure, glucose, and insulin level in the SHR+PCA group compared with the SHR group (p<0.05). Also, the PCA supplement induced higher insulin-mediated vasorelaxation in the SHR+PCA group than that in the SHR group (p<0.05). However, the endothelium-denuded insulin-mediated vasorelaxation was comparable among three groups. Moreover, the protein expression of insulin receptor and eNOS was significantly increased after the PCA supplement.

CONCLUSIONS: The 8-week PCA supplement could ameliorate the blood pressure and insulin-mediated vasorelaxation in hypertension. This vascular improvement was associated with the increase of insulin receptor and eNOS protein via the endothelium-dependent pathway.

2802 Board #74 June 1 11:00 AM - 12:30 PM
Prenatal Programming of Hypertension by Dietary Protein Deprivation Alters Skeletal Muscle Reflex Function in Rats
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(No relationships reported)

The cardiovascualr response to exercise is enhanced in hypertension. Recent studies using a rat model of essential hypertension have suggested that this exaggerated responsiveness is mediated, in part, by the skeletal muscle exercise pressor reflex (EPR). It remains unknown, however, whether EPR dysfunction manifests in other forms of disease.

PURPOSE: To address this issue, EPR function was investigated in adult rats that were prenatally programmed to express hypertension as a result of maternal dietary protein deprivation. Prenatal programming of hypertension (PPH) in this manner is a commonly used model for the hypertension that develops in adults that were born small for gestational age.

METHODS: Pregnant Sprague-Dawley rats were fed either a 6% (PPI) or 20% (control) protein diet during the last half of the gestational period. In 10 PPH and 11 control adult offspring, EPR function was assessed by electrically-inducing hindlimb muscle contraction. The mechanically-sensitive component of the EPR was selectively activated by passively stretching hindlimb muscle while the chemically-sensitive component was stimulated by locally administering capsaicin (1.0 µg/100 µl) into the circulation of the hindlimb.

RESULTS: Resting systolic blood pressure was significantly higher (P < 0.05) in PPH compared to control rats (140 ± 3 vs. 128 ± 3 mmHg, respectively). Stimulation of the EPR evoked significantly larger increases in mean arterial pressure (ΔMAP from baseline: 40 ± 7 vs. 20 ± 4 mmHg, P < 0.05), heart rate (ΔHR from baseline: 19 ± 3 vs. 5 ± 1 bpm, P < 0.05) and renal sympathetic nerve activity (ΔRSA: 198 ± 29 vs. 168 ± 14 %, P < 0.05) in PPH compared to control whereas developed tension was not different between groups (ΔTension: 0.84 ± 0.07 vs. 0.81 ± 0.7 kg). The MAP, HR and RSA responses to selective activation of the mechanically and chemically-sensitive components of the EPR were likewise significantly greater in PPH compared to control.

CONCLUSIONS: These data demonstrate that the EPR is overactive in prenatally programmed hypertension. This is an important finding as it suggests that muscle reflex dysfunction is not unique to essential hypertension but may play a significant role in the generation of abnormal cardiovascular control during exercise in other forms of disease. Supported by NIH HL-085422

2803 Board #75 June 1 11:00 AM - 12:30 PM
Effect Of Resistance Exercise Training On Arterial Reservoir Pressure In Prehypertensive Men And Women
Kevin S. Heffernan, 1 Eun Sun Yoon,2 Justin Davies,1 James E. Sharman,1 Bo Fenhall, FACSM,3 Jae Young Jea,1 Syracuse University, Syracuse, NY. 2University of Seoul, Seoul, Korea, Republic of. 3University of Illinois- Chicago, Chicago, IL.

(No relationships reported)

BACKGROUND: The central blood pressure (BP) waveform is viewed as a composite of overlapping incident and reflected pressure waves. Recently, it has been suggested that the capacitance property of large central arteries also contribute to the morphology of the BP waveform (i.e. reservoir pressure). Resistance exercise training (RET) reduces central BP yet it appears to do this without changing pressure from wave reflections.

PURPOSE: The purpose of this study was to examine the contribution of the arterial reservoir to changes in central BP following RET in men and women with pre-hypertension.

METHODS: Twenty-one participants (age 61±1 yrs, n = 6 male) with pre-hypertension (average SBP/DBP = 138/84 mmHg) were randomized to either 12-weeks of RET (n = 11) or an inactive control group. Central aortic BP was derived from radial pressure waveforms using tonometry and a generalized transfer function. Also derived from BP waveforms were forward wave pressure, excess wave pressure, augmented pressure, augmentation index (AIx), left ventricular pressure effort, and reservoir pressure.

RESULTS: A significant group-by-time interaction for central blood pressure (SBP) was noted (p<0.05). There was a reduction in central SBP following RET (134±5 to 129±4 mmHg) and a slight increase in central SBP in the control group (130±5 to 133±4 mmHg). There were also significant group-by-time interactions for forward wave pressure (p<0.05), excess pressure (p<0.05), and reservoir pressure (p<0.05). Following RET there were reductions in forward wave pressure (32±2 to 30±2 mmHg) excess pressure (42±3 to 40±3 mmHg) and reservoir pressure (38±3 to 35±3 mmHg). There were slight increases in forward wave pressure (27±2 to 30±2 mmHg), excess pressure (35±3 to 39±3 mmHg), and reservoir pressure (31±3 to 35±3 mmHg) in the control group. There were no changes in augmented pressure, AIx or left ventricular pressure effort in either group (p>0.05).

CONCLUSIONS: RET reduces central SBP in pre-hypertensive men and women. Changes in forward wave/excess wave pressure and reservoir pressure without changes in augmented pressure suggest that central SBP reduction with RET may be due to changes in the impedance and capacitance properties of arteries and not changes in pressure from wave reflections.

2804 Board #76 June 1 11:00 AM - 12:30 PM
The Hemostatic Responses to Acute Exercise of an At Risk Obstructive Sleep Apnea Population
Paul Nagelkirk, Steve Veshbach, Amanda Mallory, Trent Hargens. Ball State University, Muncie, IN. (Sponsor: Christopher Womack, FACSM)

(No relationships reported)

Obstructive sleep apnea (OSA) is a sleep disorder that places one at increased risk for cardiovascular disease (CVD) and CVD related events. Patients with OSA exhibit elevated coagulation and decreased fibrinolytic potential, both of which are associated with incidence of CVD and its sequelae. The hemostatic response to a stressor such as maximal exercise may differentiate clinical and demographic groups better than baseline profiles. Hemostatic exercise responses are also related to CVD morbidity and mortality, to date, no research has examined the impact of exercise on measures of coagulation and fibrinolysis in this population.

PURPOSE: To compare the fibrinolytic and coagulation responses to exercise between subjects at high risk for OSA and control subjects.

METHODS: Seventeen obese men and women (BMI = 32.1 ± 5.7kg/m2) completed the study: 8 at risk for OSA (apnea-hypopnea index = 10.6 ± 8.2 events/hour) and 9 control subjects. Subjects performed maximal exercise tests on a cycle ergometer. Plasma concentrations of fibrinogen, active tissue plasminogen activator (tPA) and plasminogen activator inhibitor (PAI-1) were assessed at rest and immediately after exercise. Body composition was assessed by DXA. Risk for OSA was established through a screening result from an at-home sleep assessment (EmFit).

RESULTS: OSA and CTRL groups were not different in regard to VO2 max (21.7 ± 5.5 vs 24.3 ± 5.4 ml/kg/min, respectively), BMI (34 ± 5.6 vs 31.2 ± 5.2 kg/m2) or body composition (39.6 ± 8.6 vs 38.1 ± 11.1% fat). The OSA group was older than the CTRL group (47 and 30 yrs, respectively), but no hemostatic variable was correlated to age. Maximal exercise induced significant changes in each hemostatic variable, but no differences were observed between groups. tPA activity (OSA = 0.99 ± 0.13 vs. 7.21 ± 1.64 IU/ml; CTRL = 1.02 ± 0.12 vs 6.76 ± 1.86 IU/ml) and fibrinogen concentration (OSA = 367.6 ± 94.9 to 377.7 ± 91.1 mg/dl; CTRL = 365.9 ± 76.2 to 413.3 ± 114.4 mg/dl) increased significantly (p<0.05). PAI-1 decreased in both groups (OSA = 4.70 ± 1.83 to 2.25 ± 0.58 IU/mL; CTRL = 7.13 ± 4.73 to 5.21 ± 3.39 IU/mL).

CONCLUSIONS: Results suggest that mild OSA (AHI 5-15 events/hr) may not impact coagulation or fibrinolytic potential. Future research needs to evaluate this response in subjects with more severe OSA.
Racial Differences in Blood Pressure Response and Vascular Function following 8-weeks of Aerobic Training
Sushant M. Ranadive, Huimin Yan, Abbi D. Lane, Peng Sun, Rebecca Kappus, Marc D. Cook, Bo Fernhall, FACSM. University of Illinois, Champaign, IL. (No relationships reported)

African-Americans (AA) have higher prevalence of hypertension than Caucasians (CA) in the United States. In addition, AA have lower endothelial function and blunted peripheral vascular dilatation. These factors are known to directly contribute to end-organ damage.

PURPOSE: The purpose of this study was to examine the effects of aerobic exercise training on blood pressure response and vascular function in young white and African American individuals.

METHODS: 32 AA (9 men and 23 women) and 34 CA (19 men and 15 women) between the ages of 18-35 volunteered for the study, and completed a 4 week control period, followed by a 8 week aerobic exercise training period (30-60 min of exercise at 60-90% of maximal heart rate, 3 times/week). Women were tested during menses. Carotid, brachial and aortic blood pressures were measured using sphygmomanometry and applanation tonometry. Forearm blood flow (FFB) was measured by strain-gauge plethysmography before and during reactive hyperemia (RH). RH was induced by 5-min of brachial arterial occlusion. All measurements were performed in a supine position.

RESULTS: Brachial SBP decreased significantly in both groups (118 ± 2 to 117 ± 2 to 114 ± 3 vs. 122 ± 2 to 119 ± 2 to 119 ± 2 mmHg; P<0.05), but the decrease in response to training was not significant, and there were no group differences. Aortic SBP was also not different between groups, and did not change with training (102 ± 2 to 103 ± 2 to 101 ± 2 vs. 103 ± 2 to 100 ± 2 to 101 ± 2 mmHg; P=0.05). However, AA had a significantly lower peak FBF (18.04 ± 1.49 ml*min⁻¹*1000) compared to CA (23.30 ± 1.35) only at the baseline but training had no significant effect on peak FBF in either group.

CONCLUSIONS: These data suggest that 8 weeks of aerobic training had no effect on BP in normotensive CA and AA, but our data suggest that a control period before initiation of training is important to assess the true effects of training on BP. Interestingly, AA have lower microvascular function despite similar BP compared to CA, but aerobic training had no effect on this. Future work is needed to determine if other interventions can affect the lower endothelial function in AA.
RESULTS: While there was no difference with acute exercise in the low-glucose condition, EPC cfROS gene expression tended to increase with exercise in the high-glucose condition (p = 0.17). MAPK gene expression tended to be higher after exercise (low glucose, p = 0.10) with no changes in expression with high glucose. TGFβ1 expression was highest after exercise in the high glucose condition (p = 0.16). CFU-Hill counts and EPC gene expression for NFκB and TNFα did not differ between conditions.

CONCLUSION: These data suggest that gene expression of major factors associated with vascular dysfunction in diabetes are minimally changed in EPCs of healthy young men in response to glucose or exercise.

2809 Board #81 June 1 11:00 AM - 12:30 PM
Comprehensive Vascular Function Testing Across The Menstrual Cycle
Karen M. Birch, University of Leeds, Leeds, United Kingdom. (Sponsor: Keith George, FACSM)

Studies evaluating the impact of menstrual cycle variability in vascular function have shown decreased brachial artery flow mediated dilatation (FMD) in the early luteal phase. However, a comprehensive quantification of FMD, low-flow mediated constriction (L-FMC) and the reactive hyperemic response has not been evaluated.

PURPOSE: To determine the impact of menstrual cycle phase on FMD, L-FMC and reactive hyperemia.

METHODS: 9 women (34 ± 9 yrs) attended the lab in the early follicular, late follicular and mid-luteal phases of the menstrual cycle. After 30 min of supine rest, brachial artery vascular function was assessed using a 5-minute forearm ischemia protocol and ultrasound. Peak blood flow within 30 s of cuff deflation and FMD from 20s of end-diastolic diameters at baseline, compared to the mean of 3 maximal end-diastolic diameters during 2.5 min post ischemia were assessed. L-FMC was determined from the mean of 3 minimum end-diastolic diameters in the 30s before cuff deflation.

RESULTS: FMD did not differ with menstrual phase (FMD Early Follicular: 8.2 ± 1.4%, Late Follicular: 6.6 ± 0.8%, Mid-luteal: 6.5 ± 1.0% p = 0.20). L-FMC exhibited a non-significant inverse pattern when compared to FMD with more constriction apparent at phases when FMD was greater (L-FMC Early Follicular: -0.65 ± 1.0%, Late Follicular: -1.1 ± 0.6%, Mid-luteal: -2.2 ± 0.6% p = 0.35). Total vascular reactivity (sum of the absolute values of FMD and L-FMC) was unaltered (Total vascular reactivity Early Follicular: 9.6 ± 1.3%, Late Follicular: 8.5 ± 0.9%, Mid-luteal: 8.0 ± 0.9% p = 0.28). Normalization to the shear response had no effect. Finally, peak blood flow after cuff deflation (a measure of resistance vessel function) was also unaltered by menstrual phase.

CONCLUSIONS: These preliminary results suggest a lack of menstrual cycle fluctuation in vasodilatory and vasoconstrictive responses to the forearm ischemia protocol.

2810 Board #82 June 1 11:00 AM - 12:30 PM
Endothelial Progenitor Cell Quantification in Young Adult Non-Smokers and Smokers by a Novel Gating Strategy

PURPOSE: Endothelial progenitor cells (EPC) are an accepted predictor of cardiovascular disease risk. Accurate identification of EPC is debatable, and to date identifying markers and isolation techniques remain to be clearly established. Primitive EPC are conventionally defined as CD34<sup>+</sup>CD133<sup>+</sup>KDR<sup>-</sup>. Few studies have investigated CD34<sup>+</sup> EPC that are endothelial in nature, and their phenotype and relation to subsets of hematopoietic cells remain elusive. Thus, reliable flow cytometry acquisition and analysis strategies are needed as EPC comprise <1% of peripheral blood mononuclear cells. Previously, it has been shown that long-term smoking decreases circulating CD34<sup>+</sup> cells in older individuals. We designed and optimized a novel cytometry protocol for accurate enumeration of EPC in recreationally-active, non-smoking young adults (n=36, 23.3±6.6yr) compared to chronic smokers (n=28,25.0±6.8yr) as part of a randomized-controlled trial (RCT) to investigate the effects of resistance training (RT) on vascular function in young, adult chronic smokers.

METHODS: Using a whole blood lysing method, 2x10<sup>5</sup> cells were stained with a 5-color antibody panel and propidium iodide for dead cell exclusion. EPC were acquired to achieve sufficient events to classify PC reliably as viable, side scatter<sup>+</sup>CD45<sup>-</sup>CD34<sup>+</sup>CD133<sup>+</sup>CD33<sup>-</sup> and subdivide them into CD34<sup>+</sup> and KDR<sup>+</sup>. To improve the accuracy of rare EPC analysis in samples with varied red cell contamination of the gating region, we based our calculation of EPC frequency not on lymphocyte scatter gating, but on a novel strategy of a combination gate of CD45<sup>+</sup>CD34<sup>+</sup> and CD34<sup>+</sup>.

RESULTS: Preliminary data show that compared to non-smokers, smokers have a higher percentage of CD133<sup>+</sup> (50±2.1% vs. 42±2.9%, p=0.03), but lower KDR<sup>+</sup> within the CD34<sup>+</sup>subset of cells (1.9±0.4% vs. 4.8±0.9%, p=0.01). Interestingly though, smokers had a higher proportion of CD45<sup>+</sup>lymphocytes than non-smokers (88.4±2.4% vs. 72.4±6.6%, p=0.01).

CONCLUSION: We demonstrated the ability to detect specific circulating EPC subsets using our novel gating strategy. In young smokers, compensatory mechanisms may prevent the decline in CD34<sup>+</sup> cells before true endothelial dysfunction exists. Our ongoing RCT will determine if RT has an effect on the number of EPC and EPC subsets in chronic smokers.

2811 Board #83 June 1 11:00 AM - 12:30 PM
Interactive Effects of Stress Reactivity and Usual Stress on Adolescents Cardiovascular Health
James N. Roemmich, FACSM, Denise M. Feda, April M. Seelbinder, Maya J. Lambiase, Joan Dom. University at Buffalo, Buffalo, NY.

Adolescents experience stressful situations at high rates during school. Psychological stress is associated with the progression of cardiovascular disease (CVD). The diathesis-stress model suggests that youth experiencing the greatest cumulative stress are at greatest risk for developing antecedents of CVD. Thus, youth with the greatest reactivity to a stressor may be at most risk for CVD pathogenesis, especially if they also incur frequent daily stressors, such as during a year of high school.

PURPOSE: To determine the relationships between the magnitude of CV stress reactivity and the amount of daily stress with the pathogenesis of CVD as characterized by carotid artery intima-media thickness (IMT) at the end of the school year.

METHODS: 23 boys and 19 girls age 13-16 y were studied for cardiovascular reactivity to an interpersonal speech stressor and usual stress (perceived stress scale-14) in August just before the start of the school year. Usual stress was measured again in October after the beginning of the school year. Carotid artery IMT was measured immediately after the school year the following June. Multiple regression was used to determine the interactive association of CV stress reactivity (e.g., systolic blood pressure (SBP) reactivity) and school year (October) stress on carotid artery IMT and BAR when covarying for resting SBP and baseline (August) level of usual stress.

RESULTS: As main effects, SBP reactivity to the speech stressor was associated with IMT (beta = 0.005, p < 0.005), while school year usual stress was not (beta = 0.002, p > 0.17). The interaction of SBP reactivity and school year usual stress was significant (p < 0.02). The overall interaction model predicted that youth with low low stress reactivity and low school stress; low reactivity and high stress; high reactivity and low stress; and high reactivity and high stress would have IMT of 0.44, 0.48, 0.55, and 0.50 mm, respectively.

CONCLUSIONS: With the methods used, higher stress reactivity and usual stress increased IMT by a predicted 25% and 12%, respectively. SBP stress reactivity predicts IMT better than usual stress, and children with the greatest reactivity to a stressor may be at the greatest risk for subclinical progression of CVD.

2812 Board #84 June 1 11:00 AM - 12:30 PM
Associations Between Sedentary Behaviour, Cardiometabolic Biomarkers And Vascular Health In Children
Nicola D. Hopkins<sup>1</sup>, Gareth Stratton<sup>2</sup>, Nicola Ridgers<sup>2</sup>, Lee E F Graves<sup>2</sup>, Lynne M. Boddy<sup>1</sup>, Rebecca Gobbi<sup>3</sup>, Lawrence Foweather<sup>1</sup>, Nigel T. Cable<sup>1</sup>, Daniel J. Green<sup>1</sup>, <sup>1</sup>Liverpool John Moores University, Liverpool, United Kingdom. <sup>2</sup>Deakin University, Melbourne, Australia. <sup>3</sup>University of Leeds, Leeds, United Kingdom. (Sponsor: Keith George, FACSM)

PURPOSE: Vascular function, measured via flow mediated dilatation (FMD), is the earliest detectable manifestation of cardiovascular disease (CVD). Vascular dysfunction is a strong independent predictor of CV events and is present in children with CVD risk factors. Emerging evidence suggests that sedentary behaviour (SB) is independently associated with CVD and mortality. Currently the relationship between SB, vascular function and artery wall thickness is unknown. We therefore aimed to assess the association between FMD, carotid artery intima-media thickness (cIMT) and SB in children.

(No relationships reported)

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METHODS: Using high resolution Doppler ultrasound we measured endothelial function and cIMT in 118 children (72[Unsupported Character - &#9792;]: 12.1±0.7; 46[Unsupported Character - &amp;#9794;]: 12.1±0.7yrs). Sedentary behaviour was assessed using objective uni-axial accelerometry. Cardiometabolic biomarkers (insulin, glucose, HbA1c, C-peptide, triglycerides, total, HDL and LDL cholesterol, C - reactive protein and adiponectin) were measured in a subgroup of children (N=53, 28 female). Data was adjusted for age, maturation and physical activity level.

RESULTS: Daily, children engaged in 496.7±90.2 min of SB. There was no significant difference between girls and boys for percentage of accelerometer wear time spent in SB ((SB%)) 68.6±12.9 vs 65.0±11.7 respectively p>0.05). FMD (9.3±4.3 vs 9.2±4.4 respectively, p>0.05) or cIMT (0.47±0.09 vs 0.49±0.08 respectively, p>0.05). Neither FMD (r=0.00, p>0.05) nor cIMT (r=0.00, p>0.05) was associated with SB. FMD was significantly related only to C - peptide only (r=0.38, p>0.01).

CONCLUSION: Our data suggest that SB is not associated with vascular health in children. This implies that interventions that aim to reduce SB per se in children may not be effective in terms of improving/maintaining vascular health. Further research is necessary to describe the mechanistic relationship, if any, between sedentary behaviour and cardiovascular risk. Additionally, our findings imply that C-peptide may contribute to regulation of vascular function.

2813 Board #85 June 1 11:00 AM - 12:30 PM Cardiopulmonary Fitness and Cognitive Function: Association with Peripheral Vascular and Cerebrovascular Function

Takashi Tarumi, Mitzi M. Gonzales, Bennett A. Fallow, Nantinee Nualnim, Hirofumi Tanaka, FACSM, Andrea P. Haley. The University of Texas at Austin, Austin, TX.

Midlife cardiovascular and cerebrovascular disease risk is associated with an elevated incidence of late-life dementia. Habitual exercise has been suggested as an efficacious lifestyle intervention to prevent or delay the onset of cognitive decline. However, it is not clear how habitual exercise influences cognitive function and whether these relations may be mediated by enhanced peripheral vascular and/or cerebrovascular function.

PURPOSE: To examine the association between exercise function and the key features of vascular and cerebrovascular function among middle-aged sedentary and endurance-trained adults.

METHODS: We studied 29 healthy sedentary and 32 endurance-trained adults aged between 41-65 years (24 males and 37 females) underwent a variety of vascular function measurements (carotid artery distensibility, brachial artery flow-mediated dilatation, and cerebrovascular reactivity to hypo- and hypercapnia) and a comprehensive battery of neuropsychological tests.

RESULTS: There were no significant differences in age, body mass, education level, and blood pressure between sedentary and endurance-trained subjects. Endurance-trained group demonstrated greater maximal oxygen consumption (VO2max) (44.6±1.6 vs. 26.1±1.1 ml/kg/min), common carotid artery distension (4.81±0.25 vs. 3.96±0.20 mm2 ) and distensibility coefficient (4.92±0.28 vs. 4.08±0.22 10-3/mmHg), brachial artery flow-mediated dilatation (6.63±0.61 vs. 4.87±0.63%), and total cognitive composite score (z-score: 0.13±0.08 vs. -0.15±0.10) than the control group (all P<0.05). Cerebrovascular reactivity to hypo- and hypercapnia was not different between the groups. Partial correlation analyses adjusted for age, sex, and education revealed that total cognitive composite score is significantly associated with VO2max (r=0.32) and cerebrovascular reactivity index (r=0.29). Moreover, VO2max was correlated with cerebrovascular reactivity index (r=0.29).

CONCLUSION: A greater cognitive function in endurance-trained adults is associated with aerobic fitness and cerebrovascular reactivity independent of potential covariates.

2814 Board #86 June 1 11:00 AM - 12:30 PM The Effect Of Interrupting Prolonged Sitting With Intermittent Activity On Markers Of Thrombotic Risk

Bethany J. Howard, Steve F. Fraser, Pameet Sethi, Ester Cerin, Neville Owen, Bronwyn A. Kingwell, David W. Dunstan. Baker IDI Heart & Diabetes Institute, Melbourne, Australia. Deakin University, Melbourne, Australia. The University of Hong Kong, Hong Kong, China. (Sponsor: Charles Matthews, FACSM)

Prolonged sitting has been associated with an elevated risk of cardiovascular mortality and venous thrombosis. While the mechanisms underlying such relationships have not been fully elucidated, activation of blood coagulation pathways may be involved. The impact of interrupting acute prolonged sitting with intermittent activity on markers of thrombotic risk has not been studied.

PURPOSE: To examine the acute effects of a single 7 hour period of prolonged sitting on blood coagulation markers with and without intermittent bouts of light- or moderate-intensity activity in sedentary older (45-65 yrs) overweight/obese adults.

METHODS: 19 overweight/obese adults (11 males/8 females; 53.8 ± 4.9yrs, BMI: 31.2 ± 4.1 kg.m-2) participated in a randomized three-period, three-treatment acute cross-over trial: 1) uninterrupted sitting; 2) sitting with 2-minute bouts of light-intensity treadmill walking every 20 minutes; and 3) sitting with 2-minute bouts of moderate-intensity treadmill walking every 20 minutes. Blood was collected at baseline (hrs) whilst seated prior to consumption of a standardised mixed meal and at the completion of each condition (7hrs). Blood coagulation markers were measured and corrected for blood volume changes. All analyses were adjusted for age, sex, body mass, baseline outcome values and order effects.

RESULTS: Compared to uninterrupted sitting, plasma fibrinogen decreased (0.17g.l-1 [0.01, 0.32], P<0.05) in the sitting with the light-intensity activity condition, but not the moderate-intensity activity condition. Both activity conditions resulted in small reductions in thrombin clotting time relative to uninterrupted sitting (light-intensity: 0.70s, [0.37, 1.02], P<0.001 and moderate-intensity: 0.57s, [0.25, 0.9], P<0.001). There were no significant between-condition differences in prothrombin time, activated partial thromboplastin time, von Willebrand factor and D-dimer.

CONCLUSION: Interrupting prolonged sitting with short, intermittent bouts of light-intensity walking reduced circulating fibrinogen in overweight/obese adults relative to uninterrupted sitting. Further investigation to optimise the timing and intensity of activity breaks is warranted to reduce possible thrombotic risk associated with prolonged sitting.

2815 Board #87 June 1 11:00 AM - 12:30 PM Racial Differences In Cardiovascular Response Following An Acute Bout Of Aerobic Exercise

Huimin Yan1, Abbi D. Lane1, Sushant M. Ranadive1, Rebecca M. Kappus1, Peng Sun1, Michael A. Behun1, Bo Fenhall, FACSM1, University of Illinois at Urbana-Champaign, Champaign, IL2, East China Normal University, Shanghai, China.

Post-exercise hypotension (PEH) is widely observed in Caucasians (CA). It is usually due to a reduction in peripheral vascular resistance that is not completely offset by a rise in cardiac output. It appears that African Americans (AA) may not exhibit PEH following aerobic exercise.

PURPOSE: To examine the cardiovascular responses following an acute bout of aerobic exercise in AA and CA.

METHODS: 24 young healthy Caucasians (CA, n = 12) and African Americans (AA, n = 12) performed 45 min of moderate intensity aerobic exercise on a treadmill at 70% of heart rate reserve. Before at rest, 20 min postexercise, and 40 min postexercise, cardiac output (CO), total peripheral resistance (TPR) and arterial compliance (compliance) were measured by ultrasound. Aortic blood pressures (BP, central (carotid femoral), leg (carotid-femoral) and brachial (carotid-radial)) pulse-wave velocity (PWV) were measured by applanation tonometry. An additional brachial BP was taken at 60 min after exercise. Time by race two-way ANOVA was used for statistical analyses.

RESULTS: See Table 1. Significant time effect was found in brachial SBP, aortic BP, brachial PWV and CO (# p<0.05). Significant race effect was found in brachial central PWV (S p<0.05). Significant interaction was found in brachial DBP (+ p<0.05).

CONCLUSIONS: Although AA have higher central and peripheral arterial stiffness than CA, both groups exhibited comparable hemodynamic responses up to 40 min following acute aerobic exercise. AA did not exhibit PEH 60 min after exercise, in contrast to CA. Future work is needed to extend the time course of measurement and to examine the mechanisms underlying the BP response.

729

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HRV and EtCO2 or cardiac index between groups

CONCLUSIONS:
This study was supported in part by NIH/NCRR/RCMI Grant 2G12RR003048 to Howard University.

RESULTS:
Capnograph (HRV) was used to measure cardiac autonomic modulation. Blood pressure (BP) was determined by an automatic monitoring device. End tidal carbon dioxide (EtCO2) was assessed using a capnograph.

Subjects:
In the SCI group as compared to the able-bodied group, these changes are comparatively small in relation to cardiovascular changes elicited by aerobic exercise. Future studies should investigate the potential mechanisms responsible for the observed increase in ∆HbMBO2 and ∆THbMbs in response to WBV.

METHODS:
Using a randomized design subjects completed three WBV exercise sessions at 30, 40 and 50 Hz. Heart rate (HR), mean arterial blood pressure (MAP), stroke volume (SV), cardiac output (CO), VO2, and relative changes in oxygenated (∆HbMBO2), deoxygenated (∆HbMb), and total (∆THbMbs) heme groups were obtained during pre-WBV standing, WBV first minute, WBV steady-state at 40, and 50 Hz.

RESULTS:
Both groups demonstrated a significant increase in VO2, ∆HbMBO2, and ∆THbMbs; yet the increase was larger in the SCI group for VO2 during WBV steady-state at 40 (p=0.01; SCI: 6.1±0.6; AB: 5.4±0.7) and 50 Hz (p=0.001; SCI: 6.9±1.2; AB: 5.3±0.7) and for ∆HbMBO2 (p=0.0001) and ∆THbMbs (p=0.0001) during post-WBV standing at 30 and 40 Hz. ∆HbMbs did not significantly change in the AB group; where as a significant decrease was revealed in the SCI group following WBV. HR, MAP, SV, or CO did not significantly change in either group and no frequency effect was revealed.

CONCLUSION: The WBV parameters used in the present study do not appear to induce significant cardiovascular benefits for the individuals with SCI. Although the increase in VO2 was higher in the SCI group as compared to the able-bodied group, these changes are comparatively small in relation to cardiovascular changes elicited by aerobic exercise. Future studies should investigate the potential mechanisms responsible for the observed increase in ∆HbMBO2 and ∆THbMbs in response to WBV.

Table 1. Hemodynamic responses to an acute bout of aerobic exercise. Mean (SE)

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2817 Board #88 June 1 11:00 AM - 12:30 PM
Whole Body Vibration Effects on Hemodynamics and Oxygen Consumption in Individuals with Spinal Cord Injury

Ceren Yasar1, Bruce Gladden, FACSM2, David Pascoe, FACSM2, John Quindry, FACSM2, JoEllen M. Sefton2. 1University of Alabama at Birmingham, Birmingham, AL. 2Auburn University, Auburn, AL.

BACKGROUND: Considering the potential of whole body vibration (WBV) exercise for activating paralyzed muscles via the Ia reflex loop and increasing the skeletal muscle metabolism, WBV exercise may provide a sufficient training stimulus for the cardiovascular system in individuals with spinal cord injury (SCI).

Objective: 1) Investigate the acute effects of WBV with varying frequencies on hemodynamic responses and steady-state oxygen consumption (VO2) in ml/kg lean mass/min) in individuals with SCI and able-bodied individuals (AB); 2) Compare physiological responses between groups and among three different WBV frequencies.

Design: A 2 (group) x 3 (treatment) x 4 (time) repeated measures factorial design with repeated measures across treatment and time.

Subjects: 11 males with SCI (C4-T6; ASIA A and B; ages: 50.4 ± 8.2) and 5 age and gender matched AB individuals (ages: 48.2 ± 6.8).

METHODS: Using a randomized design subjects completed three WBV exercise sessions at 30, 40 and 50 Hz. Heart rate (HR), mean arterial blood pressure (MAP), stroke volume (SV), cardiac output (CO), VO2, and relative changes in oxygenated (∆HbMBO2), deoxygenated (∆HbMb), and total (∆THbMbs) heme groups were obtained during pre-WBV standing, WBV first minute, WBV steady-state, and post-WBV standing.

RESULTS: Both groups demonstrated a significant increase in VO2, ∆HbMBO2, and ∆THbMbs; yet the increase was larger in the SCI group for VO2 during WBV steady-state at 40 (p=0.01; SCI: 6.1±0.6; AB: 5.4±0.7) and 50 Hz (p=0.001; SCI: 6.9±1.2; AB: 5.3±0.7) and for ∆HbMBO2 (p=0.0001) and ∆THbMbs (p=0.0001) during post-WBV standing at 30 and 40 Hz. ∆HbMbs did not significantly change in the AB group; where as a significant decrease was revealed in the SCI group following WBV. HR, MAP, SV, or CO did not significantly change in either group and no frequency effect was revealed.

CONCLUSION: The WBV parameters used in the present study do not appear to induce significant cardiovascular benefits for the individuals with SCI. Although the increase in VO2 was higher in the SCI group as compared to the able-bodied group, these changes are comparatively small in relation to cardiovascular changes elicited by aerobic exercise. Future studies should investigate the potential mechanisms responsible for the observed increase in ∆HbMBO2 and ∆THbMbs in response to WBV.
Cardiovascular And Perceptual Responses To Blood Flow Restricted Resistance Exercise Performed With Different Restrictive Cuffs

Christopher A. Fahs, Lindy M. Rossow, Jeremy P. Loenneke, Robert Thiebaud, Takashi Abe, Vanessa D. Sherk, Michael G. Bemben, FACSM.
University of Oklahoma, Norman, OK.
(No relationships reported)

PURPOSE: To determine if the type of restrictive cuff used during BFR resistance exercise influences the cardiovascular and perceptual responses during and following an acute bout of BFR exercise.

METHODS: In a randomized, cross-over study design, twenty-seven young men and women completed two bouts (4 sets each) of BFR knee extension exercise at 20% 1-RM while wearing either 5 cm (narrow cuffs) or 13.5 cm (wide cuffs) wide pneumatic cuffs inflated to 130% of their brachial systolic blood pressure. Measurements of brachial (BPB) and aortic (aBP) blood pressure (BP), heart rate (HR), and augmentation index (Alx) were taken before and after the restrictive cuffs were applied and inflated, after the 2nd (mid) and 4th (post) set of resistance exercise, and 5- and 15-min into recovery. Ratings of perceived exertion (Borg, 6-20 scale; RPE) and pain (1-10 scale) were assessed before exercise and after the 2nd and 4th set of exercise.

RESULTS: Applied cuff pressure was not different between the narrow and wide cuff bouts (152 vs 154 mmHg, p=0.616). During BFR exercise (mid), compared to the narrow cuffs, wide cuffs caused a greater elevation in HR (92 vs 78 bpm, p<0.05), central BP (systolic: 133 vs 119 mmHg, p<0.05; diastolic: 104 vs 86 mmHg, p<0.05), RPE (14 vs 13, p<0.05) and pain (5 vs 3, p<0.05) and a greater decrease in Alx (4 vs 1 %, p<0.05).

CONCLUSIONS: These findings suggest that during low-intensity BFR resistance exercise wide cuffs cause greater demands on the cardiovascular system and increase ratings of pain and RPE to a greater extent compared to BFR resistance exercise with narrow cuffs inflated to the same pressure. Cuff application pressure may need to be adjusted depending on the width of the restrictive cuff to improve subject comfort and to standardize the degree of blood flow restriction.

Impact Of Cardiovascular Fitness On Pentraxin 3 Levels In Response To Concurrent Stressors

Chun-Jung Huang1, David A. McAlpine1, Heather E. Webb2, Robert L. Franco3, Supatchara E. Tangsilsat4, Kathleen N. Beasley5, Gary H. Kanimori, FACSM6, Edmund O. Acevedo, FACSM1. 1Florida Atlantic University, Boca Raton, FL. 2Mississippi State University, Starkville, MS. 3Virginia Commonwealth University, Richmond, VA. 4University of New South Wales, Sydney, Sydney, Australia. 5Walter Reed Army Institute of Research, Silver Spring, MD.
(No relationships reported)
Pentraxin 3 (PTX3) is primarily generated by endothelial cells and monocytes/macrophages and has recently been identified as a biomarker of vascular inflammation in predicting cardiovascular events. Although recent studies have shown that exercise has a positive/negative effect on the release of plasma PTX3, no studies have examined whether cardiovascular fitness is associated with plasma PTX3 response to a combined (exercise and mental) stress.

CONCLUSION: Increased MAP from cold exposure may maintain perfusion to the brain during an orthostatic challenge.
CONCLUSIONS: The purpose of this study was to examine the effect of cardiovascular fitness on plasma PTX3 and catecholamine (epinephrine [EPI] and norepinephrine [NE]) levels to a dual stress model. To elucidate possible mechanisms for the elevated PTX3 in response to dual stress, the relationships of EPI and NE with PTX3 were examined.

METHODS: Fourteen subjects were classified into high fit (N=7; VO2max = 50.99 ± 2.19 ml/kg/min-1) and low fit (N=7; VO2max = 36.27 ± 3.11 ml/kg/min-1) groups and completed two counterbalanced experimental conditions. The exercise-alone condition (EAC) consisted of cycling at 60% VO2max for 37 minutes, while the dual-stress condition (DSC) included 20 minutes of a mental stress while cycling for 37 minutes.

RESULTS: Plasma PTX3 revealed significant increases over time in both high fit and low fit group in response to EAC and DSC (p < 0.02). No difference in PTX3 levels was observed between EAC and DSC. Furthermore, significant time effect and time by fitness level interaction in plasma EPI and NE were found in both EAC and DSC with greater levels in high fit group (p < 0.05). Additionally, plasma PTX3 was not correlated with EPI and NE neither EAC nor DSC.

CONCLUSION: These results suggest that cardiovascular fitness may not affect the release of plasma PTX3 to stress reactivity although exacerbated EPI and NE are seen in DSC and high fit group. In addition, plasma PTX3 could be used as an inflammatory biomarker for exercise while mental stress does not modulate PTX3 levels.

**Board #94**
June 1 11:00 AM - 12:30 PM
**Femoral Blood Flow and Cardiac Output during Blood Flow Restricted Leg Press Exercise**
Meghan Everett, Kyle Hackney, David Martin, Lori Ploutz-Snyder, FACSM, NASA-JSC, Houston, TX.

Low blood flow restricted resistance exercise (LBFR) causes muscle hypertrophy that may be stimulated by the local ischemic environment created by the cuff pressure. However, local blood flow (BF) during such exercise is not well understood.

**PURPOSE:** To characterize femoral artery BF and cardiac output (CO) during leg press exercise (LP) performed at a high load (HL) and low load (LL) with different levels of cuff pressure.

**METHODS:** Eleven subjects (men/women 4/7, age 31.4±12.8 y, weight 68.9±13.2 kg, mean±SD) performed 3 sets of supine left LP to fatigue with 90 s of rest in 4 conditions: HL (%1-RM/cuff pressure: 80%/0); LL (20%/0); LBFR (20%/1.3 x diastolic blood pressure, BP); LBFR (20%/1.3 x supine systolic BP). The cuff remained inflated throughout the LBFR exercise sessions. Artery diameter, velocity time integral (VTI), and stroke volume (SV) were measured using Doppler ultrasound at rest and immediately after each set of exercise. Heart rate (HR) was monitored using a 3-lead ECG. BF was calculated as VTI x vessel cross-sectional area. CO was calculated as HR x SV. The data obtained after each set of exercise were averaged and used for analyses. Multi-level modeling was used to determine the effect of exercise condition on dependent variables. Statistical significance was set a priori at p<0.05.

**RESULTS:** Artery diameter did not change from baseline. BF increased (p<0.05) after exercise in each condition except LBFR in the order of HL (12.7±1.42 cm²,mean±SE) > LL (9.9±0.82 cm²) > LBFR (6.47±0.79 cm²) > LBFR (3.51±0.59 cm²). Blunted exercise induced increases occurred in HR, SV, and CO after LBFR compared to HL and LL. HR increased 45% after HL and LL and 28% after LBFR (p<0.05), but SV increased (p<0.05) only after HL. Consequently, the increase (p<0.05) in CO was greater in HL and LL (~3 L/min) than in LBFR (~1 L/min).

**CONCLUSION:** BF during LBFR was 1/3 of that observed in HL, which supports the hypothesis that local ischemia stimulates the LBFR hypertrophic response. As the cuff did not compress the artery, the ischemia may have occurred because of the blunted rise in CO or because arterial BP cannot overcome the cuff pressure. As LBFR effectively reduced BF and CO with cuff pressures less than systolic BP, future studies should investigate the hypertrophic potential of LBFR at even lower cuff pressures.

**Board #95**
June 1 11:00 AM - 12:30 PM
**The Influence Of Spontaneous Sympathetic Bursts On Conduit Artery Shear Rate And Diameter In Humans**
Seth T. Fairfax, Jaume Padilla, Paul J. Fadel, FACSM, University of Missouri, Columbia, MO. (Sponsor: Paul J. Fadel, FACSM)

Recently, there has been interest in understanding the interaction between muscle sympathetic nerve activity (MSNA) and shear-induced dilation. This has primarily been examined using flow-mediated dilation (FMD) before and after perturbations that cause reflex-mediated increases in MSNA. However, whether spontaneous changes in resting MSNA alter conduit artery shear rate and diameter on a beat-by-beat basis has not been examined.

**PURPOSE:** To test the hypothesis that, under resting conditions, individual bursts of MSNA decrease shear rate and consequently decrease diameter of the common femoral artery (CFA).

**METHODS:** In 8 healthy young men, MSNA (peripheral nerve microneurography), heart rate (ECG), arterial blood pressure (finger photoplethysmography), and the diameter and mean velocity of the common femoral artery (duplex Doppler ultrasound) were measured continuously during 20 minutes of supine rest. Signal averaging was used to characterize the beat-by-beat changes in mean arterial blood pressure (MAP), CFA diameter and calculated CFA shear rate for 15 cardiac cycles following each MSNA burst.

**RESULTS:** A consistent and significant decrease in CFA shear rate occurred following spontaneous bursts of MSNA, reaching a peak change at about 8 seconds (~5.7% ± 1.6%, p<0.05 vs. baseline). However, during this same time, an increase in CFA diameter (peak change of 0.3% ± 0.6%, p<0.05 vs. baseline) was observed along with a rise in MAP (peak change of 3.0% ± 0.4%, p<0.05 vs. baseline).

**CONCLUSIONS:** These preliminary findings indicate that on a beat-by-beat basis, CFA diameter does not decrease in response to a spontaneous burst of MSNA, but rather it increases. This suggests that CFA diameter is not influenced by spontaneous decreases in shear rate following MSNA bursts. In contrast, the increase in CFA diameter appears to be associated with an increase in blood pressure. Future studies examining the influence of MSNA burst pattern and size on shear-induced conduit artery dilation during resting conditions warrant consideration.

Supported by NIH ROIHL093167

**Board #96**
June 1 11:00 AM - 12:30 PM
**Effect of Statins on Creatine Kinase Levels Before and After a Marathon Run**
Amanda L. Zaleski1, Jeffrey A. Capizzi2, Kevin D. Ballard2, Christopher Troyanos1, Pierre A. D’Hemecourt, FACSM3, Paul D. Thompson, FACSM4, Beth A. Parker4.
1Hartford Hospital, Hartford, CT. 2University of Connecticut, Storrs, CT. 3Children’s Hospital, Boston, MA.

(No relationships reported)

**PURPOSE:** We sought to determine if statin users running a marathon exhibited greater evidence of muscle damage assessed by serum CK levels than marathon runners not using these medications.

**METHODS:** We measured serum levels of myoglobin, total creatine kinase (CK) and the CK myocardial (CK-MB), muscle (CK-MM) and brain (CK-BB) isoenzymes in 37 individuals treated with statins and in 43 non-statin treated controls running the 2011 Boston Marathon. Venous blood samples were obtained the day before (PRE) as well as within 1-hour (FINISH) and 24-hours after (POST) the race. Hematocrit and hemoglobin were used to adjust for changes in plasma volume. CK distribution was normalized using log transformation before analysis.

**RESULTS:** The increase in CK-MB 24 hours after exercise was also greater in statin users (PRE to POST: 1.1±3.9 to 8.9±7.0 U/L) than controls (PRE to POST: 0.0±0.0 to 4.2±5.0 U/L, p<0.05 for comparison) whereas increases in muscle myoglobin did not differ at any time point between groups. Increases in CK at both FINISH and POST race measurements were directly related to age in the statin users (r²=0.13 and 0.14; p<0.05) but not in controls (r²=0.02 and 0.00; p=0.42) suggesting that susceptibility to exercise-induced muscle injury with statins increases with age.

**CONCLUSIONS:** We conclude that statins increase exercise-related muscle injury.
Angiogenic growth factors can provoke angiogenesis by acting directly on the endothelium or by initiating mobilization and/or enhancing function of circulating angiogenic cells (CACs) from the bone marrow. Endurance exercise may increase plasma levels of angiogenic cytokines, anti-inflammatory cytokines and colony-stimulating factors.

PURPOSE: To test the hypothesis that basal and acute exercise-induced levels of angiogenic cytokines differ between trained and untrained young men.

METHODS: Ten endurance-trained and ten sedentary healthy young men were studied. Maximal oxygen uptake (VO2max) was assessed using a graded treadmill running protocol. Subjects performed 30 minutes of treadmill running at 75% VO2max. Blood samples were obtained before and after exercise. Plasma levels of VEGF, basic fibroblast growth factor (bFGF), placental growth factor (PIGF), and soluble VEGF receptor (sFlt-1) were measured by multiplex ELISA. Data are presented as means ± SEM.

RESULTS: Contrary to our hypothesis, there were no statistically significant differences between groups in VEGF, bFGF, PIGF, or sFlt-1 before or after acute exercise (P > 0.05). Examination of the main effect of acute exercise with groups combined indicated that VEGF did not change significantly (P > 0.05), bFGF increased by ~25% (6.2 ± 0.2 vs. 7.8 ± 0.9 pg/mL; P = 0.06), PIGF increased by ~16% (16.2 ± 0.7 vs. 18.7 ± 1.3 pg/mL; P < 0.05), and sFlt-1 increased by 36% (166 ± 7 vs. 225.6 ± 11.5 pg/mL; P < 0.001). Previous data indicate a role for VEGF and angiogenic cytokines in acute exercise-induced mobilization of CACs from bone marrow and CAC function. However, our data do not support such a correlation between circulating angiogenic cytokines and previously published data on functional measures in CACs from these same subjects (Jenkins et al., J Appl Physiol., 2011).

CONCLUSIONS: Acute endurance exercise increases plasma bFGF, PIGF, and sFlt-1 levels in sedentary and endurance-trained young men, but cytokine levels did not differ by training status. We speculate that the relationship between training status and acute exercise-induced increases in angiogenic growth factors associated with CACs occur locally at the tissue level and may not be detectable at the systemic level.

Supported by NIH AGT3200068 and UMD Kinesiology Graduate Research Initiative Fund.
METHODS: 12 women (22 ± 2 yrs) completed 4 weeks of either SIT (n = 6) or continuous sprint training (CST; n = 6) on 3 days/week. SIT consisted of four 30 s Wingate tests separated by 4.5 min recovery. CST involved sprint cycling for ~3–4 min, until the participant reached the equivalent work achieved in four 30 s Wingate tests performed in their first training session. Prior to and following training, VO2peak and lactate threshold (LT) were estimated from a cycling incremental exercise test. Vascular function was assessed from brachial artery flow-mediated dilation (FMD) and total vessel reactivity (TVR). Circulating progenitor cells (CPCs), an index of vascular repair, were defined as triple positive cells (CD45<sup>-</sup>CD34<sup>-</sup>KDR<sup>-</sup>).

RESULTS: 4 weeks of SIT or CST improved VO2peak (SIT 2279 ± 360 ml/min, Post SIT 2523 ± 318 ml/min; Pre CST 2315 ± 222 ml/min, Post CST 2380 ± 160 ml/min; P < 0.05) and increased LT (Pre SIT 773 ± 106 ml/min, Post SIT 877 ± 164 ml/min; Pre CST 819 ± 129 ml/min, Post CST 908 ± 136 ml/min; P < 0.05), with no group x time interaction (P > 0.05). CPCs did not significantly increase post training (Pre SIT 0.0020 ± 0.0012%/leukocytes, Post SIT 0.0026 ± 0.0022%/leukocytes; Pre CST 0.0024 ± 0.0025%/leukocytes, Post CST 0.0031 ± 0.0023%/leukocytes; time: P = 0.09). FMD and TVR did not change following training in either group (P > 0.05).

CONCLUSION: Despite the differences in the shear stress profile and training time, SIT and CST produced similar results. The improvement in aerobic fitness is consistent with previous studies and is suggestive of enhanced skeletal muscle metabolism. Conversely, training had minimal effect on vascular function and repair. This may be due to healthy vasculature at baseline, or a lack of systemic adaptation.

2829 Board #101 June 1 11:00 AM - 12:30 PM
Critical Microvascular Po2 And Muscle Fatigue During Acute Femoral Artery Occlusion
William L. Sexton, FACS, R. Reed Lambert, Tyler G. Robertson. A.T. Still University of Health Sciences, Kirksville, MO.

Muscle function is impaired in low flow states due, in part, to the reduction in oxygen delivery (QO2) relative to oxygen consumption (VO2). Surprisingly however, the degree of muscle fatigue during acute femoral artery occlusion is variable and may be associated with subtle differences in the QO2 to VO2 ratio, which can be estimated by measurement of microvascular PO2 (PO2m) in the contracting muscle. Preliminary observations suggested that even small increases in PO2m during femoral artery ligation can attenuate muscle fatigue.

PURPOSE: The purpose of this study was to characterize the relationship between PO2m and muscle fatigue during acute femoral artery ligation in the rat extensor digitorum longus muscle (EDL).

METHODS: Female Sprague-Dawley rats (n=8, 243 ± 3 g) were anesthetized (pentobarbital, 45 mg/kg ip) and a 5-0 suture snare was placed around the left femoral artery. The left EDL was isolated and the distal tendon was cut and attached to a load cell interfaced with a Muscle Tension Analyzer. PO2m was measured using phosphorescence quenching (and Oxyphor G2). PO2m and twitch tension were recorded continuously throughout 30 s of baseline, femoral occlusion, 10 min of electrically-stimulated contractions (1 Hz, 6V), and for 4 min after release of the femoral artery snare.

RESULTS: After 30 s of baseline recording the femoral artery was occluded and PO2m fell from 23 ± 1 mmHg to 10 ± 1 mmHg within 40s. PO2m during contractions varied between 4 and 15 mmHg. When % fatigue was plotted against PO2m, a sharp inflection was noted a PO2m = 8 mmHg. When PO2m was greater than 8 mmHg (12 ± 1 mmHg) during femoral occlusion there was less muscle fatigue (12 ± 2%, n=8). However, when PO2m was less than 8 mmHg (6 ± 1 mmHg) there was marked fatigue (46 ± 7%, n=10).

CONCLUSIONS: These results suggest that, despite femoral artery occlusion, in some rats there was sufficient collateral blood flow to the EDL to maintain a critical PO2m (>8 mmHg) and sustain muscle twitch tension. However, in those rats in which PO2m in the EDL fell below 8 mmHg there was marked muscle fatigue. These results suggest there is a critical PO2m necessary to sustain contractile function in the rat EDL muscle. (Supported by the Graduate Program Committee, KCOM - ATSU)

2830 Board #102 June 1 11:00 AM - 12:30 PM
Chronic Heart Failure Alters nNOS-mediated Control of Skeletal Muscle Microvascular O2 Delivery and Utilization
Steven Copp, Daniel Hirai, Scott Ferguson, Clark Holdsworth, Timothy Musch, FACS, David Poole, FACS, Kansas State University, Manhattan, KS.

Chronic heart failure (CHF)-induced reductions in NO bioavailability impair peripheral vasomotor control and lower the resting and contracting microvascular O2 delivery/O2 utilization ratio (which sets the microvascular O2 partial pressure, PO2mv, and represents the pressure head for capillary-myoocyte O2 flux). Given well-documented CHF derangements of endothelial function, the tacit presumption has been that reductions in NO bioavailability result exclusively from impaired eNOS function.

PURPOSE: To test the hypothesis that CHF alters nNOS-mediated control of skeletal muscle PO2mv.

METHODS: 10 healthy (left ventricular end diastolic function, LVEDP: 6±1 mmHg) and 12 CHF (coronary artery ligation, LVEDP: 13±1 mmHg; P<0.05) rats had their right splanchnic muscle exposed. Silver wire electrodes elicited 1 Hz (~6-8 V) twitch contractions for 3 minutes before and after acute nNOS inhibition via S-methyl-L-thiocitrulline (SMTC, 0.56 mg/kg i.a.); PO2mv was measured via phosphorescence quenching and Oxyphor G2. PO2m and twitch tension were recorded continuously throughout 30 s of baseline, femoral occlusion, 10 min of electrically-stimulated contractions (1 Hz, 6V), and for 4 min after release of the femoral artery snare.

RESULTS: After 30 s of baseline recording the femoral artery was occluded and PO2m fell from 23 ± 1 mmHg to 10 ± 1 mmHg within 40s. PO2m during contractions varied between 4 and 15 mmHg. When % fatigue was plotted against PO2m, a sharp inflection was noted a PO2m = 8 mmHg. When PO2m was greater than 8 mmHg (12 ± 1 mmHg) during femoral occlusion there was less muscle fatigue (12 ± 2%, n=8). However, when PO2m was less than 8 mmHg (6 ± 1 mmHg) there was marked fatigue (46 ± 7%, n=10).

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2831 Board #103 June 1 11:00 AM - 12:30 PM
Heart Rate Variability Following Two Different Exercise Modalities
Michael R. Esco, Henry N. Williford, FACSM, Michele S. Olson, FACSM, Aindrea N. McHugh, Barbara E. Bloomquist. Auburn University Montgomery, Montgomery, AL.

Various components of exercise prescription, e.g., intensity and duration, have been found to be associated with cardiac-autonomic recovery. However, it is not fully known if the recovery of the autonomic nervous system varies between different modes of exercise.

PURPOSE: The purpose of this study was to analyze cardiac-autonomic control, via heart rate variability (HRV), between acute bouts of treadmill (T) and cycle (C) exercise at the same intensity.

METHODS: Fourteen apparently healthy men participated in this study. Each subject performed maximal graded exercise tests on T and C ergometers on two separate days. The subjects returned to the lab on two additional days that were separated by 72 hours to 1 week. During these visits, they performed, in random order, 30-minute exercise bouts on T or C at 70% of their mode-specific VO2peak. Electrocardiography (ECG) was analyzed for 10 minutes before and 30 minutes after each exercise bout. The ECG was divided into three 5-minute segments during which paced breathing (12 breaths.min<sup>-1</sup>) took place as follows: the last 5-minutes of the pre-exercise period (Pre), and between 15-20 minutes (Post-1) and 25-30 minutes (Post-2) of the post-exercise period. HRV was analyzed for each 5-minute epoch via frequency domain as follows: normalized high frequency power (HFnu); normalized low frequency power to HFnu ratio (LF/HF).

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RESULTS: HFnu (ms2) at Pre, Post-1, and Post-2 for T was 50.9 ± 11.7, 43.1 ± 9.0, and 47.4 ± 7.9, respectively, and for C was 50.7 ± 10.0, 41.8 ± 9.5, and 44.8 ± 8.4, respectively. LF/HF at Pre, Post-1, and Post-2 for T was 0.8 ± 0.5, 0.9 ± 0.5, and 0.8 ± 0.3, respectively, and for C was 0.8 ± 0.5, 1.1 ± 0.5, and 1.0 ± 0.4, respectively. There were no significant differences between HFnu or LF/HF ratio between T and C at Pre (p > 0.05). HFnu and LF/HF at Post-2 were significantly different between the two modes (p < 0.05). HFnu and LF/HF were significantly lower between Pre and Post-1 and 2 in C (p < 0.05). However, HFnu was only significantly different between Pre and Post-1 (p < 0.05), but not between Pre and Post-2 in T. LF/HF was not significantly different between Pre and either of the Post time points in T (p > 0.05).

CONCLUSIONS: The results of this study suggest that C is associated with a greater disturbance of post-exercise cardiac-autonomic control compared to T.

2832 Board #104 June 1 11:00 AM - 12:30 PM Heart Rate Response To An Orthostatic Challenge In The Early Postpartum Period Chantale R. Brun1, Michelle F. Mottola, FACSM2, Michel J. Johnson1. 1University of Moncton, Moncton, NB, Canada. 2The University of Western Ontario, London, ON, Canada. (Sponsor: Michelle F Mottola, FACSM) (No relationships reported)

Cardiovascular adaptations occur early in pregnancy and persist throughout gestation. Some of these cardiovascular changes may still be apparent in postpartum women for an unknown period of time. To date there is a paucity of research examining the postpartum period regarding the duration and magnitude of these cardiovascular changes, especially in regards to autonomic regulation. The actual role of the autonomic nervous system during pregnancy is poorly understood and therefore understudied in the postpartum period.

PURPOSE: To investigate the heart rate response to an orthostatic challenge in active women at two months postpartum.

METHODS: Women who were active throughout pregnancy were recruited at two months postpartum (PP; n=20). The control group was composed of similar active, non-pregnant women (in luteal phase of their menstrual cycle) with comparable physical activity backgrounds (NP; n=20). Heart rate (HR) was assessed after 20 minutes in a seated position and after 5 minutes in the standing position (standard 4-lead electrocardiogram, Sensor Medics, Vmax 29c).

RESULTS: HR measured in the seated position was significantly lower in the PP group (PP; 68 ± 2 vs. NP; 75 ± 2 bpm; p<0.05). After five minutes of standing, HR was also significantly lower in the PP group (PP; 77 ± 2 vs. NP; 85 ± 2 bpm, p<0.05). No difference occurred in the Delta HR response (standing HR - seated HR) between groups (PP: 13 ± 4 vs. NP: 9 ± 3, p = 0.454).

CONCLUSION: Reactivity to an orthostatic challenge in postpartum women is similar to the non-pregnant response despite absolute HR values being significantly lower. The early postpartum period may reflect changes in the cardiovascular response at rest (in both positions related to a higher stroke volume (not yet returned to pre-pregnancy values)) from late pregnancy.

2833 Board #105 June 1 11:00 AM - 12:30 PM Autonomic and Cardiovascular Function of Hormone-Receptor Positive Breast Cancer Patients Following Treatment with Anthracycline-Containing Chemotherapy Whitney E. Hornsby1, Michel G. Khoury1, Susan G. Lakoski2, Phil Ainslie3, Jonathon Smuré4, Miranda West1, Amy Lane1, April Coan1, Fernando Ona5, James E. Klaunig2, David M. Koceja1, Robert F. Chapman, FACSM1, Lee W. Jones1. 1Duke University Medical Center, Durham, NC. 2University of Texas Southwestern Medical Center, Dallas, TX. 3University of British Columbia, Kelowna, BC, Canada. 4Boston University, Boston, MA. 5Indiana University, Bloomington, IN. (No relationships reported)

Anthracycline-containing chemotherapy [e.g., doxorubicin or epirubicin] is considered standard treatment for early-stage breast cancer, however it causes left ventricular (LV) dysfunction. This cardiac impairment manifests as increased cardiac size (LV remodeling) and reduced left ventricular ejection fraction (LVEF), which may lead to heart failure. Current detection techniques (resting LVEF) are insensitive to detecting early cardiac impairment.

PURPOSE: To evaluate autonomic and cardiovascular function in breast cancer patients with preserved cardiac function (i.e., LVEF >50%).

METHODS: Thirty-nine women (26 ± 23 months post chemotherapy) and 11 age-matched healthy women were studied. Autonomic function was assessed using heart rate (HR, ECG), heart rate variability (HRV, spectral analysis) and baroreflex sensitivity (BRS, transfer function analysis). A cardiopulmonary exercise test and echocardiography were performed to assess peak cardiovascular function (VO2peak and cardiac function (LV volumes and LVEF), respectively. To explore time-based differences since completion of chemotherapy, patients were sub-classified into two distinct groups: Cohort I: < 5 ± 2 months and Cohort II: 15 ± 18 months.

RESULTS: Resting HR was higher among patients compared to controls (81 ± 10 versus 63 ± 8, beats.min-1; p<0.01); no differences were identified for HRV or BRS. VO2peak was reduced in patients (24.3 ± 4.6 versus 33.4 ± 6.6 mL.kg-1.min-1; p<0.001). Resting HR and VO2peak were similar between breast cancer cohorts despite normalized LV volumes for Cohort II.

CONCLUSION: Breast cancer patients approximately 2 years after the completion of chemotherapy have significant impairments in cardiovascular (reduced VO2peak) and autonomic (elevated resting HR) function despite preserved LVEF. The magnitude of autonomic dysfunction and VO2peak impairment was similar regardless of time since the completion of chemotherapy. Measurement of cardiac function alone may be insufficient to characterize cardiovascular health in early breast cancer patients. These results suggest an urgent need for therapeutic strategies (e.g. aerobic training) to prevent and/or treat global cardiovascular dysfunction in breast cancer patients.

2834 Board #106 June 1 11:00 AM - 12:30 PM Volume of Physical Activity and Hemostatic Variables in Pregnant Women Christine Nicewonger1, Kelly Mattran2, Christopher J. Womack, FACSM3, Robert E. Lee2, Judith A. Flohr3. 1Michigan State University, East Lansing, MI. 2James Madison University, Harrisonburg, VA. (No relationships reported)

PURPOSE: To evaluate potential relationships between hemostatic variables and physical activity (PA) during pregnancy.

METHODS: Fasted blood draws (6-10AM) were obtained from 23 pregnant women (19-34yrs) and analyzed for tissue plasminogen activator (tPA) antigen, tPA activity, plasminogen activator inhibitor-1 (PAI-1) antigen, and vonWillebrand factor (vWF) antigen. PA was assessed by Modifiable Activity Questionnaire (MAQ) and converted to METmin/m/W (MET). Average daily step count (STEP) was obtained from 2 week pedometer logs. Participants were grouped by MET as “meeting” (n=15) or “not meeting” (n=8) the American College of Obstetricians and Gynecologists’ PA recommendations (450 MET) and by STEP as “sedentary” (<5,000 steps/day; n=12) or “at least low active” (5,000+ steps/day; n=4). Gestational age (GA), MET, STEP, and pre-pregnancy PA were possible predictors for hemostatic variables using forward stepwise multiple regression. Multiple linear regression provided y-intercept and slope, allowing extrapolation of pre-pregnancy dependent variables and mean expected changes over GA. ANCOVA determined if differences existed in hemostatic variables among PA groups, controlling for GA and pre-pregnancy PA.

RESULTS: Multiple regression results suggest that PAI-1 and tPA antigen were higher and tPA activity lower with increased GA (p<0.05) and GA and MET were significant predictors of tPA antigen (p<0.01). Linear regression using STEP classifications resulted in a significant difference in y-intercept for tPA antigen (p<0.05), suggesting that tPA antigen may be lower pre-pregnancy in women accumulating at least 5,000 step/day vs. those who are sedentary. No significant slope differences were observed in hemostatic variables in relation to PA. ANCOVA analysis indicated a significant difference in tPA activity based on MET classifications (p<0.04).

CONCLUSION: The associations between PA and 1)tPA antigen and 2) tPA activity are novel and suggest that PA may help attenuate the extent of hypercoagulation in normal pregnancy. Future research is warranted as regular PA, independent of pregnancy, is known to enhance fibrinolytic profile and reduce blood coagulation potential in women of child-bearing age and pregnant women are predisposed to hypercoagulation-related health issues.

Funded by the Morrison Bruce Center for the Promotion of Physical Activity for Girls and Women.

735
CONCLUSION:
Aging is associated with impaired endothelial function and menopause may accentuate endothelial dysfunction. Increased sympathetic nerve activity with advancing age is also associated with impaired endothelial dysfunction. These alterations might also affect not only vasodilatation of large arteries but also small artery function. Near infrared spectroscopy (NIRS) can allow to determine the relative changes of oxygenated hemoglobin (HbO2) in the small artery with high temporal resolution. However, little is known about small artery function of aged women.

PURPOSE:
To determine the influence of aging and sympathetic nerve activity on small artery during reactive hyperemia in women.

METHODS:
Ten young (22±0.4yrs, means±S.E.M.), 11 middle (42±6.5yrs) and 13 old healthy women (62±5.7yrs) were studied. Post occlusive reactive hyperemia was induced via inflation of a blood pressure cuff (2 min) on the upper arm following static handgrip exercise. Sympathetic nerve activity was stimulated induced by the cold pressor test (CPT) from the last 1 min during occlusion to the first 2 min during reactive hyperemia. The recovery time of HbO2 is half the time required for the HbO2 to reach maximal value in response to cuff release from the time of cuff occlusion.

RESULTS:
Baseline MBP did not differ significantly between MCI and control groups (91 ± 10 mmHg and 86 ± 12 mmHg respectively (p=0.11). CBF was 10% lower in MCI than the normal controls (594.3 ± 105.4 vs. 657.4 ± 130.6 ml/min, p=0.10), but not statistically significant. No difference in CBFV was observed (MCI 51.8 ± 11.4 vs. Control 57.1 ± 16.2 cm/sec, p=0.24). However, cerebrovascular resistance was increased by 23% in MCI subjects (0.16 ± 0.03 vs. 0.13 ± 0.13mmHg·min/ml, p=0.02). What is more, no significant differences in the recovery time of HbO2 with CPT among subjects (p<0.05 respectively), whereas no difference was observed between young and middle women. In contrast, CPT slowed the recovery time in HbO2 in middle (12.0±0.6sec) and old (15.3±0.7sec) but not in young (9.5±0.5 sec). Moreover, there were significant differences in the recovery time of HbO2 with CPT among subjects (p<0.05 respectively).

CONCLUSIONS:
These results indicate that post menopausal women exhibit a delayed HbO2 response during reactive hyperemia. Furthermore, sympathetic nerve system may be related to HbO2 responses after middle age. We suggest that these alterations in HbO2 kinetics are indicative of microvasculature dysfunction in these subjects.

INTRODUCTION:
Brain perfusion is reduced in patients with Alzheimer’s disease (AD). Whether this is a primary or contributing factor has not been established. Changes in cerebral hemodynamics in patients with mild cognitive impairment (MCI), often a prodromal stage of AD, has not been carefully studied.

PURPOSE:
This study tested the hypothesis that global cerebral blood flow (CBF) is reduced in patients with MCI relative to age and education matched cognitively normal older adults.

METHODS:
Twenty-one MCI patients (10 females, 67 ± 6 yr BMI: 24 ± 5 kg/m²) and 20 normal control subjects (14 females, 68 ± 7 yr, BMI: 22 ± 4 kg/m²) participated. Patients with MCI had a global CDR or Clinical Dementia Rating (CDR) score of 0.5 and scores ≥ 1SD below the appropriate norm on the Wechsler Logical Memory Test. Blood flow was measured using high resolution 2D transcranial Doppler (TCD) and color Doppler ultrasonography in the internal carotid (ICA) and vertebral arteries (VA). Global CBF was calculated as a sum of both the ICA and VA measures. Transcranial Doppler (TCD) was used to measure CBF velocity (CBFV) in the middle cerebral artery (MCA). Cerebrovascular resistance (CVR) was calculated as mean blood pressure (MBP) divided by global CBF.

RESULTS:
Baseline MBP did not differ significantly between MCI and control groups (91 ± 10 mmHg and 86 ± 12 mmHg respectively (p=0.11). CBF was 10% lower in MCI than the normal controls (594.3 ± 105.4 vs. 657.4 ± 130.6 ml/min, p=0.10), but not statistically significant. No difference in CBFV was observed (MCI 51.8 ± 11.4 vs. Control 57.1 ± 16.2 cm/sec, p=0.24). However, cerebrovascular resistance was increased by 23% in MCI subjects (0.16 ± 0.03 vs. 0.13 ± 0.13 mmHg·min/ml, p=0.02).

CONCLUSION:
The observed increase in CBFV in MCI suggests that vascular mechanisms may be at play in prodromal AD. Development of pharmacological and/or non-pharmacological interventions such as exercise training to reduce CBFV may improve brain perfusion to prevent or slow AD.

E-24
Free Communication/Poster - Cognition and Physical Activity
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2838 Board #110
June 1
9:30 AM - 11:00 AM
Cognitive Decline Precedes Physical Function Change in Patients with Early Mild Cognitive Impairment.
Benjamin Y. Tseng1, Estee Brunk2, Kristen Martin-Cook1, Kyle Armstrong2, Vincent L. Aengevaeren2, Myron Weiner2, Benjamin D. Levine, FACSM1, Rong Zhang2
1University of Texas Southwestern Medical Center, Dallas, TX. 2Institute for Exercise and Environmental Medicine, Dallas, TX. (Sponsor: Benjamin Levine, FACSM)

No relationships reported

Physical function and motor control deteriorate with aging. These deficits are likely to be exacerbated in patients with Alzheimer’s disease (AD). However, whether this is the case for patients with Mild Cognitive Impairment (MCI), often a transitional stage between normal aging and AD, is not known.

PURPOSE:
To evaluate physical function in patients with MCI.
METHODS: Twenty eight MCI patients (13 males, age 68±6 yrs, BMI 28±5), and 21 age and education matched cognitively normal adults (6 males, age 68±7 yrs, BMI = 26±4) underwent physical function assessment including level of aerobic fitness (VO2max), gait velocity, timed-up-and-go, functional reach, and reaction time. Diagnosis of MCI required a memory complaint, objective evidence of memory impairment as measured by the Logical Memory subscale of the Wechsler Adult Intelligence Test and no subjectively or objectively reported overall functional impairment indicated by a Clinical Dementia Rating (CDR) score ≤ 0.5.

RESULTS: No differences in physical function were observed in MCI patients when compared to the normal controls (see Table 1).

CONCLUSION: We did not find physical function deficits in patients with MCI. These findings suggest that exercise testing and training can be implemented safely in these patients to prevent further physical function decline at the early stage of neurodegenerative disease.

Table 1. Aerobic fitness, physical function, and cognitive performance in MCI and normal subjects.

<table>
<thead>
<tr>
<th></th>
<th>MCI (n=28)</th>
<th>Normal (n=21)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2max (ml/kg/min)</td>
<td>22.98±5.21</td>
<td>22.51±4.89</td>
<td>0.784</td>
</tr>
<tr>
<td>Stride Velocity (m/sec)</td>
<td>1.16±0.15</td>
<td>1.04±0.13</td>
<td>0.142</td>
</tr>
<tr>
<td>Timed-Up and-Go (sec)</td>
<td>13.2±1.64</td>
<td>13.8±1.56</td>
<td>0.299</td>
</tr>
<tr>
<td>Reaction Time (sec)</td>
<td>29.6±5.95</td>
<td>31.9±8.78</td>
<td>0.774</td>
</tr>
<tr>
<td>Logical Memory (immediate)</td>
<td>30.41±8.90</td>
<td>29.89±6.61</td>
<td>0.001</td>
</tr>
<tr>
<td>Logical Memory (delayed)</td>
<td>11±2</td>
<td>13±2</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Studies had reported that aerobic exercises can improve cognition function in depression. Whether aerobic exercise is viable treatment for chronic unpredictable stress (CUMS)-induced depression is unclear, especially if it could prevent cognition decline when subjects were exposed to CUMS is still unknown.

PURPOSE: To investigate the effect of aerobic exercises on the cognition in CUMS-induced depression rats; to determine that the lack of 5-HT is the mechanism underlying the cognitive impairment in depressive rats.

METHODS: 32 four-month-old male SD rats were divided into 4 groups: common group (C), CUMS depression model group (D), CUMS and aerobic exercise group (DE), CUMS and fluoxetine group (DF). The D, DE and DF groups were exposed to CUMS for 4 weeks with or without access to 18-days 64%VO2max treadmill running or intragastric injection of antidepressant fluoxetine. On the end of CUMS, open-filed test was performed, hippocampus and brain raphe nucleus were collected for 5-HT measurement. Group comparisons were made using one-way ANOVA.

RESULTS: Compared to the C group, the score of activity (43.00±16.56 vs. 80.17±19.17 frequency/5min, p<0.05) and space exploration tend (20.92±9.50 vs. 47.42±5.32, p<0.05) in open-filed test were significantly declined, and 5-HT in hippocampus was decreased in the D group (29.07±0.56 vs. 31.54±0.88, p<0.05). Compared to the D group, the score of activity trend (79.50±15.85, 59.50±8.24 vs. 43.00±16.56, p<0.05) in open-filed test in DE group was higher than the others. 5-HT level in hippocampus was increased (31.29±1.45, 32.43±1.22 vs. 29.07±0.56, p<0.05) in the DE and DF groups, and there were no differences between the DE and DF groups (31.29±1.45 vs. 32.43±1.22, p>0.05). 5-HT level in brain raphe nucleus was significantly increased in DE group (37.22±0.26, 36.25±0.36 vs. 36.24±0.10, p<0.05).

CONCLUSIONS: The cognitive impairment and the lower level of 5-HT were observed in CUMS-induced depressive rats. Aerobic exercises have antidepressant effects in CUMS-induced depression by promoting the produce of 5-HT in brain raphe nucleus. Results indicated the mechanisms underlying the antidepressant effects of aerobic exercises and of fluoxetine may be different.

Supported by TSTC Grant, 10JCYBJC11800, 09ZCZDSF04600.

2839 Board #111 June 1 9:30 AM - 11:00 AM
Aerobic Exercises Improve Cognition Function in Chronic Unpredictable Mild Stress-Induced Depressive Rats
Yahong Jin1, Li Wen1, Lei Li1, Shixiang Chen2, Sai Zhang2. 1Tianjin University of Sport, Tianjin, China. 2Chinese People’s Armed Police Forces Medical College, Tianjin, China.

(No relationships reported)

Studies had reported that aerobic exercises can improve cognition function in depression. Whether aerobic exercise is viable treatment for chronic unpredictable stress (CUMS)-induced depression is unclear, especially if it could prevent cognition decline when subjects were exposed to CUMS is still unknown.

PURPOSE: To investigate the effect of aerobic exercises on the cognition in CUMS-induced depression rats; to determine that the lack of 5-HT is the mechanism underlying the cognitive impairment in depressive rats.

METHODS: 32 four-month-old male SD rats were divided into 4 groups: common group (C), CUMS depression model group (D), CUMS and aerobic exercise group (DE), CUMS and fluoxetine group (DF). The D, DE and DF groups were exposed to CUMS for 4 weeks with or without access to 18-days 64%VO2max treadmill running or intragastric injection of antidepressant fluoxetine. On the end of CUMS, open-filed test was performed, hippocampus and brain raphe nucleus were collected for 5-HT measurement. Group comparisons were made using one-way ANOVA.

RESULTS: Compared to the C group, the score of activity (43.00±16.56 vs. 80.17±19.17 frequency/5min, p<0.05) and space exploration tend (20.92±9.50 vs. 47.42±5.32, p<0.05) in open-filed test were significantly declined, and 5-HT in hippocampus was decreased in the D group (29.07±0.56 vs. 31.54±0.88, p<0.05). Compared to the D group, the score of activity trend (79.50±15.85, 59.50±8.24 vs. 43.00±16.56, p<0.05) in open-filed test in DE group was higher than the others. 5-HT level in hippocampus was increased (31.29±1.45, 32.43±1.22 vs. 29.07±0.56, p<0.05) in the DE and DF groups, and there were no differences between the DE and DF groups (31.29±1.45 vs. 32.43±1.22, p>0.05). 5-HT level in brain raphe nucleus was significantly increased in DE group (37.22±0.26, 36.25±0.36 vs. 36.24±0.10, p<0.05).

CONCLUSIONS: The cognitive impairment and the lower level of 5-HT were observed in CUMS-induced depressive rats. Aerobic exercises have antidepressant effects in CUMS-induced depression by promoting the produce of 5-HT in brain raphe nucleus. Results indicated the mechanisms underlying the antidepressant effects of aerobic exercises and of fluoxetine may be different.

Supported by TSTC Grant, 10JCYBJC11800, 09ZCZDSF04600.

2840 Board #112 June 1 9:30 AM - 11:00 AM
Type 1 Diabetes-associated Cognitive Decline: Nature And Magnitude - A Meta-analysis.
Cajsa Tonoli1, Elsa Heyman2, Luk Bayse1, Nathalie Pattyn1, Serge Berthoin2, Romain Meeusen, FACSM1. 1Vrije Universiteit Brussel, Brussels, Belgium. 2University Nord de France, Lille, France.

(No relationships reported)

PURPOSE: This meta-analysis was conducted to determine mechanisms and size of cognitive decline in patients with type 1 diabetes (T1D) and the potential associations with episodes of hypoglycemia (EoH), chronic hyperglycemia and early age of onset (EO).

METHODS. PubMed and ISI Web of Knowledge were identified studies on cognitive function (CF) and on its possible determinants in T1D patients. Cohen’s d statistics were used for calculating effect sizes (ES). Effect sizes (d) are defined as small = .3, medium = .5 and large = .8. Meta-analysis was performed where a minimum of 3 studies had assessed the same domain of CF.

RESULTS. According to the literature, mechanisms for cognitive decline are ascribed to EoH, chronic hyperglycemia and C-peptide/insulin deficiency. Results are shown in table 1. No significant differences were found between T1D children who did experience EoH vs. T1D children who did not experience EoH. There were insufficient studies on the association of CF with EoH or EO of diabetes in T1D adults, and with poor glycaemic control in T1D children to perform meta-analyses.

CONCLUSION. Cognitive decline seems to be related to an EO of diabetes and to high HbA1c levels. The magnitude of the cognitive decline is mild to moderate and is more severe in adults than in children; suggesting duration of diabetes and hyperglycaemia could have effects on CF. Considering its well-known positive effects on glycaemic control, physical activity could have beneficial effects for the CF.
The study of dual-task interference.

RESULTS:
The ImPACT produces six subscores used to evaluate cognitive function following concussive events. Twelve athletes with diagnosed concussions were excluded from the analyses. Paired-sample t-Tests were used to analyze ImPACT scores between seasons. Pearson's Correlations were used to compare the HIT System data with the ImPACT data.

CONCLUSIONS:
During a three-year investigation, 53 class 3A high school football players were fitted with the Head Impact Telemetry (HIT) System. Prior to each competitive season, each athlete completed a baseline assessment of cognitive function (ImPACT). The HIT System incorporates six single-axis accelerometers in a helmet and records linear and rotational acceleration. The ImPACT produces six subscores used to evaluate cognitive function following concussive events. Twelve athletes with diagnosed concussions were excluded from the analyses. Paired-sample t-Tests were used to analyze ImPACT scores between seasons. Pearson’s Correlations were used to compare the HIT System data with the ImPACT data.

Table 1: Estimates of the size of Cognitive decline in T1D.

<table>
<thead>
<tr>
<th>CF</th>
<th>T1D vs non-diabetic subjects</th>
<th>EO (c) vs. late onset (&gt;4) of T1D</th>
<th>Poor controlled (HbA1c &gt; 8%) vs. well-controlled T1D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children Adults</td>
<td>Children Adults</td>
<td>Adults</td>
</tr>
<tr>
<td>Attention</td>
<td>-20 [-11, -29]*</td>
<td>-4 [-8, -40]*</td>
<td>-2 [-19, -44]*</td>
</tr>
<tr>
<td>Full IQ</td>
<td>-35 [-26, -45]*</td>
<td>-12 [-24, -20]*</td>
<td>-12 [-3, -22]*</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>07 [-05, 19]</td>
<td>-12 [-26, -11]*</td>
<td>-12 [-26, -11]*</td>
</tr>
<tr>
<td>Executive Function</td>
<td>-14 [-59, 30]</td>
<td>-44 [-59, -28]*</td>
<td>-12 [-34, 10]</td>
</tr>
<tr>
<td>Spatial Memory</td>
<td>-20 [-07, -32]*</td>
<td>-41 [-55, -26]*</td>
<td>-21 [-25, -17]*</td>
</tr>
</tbody>
</table>

Data expressed as cohen’s d [95% CI]. Values with * = significant.
RESULTS: Participants reported significantly fewer concussion symptoms during the year two preseason assessment compared to year one (2.15 ± 3.90 vs 3.39 ± 3.88 p < .05). No other ImPACT subscore produced significant paired-sample t-Test. No significant relationships were observed through Pearson’s Correlations between cumulative HIT System data and ImPACT scores.

CONCLUSIONS: Other research has suggested there should be an age-related improvements on cognitive tests commonly used for concussion assessment. The athletes in this pilot study do not show the same improvements, but rather appear to have stunted cognitive function. While it is not entirely clear why, this may have been a result of cumulative sub-concussive impacts.

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### 2844 Board #116 June 1 9:30 AM - 11:00 AM Positive Relationship between Fitness and Academic Proficiency in Elementary and Middle School Youth

Randal P. Claytor1, Keith Weiser1, Joshua S. Claytor2,1. *Maini University, Oxford, OH.* 2.Colege of Wooster, Wooster, OH. (Sponsor: Helaine Alessio, FACSMM)

(Please note: no relationships reported)

PURPOSE: Determine the extent of the association between school-based measures of physical fitness and state-wide, standardized assessments of reading and math.

METHODS: PE teachers were provided and trained to administer the Fitnessgram. Pacer (P) assessed aerobic fitness (AF), paced 90°degree push-up (PU) and paced curl-up (CU) assessed muscular fitness (MF); a fitness composite score (P, PU, & CU) was calculated. Individual Reading and Math (adjusted) scores from the Ohio Achievement Assessment (OAA) was collected from participating school districts.

RESULTS: PF data on 5295 youth (50% male; 29%-4th, 24%-5th, 19%-6th, 15%-7th, 12%-8th) from 1888 counties, 22 school districts and 5/7 school district typologies (DT), based on geography and household income levels was collected. P, PU, CU, and FC were significantly correlated with OAA-R and OAA-M, respectively (all p<0.0001). Multivariate ANOVA detected significant Sex (P, PU, CU, FC, & OAA-R; p<0.0001), however (OAA-M, BMI-Z, & BMI%- did not differ by Sex) and Grade (P, PU, FC, OAA-R, OAA-M, BMI-Z, & BMI%; p<0.0001) main effects and a significant Sex X Grade interaction. Multiple regression determined that P, CU, & Sex were significantly (p<0.0001) associated with OAA-R; P, CU & PU were significantly associated with OAA-M. Grade, BMI%, & DT were not associated with either academic measure.

CONCLUSIONS: AF, MF and Sex (Reading only) are associated with standardized Reading & Math assessments in 4th - 8th graders. Additionally, Grade, BMI% and DT are not associated with Reading and Math proficiency scores in youth. These findings suggest PA that leads to PF is important for increased academic proficiency regardless of school-related geographic and socio-economic indicators. Policy makers and other stakeholders should use this information to implement creative ways to increase PA and PF before, during, and after the school day as an additional mechanism to enhance academic proficiency in youth.

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### 2845 Board #117 June 1 9:30 AM - 11:00 AM Associations Between Objectively Measured Physical Activity And Cognitive In Adolescents: Evidence From The ALSPAC Cohort

Josephine N. Booth1, Andy R. Ness2, Phillip D. Tomporowski2, Samantha D. Leary2, Carol Joinson3, James M. E Boyle1, John J. Reilly4. 1.University of Strathclyde, Glasgow, United Kingdom. 2.University of Bristol, Bristol, United Kingdom. 3.University of Georgia, Athens, GA. (Sponsor: David A. Rowe, FACSMM)

(Please note: no relationships reported)

Emerging findings suggest that Physical Activity (PA) influences executive functioning (EF) however there are inconsistencies in the literature. The strongest associations have been found for tasks assessing planning though effect sizes are not consistent across other aspects (e.g. working memory and switching). Effect sizes are also related to the amount of PA performed; however a paucity of evidence from studies using objectively measured PA precludes firm conclusions being drawn.

PURPOSE: To examine the relationship between objectively measured levels of PA and EF in English adolescents.

Method: 5593 participants (47.6% male) from the Avon Longitudinal Study of Parents and Children (ALSPAC) had valid accelerometer measurements of PA (at least 10 hours a day on a minimum of three days) at 11 years of age. PA was recorded as average counts per minute (cpm) and as daily number of minutes spent in moderate to vigorous physical activity (MVPA). Participants completed three tasks of EF from the Test of Everyday Attention for Children (TEA-Ch) assessing attention, inhibition and working memory.

RESULTS: Mean cpm was 604 (SD = 178) and the mean number of minutes per day spent in MVPA was 23 (SD=15). Moderate gender differences in PA were observed for cpm (effect size = 0.66, 95% CI 0.60-0.71) and daily minutes in MVPA (effect size = 0.70, 95% CI 0.65-0.75). Small to medium effect sizes (ranging from 0.18-0.40) were found for gender on all tasks of executive function. While further analysis is currently underway, preliminary findings indicate that both total volume of physical activity (cpm) and MVPA are predictive of EF at 11 but that the amount of variance explained is small (ranging from 0.1% - 0.6%).

CONCLUSIONS: Findings suggest that while PA is predictive of EF task performance the effects are small. Further work is underway to explore potential confounders as well as mediators and moderators of this relationship. One possibility is that PA is predictive of specific aspects of EF but not others. In addition, the findings may reflect the low amounts of MVPA observed in the present sample. These findings will lead to a greater understanding of the impact of PA on cognitive development and will have implications for research and policy concerning PA and education.

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### 2846 Board #118 June 1 9:30 AM - 11:00 AM Effects Of Physical Activity On The Aging Of Motor And Perceptual Inhibition

Cedric T. Albinet1, Geoffroy Boucard2, Fabienne Collette2, Cedric A. Bosquet1, Michel Audiffren1. 1.University of Poitiers, Poitiers, France. 2.University of Liege, Liege, Belgium. (Sponsor: Phillip D. Tomporowski, FACSMM)

(Please note: no relationships reported)

Aging has a detrimental effect on behavioral inhibition (a core executive function), but physical activity (PA) appears to moderate this decline. However, different types of inhibition exist and for the influence of aging and PA may differ.

PURPOSE: To evaluate the influence of age and regular PA on the performance of different cognitive tasks that separate perceptual and motor inhibition.

METHODS: Fifty adults participated in the study. Twenty-six young (Y, 20±2 yrs) and 24 older (O, 72±3 yrs) were classified as physically active (A) or sedentary (S), according to measures of past (Historical Leisure Activity Questionnaire, hours/week and METs-h/week) and present (Actigraph GT1M, steps/day and time spent/day in moderate to vigorous PA). They performed the tasks developed by Nassauer and Halperin (2003), which assessed perceptual and motor inhibition. Performance in the inhibition tasks was assessed by Reaction Time (RT in ms) and response accuracy (% of correct responses) as a function of condition (no conflict vs. perceptual or motor conflict).

RESULTS: Overall, older were slower than young adults, and active people were faster than sedentary people. Preliminary results showed a differential effect of PA as a function of age and type of inhibition. Concerning motor inhibition, there was no effect of PA for the young groups (p>0.05). However, in the motor conflict condition, the OA group was significantly more accurate (95%) than the OS group (91%), although there was no significant RT difference (p>0.05) between the 2 groups (693±154 ms vs. 734±84 ms, for OA and OS respectively). Concerning perceptual inhibition, there was no effect of PA for the 2 groups of older (p>0.05). However, for the same accuracy level, YA were significantly (p<0.05) faster (485±64 ms) than YS (550±69 ms) in the perceptual conflict condition, although there was no RT difference in the no-conflict condition (350±24ms vs. 357±26 ms, for the YA and YS respectively).

CONCLUSION: The effects of PA on inhibition appears to be moderated by both age and type of inhibition measured, deserving future research to understand the functionality of this dissociation.

Supported by a grant from Région Poitou-Charentes and FEDER.

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Exposure to Particulate Matter (PM) has been linked to inflammation and cognitive decline. It was shown that participation in an aerobic training program improves cognitive functions. Brain-Derived Neurotrophic Factor (BDNF) is a key mediator of the underlying mechanisms. Recently, we found that the exercise-induced increase in BDNF serum level did not occur after cycling under high PM exposure.

**PURPOSE:** To investigate the effect of PM exposure during aerobic training on cognitive performances. The impact of PM exposure during the program was analyzed by white blood cell count (WBCC) and exhaled NO (eNO) as markers for respectively systemic and respiratory inflammation.

**METHODS:** Two groups of inactive volunteers completed an aerobic training program of 12 weeks with 3 sessions/week, one group (n = 15) in the city of Brussels and the other group (n = 9) in the rural environment of Mol. Ultrafine Particle (UFP) concentration was measured during each training session. Before and after the program aerobic fitness (cooper test), white blood cell count (WBCC), exhaled NO (eNO), serum BDNF value and cognitive performances on the stroop test were analyzed.

**RESULTS:** UFP concentrations differed significantly with 7243.7 particles/cc in Brussels and 5625.2 particles/cc in Mol (p = 0.003). Performances on the cooper test significantly improved (p = 0.0001) with 15% in Brussels and 21% in Mol and did not differ between both groups (p = 0.16). The group from Mol improved its performance on the stroop test, measured by stroop interference in the reaction time, with 69.3 ± 64.4 ms (p = 0.023). In contrast, the group from Brussels did not improve its performance (7.4 ± 83.7 ms; p = 0.74). Exhaled NO (+30%; p = 0.006) and blood neutrophil concentration (+18%; p = 0.042) increased after the program in Brussels, whereas eNO (-3%; p = 0.80) and neutrophil concentration (-6%; p = 0.65) did not differ after the program in Mol. No effects were found on serum BDNF value (p = 0.96).

**CONCLUSIONS:** The results show that regular exercise in urban environment with high traffic-related air pollution increases markers of respiratory and systemic inflammation. In line with our previous findings where the exercise-induced increase in BDNF does not occur with exercise in polluted air, this study shows no improvements in cognitive performances with training in polluted air.

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<table>
<thead>
<tr>
<th>Values are mean ± SD. *Significant difference from neutral water immersion, P &lt; 0.05.</th>
<th>BASE</th>
<th>30 min</th>
<th>60 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectal temperature (°C)</td>
<td>NEUTRAL</td>
<td>37.4±0.6</td>
<td>37.4±0.5</td>
</tr>
<tr>
<td>COLD</td>
<td>37.3±0.3</td>
<td>37.3±0.4</td>
<td>37.3±0.4*</td>
</tr>
<tr>
<td>Mean skin temperature (°C)</td>
<td>NEUTRAL</td>
<td>31.1±0.8</td>
<td>31.8±0.6</td>
</tr>
<tr>
<td>COLD</td>
<td>32.4±0.4</td>
<td>32.4±0.5*</td>
<td>32.4±0.5*</td>
</tr>
<tr>
<td>Mean arterial pressure (mmHg)</td>
<td>NEUTRAL</td>
<td>85±10</td>
<td>75±8</td>
</tr>
<tr>
<td>COLD</td>
<td>82±8</td>
<td>81±11*</td>
<td>86±8*</td>
</tr>
</tbody>
</table>

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**E-25**  
**Free Communication/Poster - Cold Stress**  
**JUNE 1, 2012 7:30 AM - 12:30 PM**  
**ROOM: Exhibit Hall**  

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**2847 Board #119 June 1 9:30 AM - 11:00 AM**  
Air Pollution Exposure During Aerobic Training: Effects On Inflammatory Markers, BDNF And Cognitive Performances.  
Inge R. Bos, Jef Vanpaepijpe, Patrick De Boer, Nathalie Pauwels, Luc Int Panis, Romain Meesen, F AcS M, Vrije Universiteit Brussel (VUB), Brussels, Belgium.  
(Free Communication/Poster - Cold Stress)

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**2848 Board #120 June 1 11:00 AM - 12:30 PM**  
Severe Drop in Body Core Temperature Following Four Cold Water Immersions  
Laura J. Palombo, Naval Health Research Center, San Diego, CA.  
(No relationships reported)

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**2849 Board #121 June 1 11:00 AM - 12:30 PM**  
Thermoregulatory and Cardiovascular Responses During 60-minute Lower Body Cold Water Immersion  
Yongsuk Seo, Matthew D. Muller, Chul-Ho Kim, Edward J. Ryan, Ellen L. Glickman, F AcS M, Kent State University, Kent, OH.  
(No relationships reported)
CONCLUSIONS: These data suggest that longer than 30 minutes of lower body cold water immersion may be beneficial for endurance performance by reducing baseline core temperature. This study was funded by aZakel Consulting & Design LLC.

2850  Board #122       June 1       11:00 AM - 12:30 PM
Thermoregulation during Lower Body Negative Pressure During the Cold.
Ellen L. Glückman, FACSM, David J. Kean, Gabriel Sanders, Corey Peacock, Jacob Barkley, Matthew Muller. Kent State University, Kent, OH.
(No relationships reported)
PURPOSE: To determine the effects cold has on thermoregulation during exposure to lower body negative pressure (LBNP).
METHODS: Eleven college aged men participated in two trials. Subjects were sapped on a gurney with their lower extremities inserted into a LBNP pressure box up to the level of the anterior superior iliac spine. Each trial consisted of a control period of 100 min followed by application of LBNP for 20 min and concluded with a 15 min recovery period. Both trials were carried out in the environmental chamber; the cold trial was performed at 10°C (cold) and the ambient trial was performed at 23°C (ambient). The order of trials was counterbalanced. Mean skin temperature and rectal temperature was measured via skin thermistors. A repeated measures analysis of variance was used to compare trials across time. VO2 was measured using a Parvo metabolic cart.
RESULTS: Mean skin temperature (Tsk) was significant for time (p<0.001), condition (p<0.001) and there was an interaction (p<0.001). The interaction was due to a greater reduction in Tsk from pre-LBNP (Tsk ambient = 33.0±0.4°C vs. cold = 31.0±1.0°C) to recovery in the ambient condition vs the cold condition (Tsk ambient = 33.7±0.9°C vs. cold = 28.9±2.0°C). Rectal temperature (Tre) was significant for time (p<0.001) and there was an interaction (p<0.002). The interaction was due to a greater reduction in Tre from pre-LBNP (Tre ambient = 37.5±0.4°C vs. cold = 37.0±1.2°C) to recovery in the ambient condition vs the cold condition (Tre ambient = 37.2±0.2°C vs. cold = 36.9±0.3°C). VO2 was significant for condition (p<0.028) only.

<table>
<thead>
<tr>
<th></th>
<th>Pre-LBNP</th>
<th>LBNP</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsk</td>
<td>33.9±0.9</td>
<td>28.5±4.9</td>
<td>31.0±1.9</td>
</tr>
<tr>
<td>Tre</td>
<td>37.1±0.2</td>
<td>37.0±0.2</td>
<td>37.0±0.3</td>
</tr>
<tr>
<td>VO2</td>
<td>4.9±1.1</td>
<td>6.3±1.6</td>
<td>6.8±1.7</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Based on these data during cold exposure and orthostatic stress homeostasis was maintained due to adjustments in metabolism.

2851  Board #123       June 1       11:00 AM - 12:30 PM
Effect Of Microenvironment Temperature On Thermoregulatory And Perceptual Responses During Exercise In The Cold
Colin R. Carriker1, Stephanie Campbell2, Adrienne Barr3, Lauren Stark4, Robert C. Pritchett1. University of New Mexico, Albuquerque, NM. 1Central Washington University, Ellensburg, WA.
(No relationships reported)
In the cold, clothing may be necessary to ameliorate thermal insulation and reduce heat loss. Outer-garments in the present study were constructed of material marketed as windproof and intended to preserve the clothing microenvironment temperature (CME) by preventing disruption of the inner air layer by cold ambient air.
PURPOSE: To investigate the effect of CME1 on thermoregulatory and perceptual responses during moderate intensity exercise (~50% VO2max; 45 min) in a cold ambient temperature, Ta (24±1°C; 66±6% humidity).
METHODS: A randomized crossover design was employed for 3 treatment garments of different thickness: Light (CL): 20 Denier, Medium (CM): 40 Denier, Heavy (CH): 70 Denier. Nine men (23.3±2.35 y, 71.7±5.9% Fat, VO2max 49.8±3.23 ml/kg/min) wore a treatment garment and baselayer pant/long sleeve shirt (100% polyester) composing a 2-layer ensemble. No hats/gloves were permitted. Trials were scheduled >2 days apart at the same time of day, 2 h post-prandial. Testing occurred during winter/early spring months. Exercise consisted of 3 consecutive series of the following: 10 min treadmill walking at 10% grade and 5 min bench stepping (height at distal patella) with simulated wind (~1.5 m/s). Pace and cadence determined by ACSM walking/step equations at ~50% VO2max. A four site mean skin temperature (Tsk) was employed (Hardy and Dubois 1938). Core temperature (Tre) measured using a rectal thermistor probe. Thermal sensation, TS, ranged from -7 unbearably cold to +7 unbearably hot.
RESULTS: CME, and Tsk were similar (p>0.108 and p>0.297 respectively) for CL, CM, CH over 45 min. CME1 (17.3±4.2°C) was greater than Tsk (p<0.05). Tre increased similarly (p=0.924) for CL, CM, CH over 45 min (1.2±0.3, 1.1±0.13 and 1.1±0.25; respectively) and was greater than rest after 15 min (p<0.05) for all conditions. CH CME increased the most over 45 min compared to CL and CM (-6.7±0.8°C, -6.2±1.5°C, and -3.7±1.8°C respectively). A low correlation was seen between CME1 and TS (r=-0.3, p>0.05) and CME1 and Tsk (r=-0.34, p<0.05). A moderate correlation was seen between Tsk and TS (r=0.53, p<0.05), and CME1 declined over 45 min while both Tsk and TS increased. Tsk is more affected by work load than the cold in CME. A windproof outer-garment preserved CME above the ambient temperature but did not effect Tsk or TS.

2852  Board #124       June 1       11:00 AM - 12:30 PM
Effect Of Caffeine Gum And Exercise On Cold Induced Vasodilation In Human Finger
(No relationships reported)
PURPOSE: This study examined whether chewing caffeine gum in conjunction with exercise would modify the cold induced vasodilation (CIVD) in human fingers.
METHODS: Two (no-caffeine; NC or caffeine intake; CI) by three (no-exercise; NE, 70% of VO2tonset, 70E; or all-out; AO) study design was employed. Ten non-cold acclimated healthy men (24.2±2.3 yrs, 175.0±5.1 cm, 71.3±6.4% body fat, 56.4±2.8 ml/kg/min VO2max) randomly participated in all six testings. In each session, subjects immersed their middle finger at 43°C water for 5 min followed by resting at ambient air for 10 min. During the resting, they either chewed caffeine gum (300 mg) or simply took a rest. Then they underwent one of three activity phases; NE for 20 min, 70E on a treadmill for 20 min, or AO with incremental exercise intensity. Upon completion of the activity phase, they immersed the middle finger at 5°C water for 20 min. A blood sample was taken from antecubital veins. During testing, finger temperature from middle finger nail bed was measured. The lowest (Tfmin) and the highest (Tfmax) randomly participated in all six testings. In each session, subjects immersed their middle finger at 43°C water for 5 min followed by resting at ambient air for 10 min. During the resting, they either chewed caffeine gum (300 mg) or simply took a rest. Then they underwent one of three activity phases; NE for 20 min, 70E on a treadmill for 20 min, or AO with incremental exercise intensity. Upon completion of the activity phase, they immersed their middle finger at 5°C water for 20 min. A blood sample was taken from antecubital veins. During testing, finger temperature from middle finger nail bed was measured. The lowest (Tfmin) and the highest (Tfmax) were calculated. Consider time variable of CIVD such as the time period between min 0 and time at Tfmin (Δtminset), time between at Tfmin and A at Tfmax (Δtmax), and Δtmax plus Δtpeak (Δtmax) was calculated.
RESULTS: Although main effects of caffeine and exercise were noticed, no interactions were found in Tfmin and Tfmax. Δtpeak in NC-NE (6.9±1.6°C) was higher than CI-NE (4.8±1.2°C) (p<0.05). Δtmax in NC-AO (1.9±0.5°C) was lower than in NC-NE and NC-70E (2.3±1.2°C) (p<0.05). and that in CI-AO (1.6±0.6°C) was lower than CI-NE (p<0.05). Caffeine and exercise did not affect on Δtminset, Δtpeak, and Δtmax but both 70E and AO shortened all time variables. No interactions were noticed in time variables of CIVD. Epinephrine level was higher in CI (291-400 pg/ml) than NC (106-362 pg/ml) (p<0.05) as well as in AO (362-400 pg/ml) than NE (106-291 pg/ml) and 70E (200-278 pg/ml).
CONCLUSIONS: The oral caffeine intake and exercise induced a small difference between the lowest and the highest finger temperatures. It appeared that exercise stimulus was stronger in modifying CIVD. Caffeine did not affect time variables of CIVD.
Hypothermia, particularly when combined with traumatic injury, is a significant contributor to fatalities in remote environments. It is therefore important to develop field methods to protect casualties from the cold whilst they await evacuation to more sophisticated medical facilities.

**Purpose:** To examine the thermoregulatory responses of men to four field methods following pre-cooling.

**Methods:** Seven healthy males completed five trials in a randomised order. These included a thermo-neutral control trial (TC), where participants remained seated and fully clothed, and four cold trials. On each cold trial, dressed in shorts only, participants were cooled to 36°C core temperature in 13°C water after which they completed a 3-hour cold air test (CAT, 0°C) in one of four field methods, these included: 1. a polythene survival bag (PB), 2. PB with 70°C hot drink (PB+HD), 3. a triple-layered metallized sheeting Blizzard survival bag (BB), and 4. BB with chemical heat pads - Blizzard Heat (BB+HP). During each CAT drinks were consumed hourly equal to 6 ml kg⁻¹ body mass. Non PB+HD trial drinks were served at 36°C. Core and mean weighted skin temperature, metabolic heat production and thermal comfort were assessed.

**Results:** Prior to the CAT, time to reach 36°C was not different (31 ± 15 min, P = 0.50). During the CAT, initial rewarming rate, afterdrop parameters (i.e. magnitude, time to nadir and return to 36°C) and core temperature were not different between the four field methods. However, compared with PB and PB+HD, skin temperature was greater (PB 25 ± 1, PB+HD 25 ± 1, BB 27 ± 2, BB+HP 28 ± 2, TC 32 ± 1 °C, P < 0.01) and metabolic heat production was lower during BB and BB+HP (BB 133 ± 73, BB+HD 149 ± 74, BB 112 ± 73, BB+HP 96 ± 62, TC 57 ± 16 W m⁻², P < 0.01). Indeed, metabolic heat production was similar to TC on BB and BB+HD by 30 min into CAT. Thermal comfort was also higher on BB+HP compared with PB+HD (P < 0.05) but not different between other field methods.

**Conclusion:** Despite cold exposure, the four field methods supported re-warming to near resting core temperatures in shivering cold-casualties. However, less metabolic heat production was required to maintain core temperature in triple-layered metallized survival bags compared with polythene survival bags. Hot drinks had no measured thermoregulatory or perceptual benefit. Supported by ESF.
RESULTS: All athletes presented with skin abrasion injuries, cold condition injuries, dehydration and environmental-related stress. Four subjects presented with soft tissue injuries. Vigour decreased continuously from the first 24 hours (p<0.05) whilst fatigue increased (p<0.05). This trend continued from start with values not recovering until recovery period post race. Continued activity resulted in increased levels of depression (p<0.05), tension (p<0.05) and confusion (p<0.05) which peaked at the 60 hour mark and decreased to the 72 hour mark. Mean sleep duration over the race period was 4.45 ± 0.12 hr: min.

CONCLUSION: Injury types and patterns documented were similar to those reported in previous adventure and ultra distance events held in extreme environments. Consistent with previous work, data shows increased fatigue and reduced vigour in response to reduced sleep.

E-26 Free Communication/Poster - Endocrine
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2857 Board #129 June 1 9:30 AM - 11:00 AM
Salivary Cortisol Production during the Ride Across America (RAAM): A Case Study and Exploratory Analysis
Matthew A. Stults-Kolehmainen1, Chuck J. Abolt2, Craig E. Broeder, FACSM1, Amy M. Flewelling1, Amanda J. Salacinski1, 1Northern Illinois University, DeKalb, IL, 2Duke University, Durham, NC. 1Exercising Nutritional Clinical Research Partners, Naperville, IL (No relationships reported)
PURPOSE: The aim of this study was to investigate the variation in salivary cortisol during the Ride Across America.
METHODS: A 51 year old elite endurance cyclist competed in the RAAM ride. Descriptives are provided in Salacinski et al. (2011, MSSE, vol 43, p S536). Saliva was collected with oral swabs throughout two different time periods: 21 awakening and before sleep samples at baseline (4 weeks before race) and 23 samples during the event and before/after periods of rest. Salivary cortisol was analyzed with a Salimetrics immuno-assay and a Biotek plate reader.
RESULTS: The subject completed 6 days, 11 hours and 19 minutes of the race before discontinuing. His average speed, including rest stops, was 10.3 mph. His mean power was 199.5 W for days 1&2 and 124 W for days 4&5. The mean cortisol concentration for 7 baseline awakening samples was 71 µg/dL (SD = .09) and before bed was .15 µg/dL (SD = .07). Seven samples were discarded for possible blood and/or sports drink contamination, leaving 16 samples (awakening: M = .35 µg/dL, SD = .23; during-race: M = .64 µg/dL, SD = .16; before bed: M = .51 µg/dL, SD = .05). Saliva pH increased from baseline (M = 7.14, SD = .74) to race time (M = 8.38, SD = .60), while 2.54 kg of fat mass was lost from pre to post race.
CONCLUSION: The subject displayed a normal cortisol production rhythm at baseline; however, race values demonstrate a state of hyper-activation, catabolism, and dysregulation.

2858 Board #130 June 1 9:30 AM - 11:00 AM
Effects of Varying Type of Physical Exercise on Children’s Salivary Cortisol
María Chiara Gallotta, Emanuele Franciosi, Gian Pietro Emerenziani, Valerio Bonavolontà, Marco Meucci, Luigi di Luigii, Laura Guidetti, Carlo Baldari, FACSM. University of Rome, Rome, Italy (No relationships reported)
PURPOSE: Aim of this study was to investigate whether different physical exercise conditions could induce different exercise-related changes on children’s salivary cortisol.
METHODS. Saliva collection of 48 children (8-11 years of age) took place before (Pre) and after (Post) 50 min of a traditional physical education (TPE) and of a coordinative physical education (CPE) lesson, respectively. Physical education (PE) sessions occurred at the same time (in the morning) of the same school day over 2 weeks. The school day was planned to have the same schedule every day during the experimental intervention with PE lessons preceded by academic classes. During the TPE lesson, children were instructed to exercise at a moderate to vigorous physical activity (MVPA corresponding to HR > 130 bpm) intensity without any specific instruction on motor coordination. The CPE lesson, conducted at the same exercise intensity, was characterized by a high variability of motor coordination and skill learning demands.
RESULTS. Results showed that participants’ salivary cortisol was significantly affected by Time (Pre vs Post) (5.51 ± 4.50 nmol/L vs 4.01 ± 2.70 nmol/L, F = 5.74; p<0.02), indicating a reduction of salivary cortisol after the two PE lessons independently of their content (F = 1.01; p=0.32).
CONCLUSION. We found that varying types of physical exercise did not differently affect children’s salivary cortisol concentration. Moreover, a significant decrease of the cortisol concentrations occurred from pre- to post-exercise. Our findings suggest that physical education could act as a distractor, leading to a reduction of school stress. These activities were probably enjoyable and relaxing for children and in turn cortisol decreased.

2859 Board #131 June 1 9:30 AM - 11:00 AM
Stress Hormone Biomarker Response in Fit and Unfit Premenopausal Women to One-Hour Aerobic Run
Lee Berk, FACSM, Paula Cavalcanti, Janhavi Soni, Shreenath Varadaran. Loma Linda University, Loma Linda, CA. (No relationships reported)
Exercise modulates the release of stress hormones and other biomarkers relative to fitness level. Various cohort studies have shown differential modulation of cortisol (CORT), HGH, TSH, FT4, insulin (INS) and iron-oxidation-binding protein myoglobin (MYO) with different exercise modalities. However, few studies have examined the differential response to aerobic exercise in fit and unfit premenopausal women.
PURPOSE: To compare low vs. high fitness premenopausal women for stress hormones and MYO blood biomarkers levels at rest and in response to a 1-hr aerobic exercise.
METHODS: 21 fit and 14 unfit premenopausal women ages 20-50 years, mean VO2 Max 42.2±5.3 and 27.9±3.3 mL/kg/min respectively, performed a 1-hr exercise 70-80% of max HR. Blood levels were determined at pre-exercise (Pr-E), immediate post-exercise (Ip-E) and 30 min post-exercise (30Po-E) for TSH, HGH, INS, FT4, CORT, 17β-Estradiol (17β-E) and MYO and adjusted for plasma volume shifts.
RESULTS: The proportion of menstrual states was similar in the two groups. 17β-E was not different between the fit and unfit group (94.6±54.6 vs. 90.7±66.8 pg/mL respectively, p=0.05). A 2x3 Mix Factorial ANOVA showed significant differences between groups in mean TSH (F=7.92; p=0.002; mean Pr-E was 1.61±0.26 for fit and 2.42±0.31 for unfit), HGH (F=19.50; p=0.002; 5.71±0.69 for fit and 5.0±1.82 for unfit), MYO (F=96.26; p<0.001; 1.76±0.66 for fit and 1.76±0.67 for unfit). Differences were found between Pr-E and 30min post exercise for TSH (p=0.003), HGH (p<0.001), MYO (p<0.001), Pr-E and Ip-E for MYO (p<0.001); and Ip-E and 30Po-E for TSH (p<0.001), HGH (p<0.001). One-way Repeated Measures showed difference in CORT levels over time in the fit group (F= 47.14; p<0.001) and unfit group (F=18.84; p<0.001). The differences were between Pr-E and Ip-E (fit: p<0.007; unfit: p=0.005), also, between Pr-E and 30Po-E (fit: p<0.007; unfit: p=0.007), and between Ip-E and 30Po-E (fit: pc<0.001; unfit: pc<0.001). ANCOVA showed no difference between groups for INS (F=26.92; p<0.837) and FT4 at Pr-E F=4.49; p=0.489).
CONCLUSION: Stress hormones CORT, HGH and MYO are differentially modulated in fit versus unfit premenopausal women. Further study is needed to elaborate the significance of these physiological differential responses, mechanisms and resultant stress implications in premenopausal women.
Changes in Selected Blood, Endocrine, and Myocardial Markers Measured During 24-hour Continuous Cycling

Serge P. von Duvillard, FACSM1, Rainer Hochgatterer2, Helmhut Ocemasek3, Martin Miehl1, Karin Vonbank1, Sabine Wurth1, Peter Hofmann, FACSM1, Gerhard Smekal1, Robert Berent1, Manfred Wonisch, FACSM2, Rochus Pokan, FACSM1. 1University of Salzburg, Salzburg, Austria. 2Hospital Linz, Linz, Austria. 1University of Vienna, Vienna, Austria. 3Medical University of Vienna, Vienna, Austria. 3University and Medical University of Graz, Graz, Austria. 3Centers for Cardiac Rehabilitation, Bad Schallerbach, Austria. 3Centers for Cardiac Rehabilitation, St. Radequand, Austria.

RESULTS: Two-way repeated measures ANOVA revealed a non-significant (P = 0.340) interaction between stage (time post-stress test) and cortisol concentrations with capillary versus venous cortisol sampling. Two-way repeated measures ANOVA revealed a non-significant (P = 0.340) interaction between stage (time post-stress test) and cortisol concentrations with capillary versus venous cortisol sampling. Two-way repeated measures ANOVA revealed a non-significant (P = 0.340) interaction between stage (time post-stress test) and cortisol concentrations with capillary versus venous cortisol sampling.

CONCLUSIONS: Capillary but not salivary is a valid technique for measuring whole blood cortisol following intense exercise.

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Vitamin D Supplementation and Physical Performance in Adolescent Swimmers

Naama W. Constantini, FACSM1, Netachen Livne2, Daniel Moran, FACSM3, Ruuan Raz2, Gal Dubnov-Raz1, 1Hadassah-Hebrew University Medical Center, Jerusalem, Israel. 2Hebrew University, Behovot, Israel. 3Ariel University Center of Samaria, Tel Aviv, Israel. 3Tel Aviv University, Tel Aviv, Israel. 3The Edmond and Lily Safra Children’s Hospital, Tel Hashomer, Israel.

RESULTS: Both groups improved their VO2 max after the aerobic exercise program (32.59±6.0 before vs 37.60±8.2 ml/min/kg after exercise in PRE p<0.01; 31.84±6.0 before vs 36.94±6.3 ml/min/kg after exercise in POST p<0.01). Important differences were observed between urinary androgens in both groups in basal values. Urinary testosterone (26.32±14.62 mg/nCr PRE vs 20.5±13.6 mg/nCr POST, p<0.05), DHEA (48.02±57.91 mg/nCr PRE vs 11.38±11.21 mg/nCr POST, p<0.05) and androstenedione levels (72.14±49.72 mg/nCr PRE vs 45.44±31.71 mg/nCr POST, p<0.05) were detected by mass spectrometry. After the exercise program, no changes in urinary androgens levels were observed in premenopausal women. However, the aerobic exercise caused an increase in urinary excretion of DHEA (11.38±11.21 mg/nCr PRE vs 55.13±57.17 mg/nCr after exercise p<0.05) in postmenopausal women.

CONCLUSION: Pre and postmenopausal women presented important differences in the basal levels of androgens. In postmenopausal women, moderate physical activity could raise levels of DHEA, probably due to an activation of the suprarenal gland. This elevation of androgens levels could bring health benefits for premenopausal women.

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Naama W. Constantini, FACSM1, Netachen Livne2, Daniel Moran, FACSM3, Ruuan Raz2, Gal Dubnov-Raz1, 1Hadassah-Hebrew University Medical Center, Jerusalem, Israel. 2Hebrew University, Behovot, Israel. 3Ariel University Center of Samaria, Tel Aviv, Israel. 3Tel Aviv University, Tel Aviv, Israel. 3The Edmond and Lily Safra Children’s Hospital, Tel Hashomer, Israel.

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CONCLUSION: Pre and postmenopausal women presented important differences in the basal levels of androgens. In postmenopausal women, moderate physical activity could raise levels of DHEA, probably due to an activation of the suprarenal gland. This elevation of androgens levels could bring health benefits for premenopausal women.
sprints. Swimming time and post-swim heart rate were measured for each stage of the test. Arm grip strength was measured using a dynamometer; balance was measured using the uni-pedaled stance test twice (eyes open/closed). All measures were taken pre- and post- intervention, and changes were calculated to serve as endpoints.

**RESULTS:** Mean serum 25(OH)D levels increased in the supplementation group (from 24.6±5.2 to 29.6±6.5 ng/ml; p<0.001) and decreased in the control group (from 24.6±4.9 to 20.3±4.3 ng/ml; p<0.001) during the study period. There were no significant between-group differences in swimming time, heart rate, strength, or balance changes post-supplementation. No significant correlations were found between age-adjusted vitamin D change in the whole study cohort, and changes in the measures of physical performance.

**CONCLUSION:** Vitamin D supplementation for 12 weeks to adolescent swimmers with vitamin D insufficiency did not affect swimming performance, power and balance, more than placebo. Despite the widespread concern that vitamin D insufficiency might influence sport performance, there is currently no evidence that improving vitamin D status would benefit these athletes. Additional studies in vitamin D deficient athletes and in other sport types are warranted.

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**2864 Board #136**

**June 1 9:30 AM - 11:00 AM**

Adiponectin is Negatively Correlated with Testosterone in Male and Female Rats

Lake A. Begg1, Joshua F. Yarrow2, Sean C. McCoy2, Christine F. Conover2, Stephen E. Borst2. 1University of Florida, Gainesville, FL 2VA Medical Center, Gainesville, FL.

(No relationships reported)

Adiponectin is an adipokine that is typically secreted in an inverse manner to adiposity, low concentrations of which are an independent risk factor for several metabolic disorders. The loss of endogenous sex-hormones increases adiposity in both males (M) and females (F) and has also been linked to a number of metabolic disorders including metabolic syndrome. Conversely, testosterone (T) administration generally reduces body fat. However, the influence of T on adiponectin requires further elucidation.

**PURPOSE:** To evaluate the effects of gonadectomy (GX) and supraphysiologic testosterone-enanthate (TE) administration on serum adiponectin in young M and F rats.

**METHODS:** Animals underwent GX or sham surgery and received either vehicle or TE (7.0 mg/kg, i.m.) for 28 days. Blood was collected at sacrifice for analysis.

**RESULTS:** Serum T was 3.3±1.0 (SHAM-M), 0.1±0.04 (GX-M), 41.5±3.1 (GX+TE-M), 0.5±0.1 (SHAM-F), 0.2±0.04 (GX-F), and 46.7±4.1 ng/ml (GX+TE-F). Serum estradiol (E2) was 4.6±0.8 (SHAM-M), 3.0±0.4 (GX-M), 6.4±0.6 (GX+TE-M), 8.8±0.7 (SHAM-F), 3.6±0.4 (GX-F), and 5.3±0.6 pg/ml (GX+TE-F). Serum adiponectin concentrations were 5760±561 (SHAM-M), 7418±429 (GX-M), 3132±179 (GX+TE-M), 6348±840 (SHAM-F), 10228±589 (GX-F), and 3738±255 ng/ml (GX+TE-F). Compared to SHAM, GX elevated adiponectin 29% (M; p<0.001) and 34% (F; p<0.01), while TE administration reduced adiponectin 58% (M) and 65% (F) compared to GX (p<0.001) and by 46% (M) and 53% (F) compared to SHAM (p<0.001). Strong negative correlations were present between T and adiponectin in both M (r=-0.747, p<0.001) and F (r=-.742, p<0.001). Conversely, E2 was not significantly associated with adiponectin in either sex.

**CONCLUSIONS:** T, but not E2, was inversely associated with adiponectin in both M and F. This is despite the fact that we have previously reported that T administration in rats reduces retroperitoneal fat pad mass 45% below GX animals, and that adiponectin is typically inversely related to fat mass. This suggests that adiponectin is regulated not only by adiposity, but also by T. The metabolic consequences associated with an elevated adiponectin following GX and a reduced adiponectin following supraphysiologic T administration remain to be identified.

Supported by a VA Merit Award to S.E. Borst

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**2865 Board #137**

**June 1 9:30 AM - 11:00 AM**

Systemic PGF2α Metabolite Response to Resistance Exercise and Naproxen Sodium

Christi Brewer, Mark Loftin, FACSM, John Garner, John Bentley, Elaine Day, Dwight Waddell. University of MS, University, MS.

(No relationships reported)

Prostaglandin F2α (PGF2α) is an endogenously produced growth factor that mediates satellite cell activity and protein incorporation into existing musculature after exercise-induced muscle injury. Accordingly, non-steroidal anti-inflammatory drugs, which inhibit prostaglandin production, have been shown to interfere with these cellular processes integral to adaptation and regeneration. Previous human research that has reported negative effects of drug-induced inhibition of PGF2α-mediated anabolic processes has limited its measurement to acute exercise, preventing decisive conclusions concerning concurrent use of anaglesics with repeated resistance exercise.

**PURPOSE:** To determine if chronic consumption of naproxen sodium (440mg) inhibits adaptation to exercise using systemic sources of PGF2α metabolites.

**METHODS:** 23 recreationally-trained college-aged males were randomly assigned to receive either placebo (n=11) or naproxen sodium (n=12). Treatments were prophylactically administered in double-blind fashion with supervised upper body resistance exercise performed twice per week for 6 weeks. Venous blood (6ml) was sampled pre- and post-workouts 1, 7, and 11 and analyzed for PGF2α metabolites using enzymeimmunoassay. Factorial mixed design ANOVA was employed to determine acute and chronic differences in systemic plasma PGF2α metabolites (pg/ml).

**RESULTS:** Factorial analysis of metabolite concentrations (pg/ml) revealed significant effects of time (p<0.005) and acute exercise (p<0.015), with average systemic metabolite increases of 13.5±11.3 pg/ml in placebo-treated participants versus 2.7±2.4 pg/ml in naproxen-treated. Analysis of the acute metabolic response, expressed as a percent change pre- to post-exercise, revealed significant treatment effects, with naproxen sodium inhibiting the typical increase in PGF2α after resistance exercise nearly two-fold. Naproxen sodium was not found to inhibit the rate of strength or size development.

**CONCLUSIONS:** While functional outcomes of strength and size showed no significant treatment effects over 6 weeks, continued inhibition of the hormonal response to resistance exercise may delay attainment of muscular fitness goals.

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**2866 Board #138**

**June 1 9:30 AM - 11:00 AM**

Effects Of Exercise Training On Insulin And IGF-1 Concentrations In Cerebellum Of Diabetic Rats

Luciana Arantes, Natalia Bertolini, Rodrigo Moura, Maria Alice Rostom de Mello, Eliete Luciano. Sao Paulo State University, Rio Claro, Brazil.

(No relationships reported)

Physical activity has proven effective increase in metabolic control in diabetic rats, and is an important component in treatment of diabetes, but less is known concerning any effects of aerobic training on insulin and IGF-1 concentrations in cerebellum of diabetic rats.

**PURPOSE:** The present study investigated the role of swimming training on cerebral metabolism of insulin and IGF-1 concentrations in cerebellum of diabetic rats.

**METHODS:** Forty Wistar rats were divided in four groups: sedentary control (SC), trained control (TC), sedentary diabetic (SD), and trained diabetic (TD). Diabetes was induced by Alloxan (35 mg kg b.w.), single dose injection. The mean blood glucose of diabetic groups was 367±40 mg/dl. Training program consisted in swimming 5 days/week, 1 h/day, 8 weeks, supporting a workload corresponding to 90% of maximal lactate steady state (MLSS). For MLSS determination, rats were submitted to three sessions of 25-min, in alternate days, supporting loads of 4, 5, or 6% of body wt. Blood samples were collected every 5 min for lactate determination. All dependent variables were analyzed by one-way analysis of variance (ANOVA) and a significance level of P<0.05 was used for all comparisons. At the end of the training period, rats were killed by decapitation and cerebellum was extracted. Insulin and IGF-1 contents determination was done by radioimmunoassay and ELISA commercial kit, respectively.

**RESULTS:** There was no difference between groups for cerebellum IGF-1 content (SC = 5.58±0.37 ng/mL/mg of wt; TC = 4.78±0.21 ng/mL/mg of wt; SD = 4.5±0.5 ng/mL/mg of wt; TD = 5.7±0.44 ng/mL/mg of wt). Insulin concentrations were not different between groups (SC = 8.8±1.3 uU/mL/g; TC = 9.2±2.6 uU/mL/g; SD = 9.3±2.4 uU/mL/g; TD = 11±1.4 uU/mL/g).

**CONCLUSION:** It was concluded that in diabetic rats, aerobic training does not induce alterations on cerebellum insulin and IGF-1 contents.
E-27  Free Communication/Poster - Endocrine - Reproductive
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

Board #139  June 1  11:00 AM - 12:30 PM
Effect of Voluntary Wheel Running on the Sex-hormone of High-fat Feeding Impuberism Male SD Rats
Yi Yan, XIE Minhao, SUN Jingquan, ZHAO Yan, LIU Junsh. Beijing Sport University, Beijing, China. (Sponsor: Tongjian You, FACSM)
(No relationships reported)
The sex hormone imbalance and sexual development delay of obese boy are associated with the nutritional obesity of high-fat and high-energy diet. However, the effect of exercise on obesity-related sex hormone imbalance is still not well known.

PURPOSE: To compare the sex hormone level of high-fat feeding and normal diet SD rats in response to voluntary wheel running.

METHODS: 3-weeks newly weaned SD rats were randomly assigned to normal diet and high-fat diet group (normal diet sedentary: NS, n=8, normal diet exercise: NE, n=8, high-fat diet sedentary: FS, n=8, high-fat diet exercise: FE,n=8) groups. After one-week adaptive feeding and one-week adaptive training, rats of SE and FE group were individually placed into the wheel-cage to do voluntary wheel running 1 hour each half day, 5days per week for 6 weeks. Food intake and running distance were monitored daily and body weight weekly. The testicile weight, testicle testosterone, estradiol; and serum testosterone, estradiol, luteinizing hormone and follicle-stimulating hormone were measured.

RESULTS: There were significant negative effects of high-fat diet on bodyweight, testicile weight, serum estradiol (all p<0.01) and testicile testosterone (p<0.05). The 6-weeks voluntary wheel running had no significant effect on the bodyweight, testicile weight and sex hormone (all p>0.05) of NS and FS. Compared to NS, FS had not only lower level of bodyweight (129.69±17.16 vs. 336.67±29.32 g, p<0.01), testicile weight (2.03±0.83 vs. 3.18±0.22 g, p<0.01), but also lower serum testosterone detectable rate (3.75% vs 87.5%). The detected serum testosterone of FS was lower (49.17±32.20 vs 91.51±86.35 ng/ml) too. In addition, FS had higher level of serum estradiol (129.04±40.55 vs. 52.66±16.29 g, p<0.01) than NS. There were no significant difference between NS and NE. FS and FE.

CONCLUSIONS: Long term high-fat diet will inhibit the growing development of newly weaned SD rats, and induce the imbalance of sex hormone. 6-weeks voluntary wheel running of two times per day can not potentially improve the growth of high-fat feeded newly weaned SD rats. The effective exercise load needs to be further detected.
Supported by NSFC of China with No. of 30800541.

Board #140  June 1  11:00 AM - 12:30 PM
Aerobic Exercise Training During Pregnancy Improves Mitochondrial Function In Human Placenta
Juanita Bustamante, Ph.D1, Robinson Ramirez-Velez, Ph.D2, Ana C. de Plata Aguilar, MS.c, Analia Czemiczyniec, Ph.D1, Silvia Lores-Arnaiz, Ph.D2. 1University of Buenos Aires, Buenos Aires Argentina, Argentina. 2University of Valle, Cali, Colombia.
(No relationships reported)

INTRODUCTION: Aerobic exercise enhances mitochondrial biogenesis and performance, favoring tighter coupling between β-oxidation and tricarboxylic acid cycle, and may concomitantly improve mitochondrial function in skeletal muscle. In other tissues, aerobic exercise in non-pregnant women affects mitochondrial function however; it is not known whether exercise produces the same effect in human placental mitochondria.

OBJECTIVES: To determine the effects of aerobic exercise training in the second half of pregnancy on mitochondrial function from human placenta.

METHODS: This was a randomized, double-blinded, controlled clinical trial of 20 healthy primigravid women between 16 and 20 weeks’ gestation. The training group (n=10) took part in aerobic exercise at an intensity of 50-65% of their maximum heart rate for 60 min, three times a week for 16 weeks. The control group (n=10) undertook their usual physical activity. Oxygen consumption, enzyme activity of respiratory complexes, and hydrogen peroxide production were measured as mitochondrial function parameters.

RESULTS: Oxygen consumption was not significantly affected by training. Activity of complex I-III of the mitochondrial respiratory chain was increased by 29% in human placental mitochondria from exercised women, as compared with control subjects (p<0.05). Also, significant increases of 45% and 27%, (p<0.05) were observed in complexes II-III and in complex IV respectively in placental mitochondria from exercised women, as compared with the controls. Mitochondrial H2O2 production rate was decreased by 27% in placental mitochondria from exercised women, as compared with control subjects (p<0.05).

CONCLUSION: Aerobic training improves mitochondrial function in human placenta by increasing mitochondrial respiratory complexes activity and decreasing H2O2 production. This intervention favors fetal oxygenation and substrate delivery and could help protection on gestational disorders associated to impaired mitochondrial function. Trial registration. NCT00741312.

Board #141  June 1  11:00 AM - 12:30 PM
Effect Of Endurance Training On Nitric Oxide Synthase Activity And Expression In Human Placenta
Silvia Lores-Arnaiz1, Robinson Ramirez-Velez2, Ana C. de Plata Aguilar2, Analia Czemiczyniec1, Juanita Bustamante. 1University of Buenos Aires, Buenos Aires Argentina, Argentina. 2University of Valle, Cali, Colombia.
(No relationships reported)

INTRODUCTION: Many studies have documented that placental development is altered by a variety of environmental factors such as aerobic exercise training which alter placental bed blood flow and/or oxygen delivery. The placenta lacks innervation, thus vascular tone regulation depends on endothelial release of vasoactive molecules such as nitric oxide (NO). Although exercise-induced increases in blood flow and in endothelial nitric oxide synthase (eNOS) expression have been reported; it is not known if exercise produces the same effect in human placenta. Objectives: To determine the effects of aerobic exercise training in the second half of pregnancy on eNOS expression and on NO production in human placenta.

METHODS: This was a randomized, double-blinded, controlled clinical trial of 20 healthy primigravid women between 16 and 20 weeks’ gestation. The training group (n=10) took part in aerobic exercise at an intensity of 50-65% of their maximum heart rate for 60 min, three times a week for 16 weeks. The control group (n=10) undertook their usual physical activity. A spectrophotometric assay was used to measure NOS activity in cytosolic samples from placental tissue and Western Blot technique was used to determine endothelial NOS expression.

RESULTS: The ratio eNOS/β-actin expression was 4-fold increased in cytosolic samples from exercised women. A 2-fold increase in NOS activity was observed in cytosolic samples from exercised women.

CONCLUSION: Training during pregnancy leads to an increase in eNOS expression and in total NO production in placental cytosol. Greater eNOS expression may also underlie the effects of exercise in the protection of gestational disorders associated to endothelial dysfunction.Trial registration. NCT00741312.
### E-28 Free Communication/Poster - Environmental Stress

**Board #143 June 1 9:30 AM - 11:00 AM**

**Cardiovascular Time Courses During Prolonged Dry Apnea in Exercising Divers**

Renza Perini, Michela Capogrosso, Sabrina Donati, Andrea Sivieri, Guido Ferretti. *Università di Brescia, Brescia, Italy.*

**Purpose:** To study the effect of increased M' on cardiovascular time courses during apnea.

**Methods:** 8 divers (age 36±7 yrs) performed voluntary maximal apnea: A) sitting at rest; B) pedaling at 30 W on a cycle ergometer. BP (finger photo-plethysmography) and arterial O2 saturation (SaO2, infrared spectroscopy) were continuously recorded before, during and after apnea. M' was measured before and after apnea by a metabolic cart. Beat to beat HR, systolic (Ps) and diastolic (Pd) pressures were obtained.

**Results:** A) apnea lasted 227±62 s. In ph I (29±3 s), HR decreased from 98±11 b/min to 82±13 b/min, returning to control values (ctrl), Ps remained equal to ctrl (140±11 mmHg), Pd (51±6 mmHg). In ph II (102±32 s), all parameters were stable, then HR fell to 57±6 b/min, while Ps and Pd increased, respectively, to 215±23 mmHg and 105±16 mmHg after 110±35 s (ph III). SaO2 was 91±5 % at the end of ph II (p<0.05) and 75±13% at the end of apnea. B) apnea lasted 88±21 s. M' was twice as at rest. During the first 24±7 s (ph a), cardiovascular parameters remained unchanged. HR (112±9 b/min) was 15±10 b/min above exercise steady state values. Ps was 167±15 mmHg and Pd 81±15 mmHg. In the following 64±22 s (ph b), a continuous fall of HR and increase in Ps and Pd occurred. At the end of apnea, HR was 55±10 b/min, Ps 244±24 mmHg and Pd 112±13 mmHg. SaO2 started to drop after ~30 s of apnea to 76±11% at the end.

**Conclusions:** apnea at exercise, with higher M', showed different cardiovascular trends from static apnea. The lack of stable cardiovascular values after the first phase a and the steep decrease in SaO2 suggest early chemoreflex activation, inducing progressive bradycardia and hypertension. The absence of initial HR drop indicates that the level of autonomic activity affects the cardiac response to breath-holding.

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### 2871 Board #142 June 1 11:00 AM - 12:30 PM

**Effects of Chronic Exercise on DNA Methyltransferase Expression in Mouse Testes**

Michael P. Marini, Lisa M. Guth, Andrew C. Venezia, Estefan P. Beltran, Espen E. Spangenberg, Stephen M. Roth, FACSM. *University of Maryland, College Park, MD.*

(No relationships reported)

**Purpose:** To examine the role of physical activity as represented by voluntary wheel running on the expression of DNA methyltransferases (DNMTs) in mouse testes.

**Methods:** Male C57BL/6J mice were randomly assigned to cages with exposure to an exercise running wheel (EX, n = 8), or cages without running wheels (SED, n = 10) from age 8 weeks to 28 weeks, at which point they were sacrificed and testes were extracted. Isoform-specific mRNA expression of isoforms of several genes that govern de novo attachment of DNA methylation marks (*Dnmt3a1, Dnmt3a2, Dnmt3b2/3*) were measured in testes and compared to a housekeeping gene (18s).

**Results:** EX males ran an average of 3610 ± 581 m/24hrs over the 20-week intervention. There was no significant difference (p>0.05) in average testicular weight between EX (101.4 ± 3.9 mg) and SED (106.6 ± 2.6 mg) cohorts. Expression levels for *Dnmt3a1, Dnmt3a2* and *Dnmt3b2/3* showed no significant differences between EX and SED cohorts after 20 weeks of exercise intervention.

**Conclusions:** These preliminary findings indicate that physical activity as represented by voluntary wheel running does not affect expression of genes that govern de novo DNA methylation in mouse testes.

This work was supported by NIH grant HD062868.
Comparison Of Serum Toxic Metals Concentrations Between Athletes And Sedentary People
Guillermo Ocina1, Carmen Crespo1, Francisco Llerena2, Javier Brazo2, Concepción Robles3, Marcos Maynar4, M Jesús Caballero2, 1Sport Sciences Faculty, University of Extremadura, Cáceres, Spain, 2Faculty of Medicine. University of Extremadura, Badajoz, Spain.

PURPOSE: To determine acute effects of flotation R.E.S.T. following maximal eccentric exercise.

Paul M. Morgan, Amanda J. Salacinski, Matthew Stults-Kolehmainen. Northern Illinois University, DeKalb, IL

METHODS: A randomized crossover study of twenty-four (N=24) untrained male subjects (23.29 ± 2.1 yr, 184.17 ± 6.85 cm, 85.16 ± 11.54 kg) participated over a 14 day period. Subjects with baseline measures as covariates. DOMS comparisons made using MANOVA.

RESULTS: Mean blood lactate lower following FLOAT (1.11 ± .27 vs 1.77 ± .98, p < 0.05) as was mean pain of knee extensors (.67 ± 1.03 vs .99 ± 1.26, p < 0.05). Mean torque (N·M) of knee extensors greater following SEAT (242.12 ± 65.46 vs 223 ± 58.03, p < 0.05). No significance observed in knee flexors, heart rate, glucose, RPE, pain, and torque analyzed with MANCOVA with baseline measures as covariates. DOMS comparisons made using MANOVA.

CONCLUSIONS: Flotation REST lowers blood lactate following a one hour flotation R.E.S.T. session, while alleviating pain in the knee extensors. Flotation REST appears to hinder ability to produce torque as proinflammation is suppressed. Therefore, flotation REST may help with recovery, but may also cause torque decrement in the following hour.
flexible cannula. Recordings were made every minute for 60 min before and after each of the treatments. During WBC participants stood in a chamber (-60±3°C) for 20 sec before entering the main chamber (-1.0°C±3°C) where they remained for 3 min and 40 sec. For CWI participants were seated in a tank filled with cold water (8±0.3°C) and immersed to the level of the sternum for 4 min. Absolute change in temperature from baseline every 10 min after treatment were analysed using a two-way ANOVA with repeated measures. The α-level was set at 0.05.

RESULTS: Muscle temperature was significantly reduced at 20, 30, 40, 50 and 60 min after both cooling modalities (p<0.01). A maximum reduction of 1.6 and 1.7°C, after WBC and CWI respectively, was recorded 60 min after treatment. However there was no significant difference between treatments (p=0.29).

CONCLUSIONS: These results suggest that WBC is effective in producing a delayed reduction in IM that is similar to that experienced after CWI.

2877  Board #149  June 1  9:30 AM - 11:00 AM
Compare Manual-Wheelchair Driving Performance in Virtual and Real Environment
Yu-Chun Liao1, Kai-Jie Sie2, Jien-Ren Huang1, Wen-Hsu Sung1, Tien-Yow Chuang3, 1National Yang-Ming University, Taipei, Taiwan. 2National Central University, Taipei, Taiwan. 3Taipei Veterans General Hospital, Taipei, Taiwan.

(No relationships reported)

People with physical disability usually need delivery aids to be independent in activities of daily life, and manual-wheelchair (MW) is one of the common delivery aids. Ability of MW driving is usually evaluated by therapists subjectively, partly underestimated and partly overestimated; whereas it is sometimes evaluated by clients' self-administered questionnaire, and is easily overestimated. We tried to develop a virtual reality MW driving system for evaluating the driving performance objectively.

PURPOSE: Compare MW driving performance in virtual environment (VE) and real environment (RE).

METHODS: Thirty healthy adults were recruited to drive a modified MW in both VE and RE. The modified MW was equipped with sensors to measure the subject's driving actions. All subjects executed three tasks: 1. straight forward (SF), 2. straight backward (SB), and 3. S-type forward (STF) in both VE and RE. In VE-tests, visual image was displayed in head mounted display (HMD). Task Complete Time (TCT) and driving path Boundary Collision Times (BCT) were used to evaluate driving performance. Measured data was analyzed with paired sample t-test and the level of .05 was set for statistical significance.

RESULTS: The average and standard deviations (SD) of BCT of SF, SB, and STF in VE were 0.07(±0.00), 0.38(±0.12) and 2.07(±1.32) respectively. Significant differences of BCT were found in the SF and STF test (p=0.00). The average and SD of TCT (in seconds) of SF, SB, and STF in VE were 17.7(±7.5), 18.3(±11.0), and 33.4(±13.2) respectively, and the values in RE were 10.9(±4.1), 15.6(±7.8), and 20.5(±6.4) respectively. Significant difference of TCT was found in the STF test (p=0.00). All of the average and SD in VE tests was greater than the relative values in RE, showing that driving performance was worse and varies greatly in VE. It may mainly result from the visual field limitation of HMD (field of view=40 degrees in diagonal). The limited visual field increased the difficulty of the tasks in VE.

CONCLUSION: The MW driving performance in VE was worse than it in RE, and we found that it may result from the visual field limit of HMD. In the future, we expect that, after modifying the limited HMD visual field, we may use these tasks in VE to evaluate MW driving performance in RE.

2878  Board #150  June 1  9:30 AM - 11:00 AM
Does Cardiovascular Health/Fitness Protect Hearing Acuity in College Students Who Use Earbud Headphones?
Helaine M. Alessio, FACSM, Ian Cramer, Lisa Treadway, Kendra Marchiondo, Sarah Stephenson, Sarah Wagner, Kathleen Hutchinson. Miami University, Oxford, OH.

(No relationships reported)

Although hearing loss has been associated with advanced age, two other factors have been shown to significantly impact hearing sensitivity: (1) use of earbud headphones when listening to personal listening devices (PLD's) due to the way they funnel sounds into the ear canal and fail to block out ambient noises, and (2) cardiovascular (CV) health, due to the importance of circulation to and oxygen utilization in muscles and bones of the inner ear.

PURPOSE: Investigate factors that affect hearing acuity in college students who listen to PLDs.

METHODS: Hearing sensitivity, earbud use, CV health and other audiological, behavioral, and health-related variables were measured in a sample of college students (N=140). Hearing sensitivity was assessed in all subjects at multiple frequencies to determine normal and abnormal hearing levels across a normal spectra of listening frequencies. Volume and duration of actual listening when using PLDs were directly measured. Maximum oxygen consumption (VO2max), body mass index, daily physical activity (PA), and blood lipid levels (total cholesterol/high density lipoprotein (TC/HDL)) were assessed.

RESULTS: The majority of students listened within relatively safe decibel ranges, although standards for PLD's do not exist. The following trends were observed in this sample: hearing acuity was best in students who had rarely used PLD's (mean±SE=4±2 vs. 8±4±2 dB), (p<.05). There was no clear evidence for cardiovascular health/fitness as indicated by VO2max, BMI, TC/HDL, and PA providing protection against hearing loss in college students (Mean Right Ear High Frequency Pure Tone Threshold and Mean VO2max: r = 0.25, BMI: r = 0.06, daily PA: r = 0.00, and TC/HDL: r = 0.00).

CONCLUSION: Using earbud headphones to listen to PLD's negatively impacts hearing acuity in college-aged students. There is no trend for high levels of cardiovascular health or fitness protecting hearing acuity compared with moderate fit college aged students, regardless of listening habits.

2879  Board #151  June 1  9:30 AM - 11:00 AM
Mild Dehydration Decreases Repeated Hill Cycling Performance In The Heat
Costas N. Bardis, Stavros A. Kavouras, FACSM, Giannis Amaoutis, Marietta Markousi, Lena Kosti, Labros S. Sidossis. Harokopio University, Athens, Greece.

(No relationships reported)

Dehydration greater than 2% of body weight, decreases exercise performance. However, the effect of mild dehydration (≤2%) is not clear.

PURPOSE: The purpose of this study was to determine the effect of mild dehydration on repeated hill cycling performance in a warm environment (32.5±0.2°C).

METHODS: A randomized crossover design was used. Ten endurance cyclists (age: 29±6 years, weight: 75.5±6.9 kg, height: 1.78±0.07 m, VO2max: 52.4±3.3 ml·min⁻¹·kg⁻¹ and Powermax: 358±18 W) completed on two separate trials a performance test consisted of three bouts of 5 km race pace hill cycling, followed by 5 km at 50% of max power output, in a laboratory ergometer. Before the performance test subjects cycled for an hour with or without water drinking, to ensure that subjects started the performance test euhydrated (EIH) or dehydrated (DEH) by 0±0% & -0.9±0.1%, respectively. After each 5 km cycling bout body weight was taken and subjects were rehydrated with water to avoid greater dehydration. Dehydration at the end of the test was for the EIH and DEH trials -0.5±0.1% and -1.7±0.1%, respectively.

RESULTS: Time to completion of the 1st, 2nd and 3rd 5km hilly cycling was faster in EIH trial (10.8±1.3 min, 11.0±1.3 min, 11.3±1.7 min) than the DEH trial (11.3±1.3 min, 11.7±1.8 min, 11.8±1.9 min). (p<0.05). As a result, mean power output was significantly greater during EIH 268±56 W than DEH 254±58 W. Core temperature at the end of the performance test was greater in DEH (38.2±0.2°C) than EIH (37.9±0.3°C). (p<0.05). Significant no differences were found between conditions for heart rate and lactic acid.

CONCLUSION: It was concluded that mild dehydration decreased cycling performance in a hot environment, possibly by inducing greater thermal load.
CONCLUSION: Breast cancer (BrCa) survivors are at increased risk of experiencing late and long-term effects of their treatment. Risk for recurrence of BrCa and cardiovascular disease (CVD) increases in long-term BrCa survivors largely because of the indirect effects of their diagnosis, including inactivity and weight gain. In addition, increased weight and inactivity are associated with primary BrCa. Inactivity can lead to low cardiorespiratory (CR) fitness level, which has been associated with CVD, BrCa, and all-cause mortality.

PURPOSE: Describe and compare CR fitness, measured as $V_{O_2 \text{peak}}$, in BrCa survivors and women at high-risk for developing BrCa.

METHODS: Thirty BrCa survivors and 21 controls were matched by age and CVD risk. Breast cancer survivors were 50.5 ± 5.6 years old and approximately 4.5 years from initial treatment. All BrCa survivors were treated with chemotherapy and/or left chest radiation and had at least 2 CVD risk factors. High-risk controls were 49.1 ± 6.5 years old, had at least 2 CVD risk factors, and high-risk for BrCa. High-risk for BrCa included a family history of BrCa and multiple (> 1) breast biopsies, but had never been exposed to anti-hormonal therapy for BrCa prevention. All participants performed a graded maximal cardiopulmonary exercise test using indirect calorimetry while walking on a treadmill.

RESULTS: $V_{O_2 \text{peak}}$ mean values (+/- S.D.) for BrCa survivors resulted in 25.4 ± 5.3 ml/kg/min compared to 26.3 ± 4.5 ml/kg/min for high-risk controls. Comparison between BrCa survivors and high-risk controls was done using a Student’s t-test, showing no significant difference in $V_{O_2 \text{peak}}$ ($p=0.52$). Twenty-six of 30 BrCa survivors and all 21 high-risk controls tested below the 20th percentile based on their age group and gender for aerobic fitness as established by the American College of Sports Medicine.

CONCLUSION: Breast cancer survivors and high-risk controls in this study had a marked decrease in $V_{O_2 \text{peak}}$ putting them at a higher risk for CVD, BrCa, and all cause mortality. Strategies to improve CR fitness should be targeted in future primary prevention and survivorship trials.

Supported by Back in the Swim and NIH BIRCWH K12 Grant.

University of Kansas Medical Center’s CTSA, NIH/NCR Grant Number UL1RR033179.

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**2880 Board #152 June 1 11:00 AM - 12:30 PM**

**Aerobic Fitness in Breast Cancer Survivors and High-Risk Control Group**

Dave Burnett, Jennifer Klemm, Patty Kluding, Charles Porter, Carol Fabian. Kansas University Medical Center, Kansas City, KS.

(No relationships reported)

Breast cancer (BrCa) survivors are at increased risk of experiencing late and long-term effects of their treatment. Risk for recurrence of BrCa and cardiovascular disease (CVD) increases in long-term BrCa survivors largely because of the indirect effects of their diagnosis, including inactivity and weight gain. In addition, increased weight and inactivity are associated with primary BrCa. Inactivity can lead to low cardiorespiratory (CR) fitness level, which has been associated with CVD, BrCa, and all-cause mortality.

**PURPOSE:** Describe and compare CR fitness, measured as $V_{O_2 \text{peak}}$, in BrCa survivors and women at high-risk for developing BrCa.

**METHODS:** Thirty BrCa survivors and 21 controls were matched by age and CVD risk. Breast cancer survivors were 50.5 ± 5.6 years old and approximately 4.5 years from initial treatment. All BrCa survivors were treated with chemotherapy and/or left chest radiation and had at least 2 CVD risk factors. High-risk controls were 49.1 ± 6.5 years old, had at least 2 CVD risk factors, and high-risk for BrCa. High-risk for BrCa included a family history of BrCa and multiple (> 1) breast biopsies, but had never been exposed to anti-hormonal therapy for BrCa prevention. All participants performed a graded maximal cardiopulmonary exercise test using indirect calorimetry while walking on a treadmill.

**RESULTS:** $V_{O_2 \text{peak}}$ mean values (+/- S.D.) for BrCa survivors resulted in 25.4 ± 5.3 ml/kg/min compared to 26.3 ± 4.5 ml/kg/min for high-risk controls. Comparison between BrCa survivors and high-risk controls was done using a Student’s t-test, showing no significant difference in $V_{O_2 \text{peak}}$ ($p=0.52$). Twenty-six of 30 BrCa survivors and all 21 high-risk controls tested below the 20th percentile based on their age group and gender for aerobic fitness as established by the American College of Sports Medicine.

**CONCLUSION:** Breast cancer survivors and high-risk controls in this study had a marked decrease in $V_{O_2 \text{peak}}$ putting them at a higher risk for CVD, BrCa, and all cause mortality. Strategies to improve CR fitness should be targeted in future primary prevention and survivorship trials.

Supported by Back in the Swim and NIH BIRCWH K12 Grant.

University of Kansas Medical Center’s CTSA, NIH/NCR Grant Number UL1RR033179.

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**2881 Board #153 June 1 11:00 AM - 12:30 PM**

**Cardiorespiratory And Neuromuscular Deconditioning In Fatigued And Non-fatigued Breast Cancer Survivors**

Sarah E. Neil1, Riggs J. Klika, FACSM², S Jayne Garland1, Donald C. McKenzie1, Kristin L. Campbell1, 1University of British Columbia, Vancouver, BC, Canada. 2Cancer Survivor Center for Health and Wellbeing, Aspen, CO.

(No relationships reported)

**PURPOSE:** Fatigue is one of the most commonly reported side effects during treatment for breast cancer, and for some fatigue can continue for an extended period following treatment completion. Cancer-related fatigue is multi-factorial in nature, and one hypothesized mechanism of both development and persistence of cancer-related fatigue following treatment is cardiorespiratory and neuromuscular deconditioning. The purpose of this study is to compare measures of cardiorespiratory and neuromuscular deconditioning in breast cancer survivors who meet the ICD-10 criteria for cancer-related fatigue with breast cancer survivors who report no fatigue.

**METHODS:** Participants performed a graded incremental exercise test on a cycle ergometer for determination of power output at lactate threshold, lactate threshold as a percentage of peak power output, and absolute and relative $V_{O_2 \text{peak}}$. Central and peripheral causes of muscle fatigue were assessed following a sustained contraction of the right quadriceps using the twitch interpolation technique and voluntary activation, peak force of the electrically-evoked twitch and the maximum voluntary contraction, and endurance time were measured.

**RESULTS:** The fatigue group reached lactate threshold at a lower power output than the control group (61.9 16.5 vs. 78.2 25.2 W, p=0.05), but there were no differences between groups for lactate threshold as a percentage of peak power output (46.7 8.2 vs. 55.4 14.7%, p=0.10), peak power output (134.4 36.2 vs. 146.8 49.4 W, p=0.46), absolute $V_{O_2 \text{peak}}$ (1.53 0.37 vs. 1.79 0.36 L/min, p=0.08), or relative $V_{O_2 \text{peak}}$ (22.9 4.7 vs. 25.2 7.5 ml/kg/min, p=0.33). When adjusted for age, the fatigue group had a lower power output at lactate threshold (60.5 ± 5.0 vs. CG 80.2 ± 6.1 W, p=0.02) and absolute $V_{O_2 \text{peak}}$ (1.50 ± 0.09 vs. 1.83 ± 0.11 L/min, p=0.03). There were no significant differences in any of the neuromuscular parameters between groups.

**CONCLUSION:** These findings support the hypothesis that cardiorespiratory deconditioning may play a role in the development and persistence of cancer-related fatigue following treatment. Future research into the use of exercise training as a tool to improve cardiorespiratory deconditioning and thereby reduce this proposed aspect of cancer-related fatigue is warranted.

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**2882 Board #154 June 1 11:00 AM - 12:30 PM**

**Effects Of Resistance Training On Muscular Strength, Body Composition And Functionality In Breast Cancer Survivors**

Takudwa A, Madzima, Emily Simonavice, Pei-Yang Liu, Jasminzka Z. Ilich, Jeong-su Kim, Bahram H. Arjmandi, Lynn B. Panton, FACSM. Florida State University, Tallahassee, FL.

(No relationships reported)

In addition to normal age-related changes, breast cancer survivors (BCS) encounter many side effects from cancer treatments that negatively affect muscular strength, body composition, and functionality. Studies have shown that resistance training (RT) in older adults can improve strength, body composition and functionality.

**PURPOSE:** To evaluate the efficacy of a RT intervention to modulate muscular strength, body composition, and functionality in BCS over a six-month period.

**METHODS:** Twenty-seven BCS (age: 64±7 yrs; BMI: 27.7±5.5kg/m²) were measured pre and post training for the following variables: muscular strength (chest press and leg extension) via one-repetition maximums (1-REP), body composition (lean mass, fat mass, lean to fat mass ratio) via dual energy X-ray absorptiometry and functionality via the continuous scale physical functional performance (CS-PFP) test. RT consisted of two days/week of ten exercises including two sets of 8-12 repetitions at ~60-80% of 1-REP. Data were analyzed using one way analysis of variances. Significance was accepted at p<0.05.

**RESULTS:** BCS significantly increased upper (70.2±22 to 88.4±22kg) and lower body (71±23 to 89±30kg) strength. There were no changes in lean mass (39.9±6.3 to 40.3±6.3kg), fat mass (30.7±9.2 to 30.9±3.9kg), percent body fat (43.0±5.2 to 43.8±5.1%), or the lean to fat mass ratio (1.36±0.31 to 1.37±0.30) over the 6 months of training. Total functionality significantly increased (66±12 to 74±12 units) along with the functionality subscales of upper body strength (64±16 to 71±17 units), lower body strength (59±15 to 69±16 units), balance and coordination (67±12 to 75±12 units), and endurance (67±12 to 75±12 units).

**CONCLUSIONS:** Six months of moderate RT significantly improved strength and functionality in BCS. Although, RT did not significantly alter body composition measures of lean and fat mass it did offset the negative decrements (loss of muscle, increase in adiposity) that usually occur as a result of cancer related treatments and aging. Funded in part by the California Dried Plum Board
2883  Board #155  June 1  11:00 AM - 12:30 PM  
**The Effect Prior Physical Activity has on Physiological and Psychological Outcomes in Cancer Survivors**  
Andrew R. Smith, Trent L. Lalonde, Brent M. Peterson, Jessica M. Brown, Kurt Dallow, FACSM, Reid Hayward, Carole M. Schneider, FACSM. Rocky Mt Cancer Rehab, Univ Northern Colorado, Greeley, CO.  
(No relationships reported)  
Cancer survivors are impacted by physical and emotional responses associated with diagnosis and treatment. Current research shows that exercise provides a positive effect in cancer survivors at various stages in their recovery.  
**PURPOSE:** To investigate the effect physical activity level prior to beginning a cancer rehabilitation program has on physiological and psychological outcomes in cancer survivors following a supervised 3-month exercise intervention.  
**METHODS:** Two hundred forty-seven cancer survivors participated in initial fitness assessments examining heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP), cardiorespiratory fitness (VO2peak), and abdominal strength (crunches). In addition, subjects completed inventories assessing fatigue and depression. Subjects were divided into three groups based on self-reported physical activity prior to the initial assessment; none (no prior physical activity), low (< 150 minutes of prior physical activity per week), and moderate (∇ 150 minutes of prior physical activity per week). Subjects were given an individualized prescription and participated in 3 months of supervised exercise. Subjects were reassessed following the 3-month intervention.  
**RESULTS:** No significant differences (p>.05) were found between prior physical activity and any of the physiological or psychological variables assessed following the 3-month intervention. However, significant improvements (p<.01) were found when comparing percent change pre to post 3-month exercise in all physiological and psychological variables (HR (-2.56%), SBP (-1.45%), DBP (-1.20%), VO2peak (+17.51%), crunches (+60.53%), fatigue (-2.13%), and depression (-2.24%)].  
**CONCLUSION:** The results of this study suggest that cancer survivors demonstrate improved physiological and psychological outcomes following a supervised three-month exercise intervention regardless of their physical activity level prior to entering a cancer rehabilitation program.

2884  Board #156  June 1  11:00 AM - 12:30 PM  
**Initial Physiological and Psychological Measures in Cancer Survivors During Treatment Versus Following Treatment**  
Colin J. Quinn, Jessica M. Brown, Trent L. Lalonde, Kurt Dallow, FACSM, Reid Hayward, Carole M. Schneider, FACSM. Rocky Mt Cancer Rehab, Univ Northern Colorado, Greeley, CO. North Colorado Family Medicine, Greeley, CO.  
(No relationships reported)  
There have been suggestions that once cancer survivors complete treatment that exercise interventions can be similar to the apparently healthy population. This implies that the negative effects of cancer treatments occur during treatment with no lingering side-effects once treatment is completed.  
**PURPOSE:** To compare cancer survivors’ initial physiological and psychological assessment values during treatment to the initial values of cancer survivors’ following treatment.  
**METHODS:** Five hundred eighty-one cancer survivors participated in initial fitness assessments examining pulmonary function, cardiorespiratory fitness (VO2peak), muscular strength, resting heart rate and blood pressure. Additionally, participants completed inventories of depression, fatigue, and quality of life. Participants were separated into two groups, those who were in treatment (n=99) and those who had completed treatment (n=482).  
**RESULTS:** Significant differences were found on the initial assessment values between groups for VO2peak (p<.05). Cancer survivors in treatment exhibited higher VO2peak scores (24.06±.76 ml/kg/min) on the initial assessment compared to cancer survivors who had completed treatment (21.97±.33 ml/kg/min). No significant differences were found in measures of pulmonary function, muscular strength, resting heart rate and blood pressure. Initial psychological parameters (depression, fatigue, quality of life) were not significantly different between groups.  
**CONCLUSION:** The higher initial VO2peak Values for cancer survivors during treatment suggest that the cumulative negative effects of cancer treatments occur throughout the treatment regimen. Cancer survivors following treatment treatment have cumulative negative side-effects and therefore need to participate in an exercise intervention designed specifically for cancer survivors.

2885  Board #157  June 1  11:00 AM - 12:30 PM  
**Validation of the Rocky Mountain Cancer Rehabilitation Institute Multistage Treadmill Protocol for Cancer Survivors**  
Daniel Y.K. Shackelford, Jessica M. Brown, Trent L. Lalonde, David S. Hydock, Carole M. Schneider, FACSM. Rocky Mt Cancer Rehab, Univ Northern Colorado, Greeley, CO.  
(No relationships reported)  
Currently there is not a multistage treadmill protocol for cancer survivors. Most protocols have stages that are either too high in intensity or too long in duration and are highly stressful for cancer survivors. The Rocky Mountain Cancer Rehabilitation Institute (RMCRI) developed a treadmill protocol designed specifically for cancer survivors to address this issue.  
**PURPOSE:** To validate the RMCRI multistage treadmill protocol for cancer survivors.  
**METHODS:** Fifteen cancer survivors completed a randomized double validation study to compare oxygen consumption (VO2peak) between two protocols. The RMCRI treadmill protocol, using gas analysis to determine VO2peak, was validated against the Bruce protocol. Participants completed the randomized trials one week apart in random order. The Bruce protocol VO2peak was then compared with the VO2peak recorded from the gas analysis for the RMCRI treadmill protocol. Additionally, ACSM’s predicted VO2peak equations were validated against the RMCRI protocol using gas analysis.  
**RESULTS:** No significant differences (p=.98) in VO2peak were found between the RMCRI protocol and the Bruce protocol and these values were significantly correlated with the RMCRI gas analysis test (R²=.712, p<.003). The VO2peak achieved using RMCRI gas analysis compared to ACSM’s predicted VO2peak equations showed no significant difference (p=.72). The VO2peak values obtained with ACSM’s predicted VO2peak equations were significantly correlated with the VO2peak values from the RMCRI protocol gas analysis (R²=.830, p<.001). This suggests ACSM’s predicted equations may be used in place of gas analysis for the RMCRI protocol.  
**CONCLUSION:** The RMCRI multistage treadmill protocol which has shorter stages and lower intensities was better tolerated and less stressful for cancer survivors. Given the validity and strong correlations to other treadmill protocols, the RMCRI cancer protocol specific should be the standard for the determination of functional capacity (VO2peak) in cancer survivors.

2886  Board #158  June 1  11:00 AM - 12:30 PM  
**Evaluation of Two Common Field Tests as Surrogate Measures of Strength in Breast Cancer Survivors**  
Melissa J. Benton, FACSM, Maura C. Schlairé, David R. Gibson. Valdosta State University, Valdosta, GA.  
(No relationships reported)  
Valid field measures of strength are potentially useful for clinical assessment of breast cancer survivors who are at risk for loss of strength, especially of the upper body, secondary to surgical mastectomy.  
**PURPOSE:** To evaluate the relationship between two common field tests and two traditional laboratory measures of upper and lower body strength.  
**METHODS:** Before and after 8 weeks of resistance training (RT), 20 female breast cancer survivors (42-80 years old) completed field testing using the Arm Curl test for upper body and Chair Stand test for lower body, followed by laboratory strength measurement using seated Chest Press for upper body and seated Leg Press for lower body. A minimum of 24 hours rest was insured between field and laboratory measurement sessions. The number of repetitions achieved in 30 seconds for the Arm Curl and Chair Stand tests was evaluated against the greatest weight pressed ten times (10RM) for the Chest Press and one time (1RM) for the Leg Press.  
**RESULTS:** After 8 weeks of RT, upper and lower body strength increased significantly (Arm Curl = 16.8 ± 0.8 to 21.3 ± 0.8 repetitions; Chair Stand = 14.4 ± 1.3 to 17.1 ± 1.2 repetitions; Chest Press = 14.2 ± 1.1 to 26.5 ± 1.4 kg; Leg Press = 61.6 ± 2.9 to 82.6 ± 6.1 kg; p < 0.001). Neither upper nor lower body strength, measured either by field or laboratory tests, was...
significantly related to participant age, time since diagnosis, or mastectomy status. There was strong intraclass agreement between pre- and post-RT values for each laboratory and field test (ICC = 0.74-0.96). Pearson correlation analysis identified strong, positive relationships between all pre- and post-RT field tests (r = 0.60-0.81, p < 0.01), and between all pre- and post-RT laboratory tests (r = 0.56-0.88, p < 0.05). However, no relationship was found between upper or lower body field and laboratory tests (p > 0.05), either before or after RT.

CONCLUSIONS: For clinical assessment of breast cancer survivors, use of either field or laboratory tests can provide reliable measures of change over time. However, based on our findings, field tests cannot be considered valid surrogates for actual laboratory measurement of either upper or lower body strength. Moreover, increased familiarity with laboratory tests based on training status does not affect these findings.

E-30 Free Communication/Poster - Fitness and Performance Testing IV
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2887 Board #159 June 1
9:30 AM - 11:00 AM
Assessment Of Field-attainable Variables For In The Quantification Of Physiological Load
Robert W. Wilson, II, Thomas S. Goeppinger, Bruce A. Wade, Ann C. Snyder, FACSM. University of Wisconsin - Milwaukee, Milwaukee, WI.

The attainment of peak performance has led coaches to plan practice sessions, with the goal of either increasing or maintaining performance capabilities. Periodization advocates that this is accomplished by adjusting the training load through changing the volume and/or the intensity of the physical work performed. The periodized plan is a prescription of load; as such it does not provide a measure of each individual’s internal physiological load (PL). Several methods have been proposed to calculate the individual PL in a field setting using heart rate (HR). Recent technological advances now allow for additional objective variables, such as respiration rate (RR), activity (ACT), percent of maximal HR (%HRmax), body posture (BP), skin temperature (ST), and peak acceleration (PA) data, which could enhance the assessment of PL to be obtained.

METHODS: To determine if these additional variables enhance the assessment of PL, we hypothesize that a multiple variable equation will produce a better fit regression equation. We further hypothesize that using the Karvonen method of %HRmaxK with RR and/or ACT will produce a better fit equation than using %HRmax alone.

RESULTS: Of the 538 regression analyses that were run, the best equation was cubic and included only the %HRmaxK variable (r=0.88, R2=77.9%, p<0.001).

CONCLUSIONS: The best fit equation utilized only %HRmaxK not RR or ACT contrary to our hypotheses. This is due to the high variability of the RR data and the low variability of the ACT data. Therefore, this analysis indicates that HR expressed as %HRmaxK is the best variable for assessing PL. The cubic regression line is very similar to an expected lactate curve with a low slope at low intensities and a fast rise toward the end.

2888 Board #160 June 1
9:30 AM - 11:00 AM
Cross-validation Of The 20-meter Shuttle Run Test For Predicting VO2max In Basketball And Soccer Players
Barbara E. Bloomquist, Michael R. Esco, Andreena N. McHugh, Henry N. Williford, FACSM. Auburn University Montgomery, Montgomery, AL.

The 20-meter shuttle run test (MST) has been shown to be an accurate field parameter for predicting maximal oxygen consumption (VO2max) field settings and is commonly used in aerobically trained individuals, such as soccer athletes. However, research examining the accuracy of the MST in athletes whose sport involves a mixed metabolic contribution from aerobic and anaerobic energy systems, such as basketball, has not been fully explored.

PURPOSE: The purpose of this study was to cross-validate the MST for predicting VO2max between soccer and basketball collegiate male athletes.

METHODS: College-age male athletes (age range = 18 to 24 years) from the university’s soccer (n = 49) and basketball (n = 62) teams were evaluated for VO2max via open circuit spirometry and maximal graded treadmill testing (TMT). The athletes performed the MST and predicted VO2max was calculated from the following regression equation: VO2max = -27.4 + 6.0 × maximal running speed (Leger et al. 1989;Mercier et al., 1983).

RESULTS: The following cross-validation statistics were computed: r = 0.79 (p < 0.01), SEE = 4.01 ml·kg⁻¹·min⁻¹ and r = 0.82 (p < 0.01), SEE = 2.42 ml·kg⁻¹·min⁻¹ for the soccer and basketball athletes, respectively. The mean (± SD) values for VO2max via TMT and MST were 56.04 (± 6.54) ml·kg⁻¹·min⁻¹ and 55.65 (± 5.36) ml·kg⁻¹·min⁻¹, respectively, for the soccer athletes and 51.60 (± 4.24) ml·kg⁻¹·min⁻¹ and 53.60 (± 3.84) ml·kg⁻¹·min⁻¹, respectively, for the basketball athletes. A paired t-test indicated that these values were not significantly different for the soccer (p > 0.05) but were for the basketball (p < 0.05) group. Lland-Altman Plots showed that the 1.96 SD of the bias ranged from -8.28 ml·kg⁻¹·min⁻¹ to 7.32 ml·kg⁻¹·min⁻¹ in the soccer athletes and from -27.6 ml·kg⁻¹·min⁻¹ to 6.76 ml·kg⁻¹·min⁻¹ for the basketball athletes.

CONCLUSIONS: The results of this investigation indicate that the MST is a moderate field predictor of VO2max in collegiate soccer and basketball players. However, predicted VO2max may be slightly higher than actual VO2max in male basketball players.

2889 Board #161 June 1
9:30 AM - 11:00 AM
Cross-Validation Of The 20-meter Shuttle Run Test For Predicting VO2max In Male And Female Soccer Players
Aindreena N. McHugh¹, Michael S. Green², Michael R. Esco³, Henry N. Williford, FACSM⁴, Tyler D. Martin⁵, Barbara E. Bloomquist⁶, Robert Pritchett⁷. Auburn University Montgomery, Montgomery, AL. ¹Troy University, Troy, AL. ²Central Washington University, Ellensburg, WA.

The 20-meter shuttle run test (MST) has been shown to be an accurate test for predicting maximal oxygen consumption (VO2max) in field settings and is commonly used in soccer players. However, it is not fully known if the precision of the MST for predicting VO2max in soccer athletes is sex-specific.

PURPOSE: The purpose of this study was to cross-validate the MST for predicting VO2max between male and female collegiate soccer players.

METHODS: Eighty-nine male (n = 49) and female (n = 40) college soccer players (age range = 18 - 24 years) were evaluated for VO2max using open circuit spirometry and maximal graded treadmill testing (GXT). Athletes performed the MST and predicted VO2max was calculated from the following regression equation: VO2max = -27.4 + 6.0 × maximal running speed (Leger et al., 1989).

RESULTS: The following cross-validation statistics were computed: r = 0.78 (p < 0.01), SEE = 4.14 ml·kg⁻¹·min⁻¹ and r = 0.49 (p < 0.01), SEE = 2.87 ml·kg⁻¹·min⁻¹ for the male and female subjects, respectively. Mean (± SD) values for VO2max via GXT and MST were 56.04 (± 6.54) ml·kg⁻¹·min⁻¹ and 57.00 (± 5.51) ml·kg⁻¹·min⁻¹, respectively, for the men and 44.20 (± 3.25) ml·kg⁻¹·min⁻¹ and 45.73 (± 3.75) ml·kg⁻¹·min⁻¹, respectively, for the women. A paired t-test indicated these values were not significantly different for the men (p > 0.05) but were for the women (p < 0.05). Bland-Altman Plots showed that the 1.96 SD of the bias ranged from -7.13 ml·kg⁻¹·min⁻¹ to 9.03 ml·kg⁻¹·min⁻¹ in the men and from -5.40 ml·kg⁻¹·min⁻¹ to 8.56 ml·kg⁻¹·min⁻¹ for the women.

CONCLUSIONS: The results of this investigation indicate that the MST is a moderate field predictor of VO2max in collegiate soccer players. However, MST may be slightly more accurate in a group of male compared to a group of female athletes. The mean value for predicted VO2max was slightly higher (~1.53 ml) than actual VO2max in the female subjects.
The end of the test. A backward stepwise multiple regression analysis was utilized to establish a prediction equation for VO$_{2\text{max}}$. The primary hypothesis was assessed using a chi-square analysis. All other analyses were evaluated using an independent samples t-test.

RESULTS: A total of 84 injuries from 64 athletes were recorded during the course of the study. The injury rate for those with high (>14) and low (≤14) composite FMS score were not significantly different (p=0.15). The mean FMS score from the injured group (15.4 ± 2.3) was only slightly lower than those in the uninjured group (16.4 ± 2.8) (p < 0.05). The injury rate was not different between athletes with at least one asymmetry in any of the individual movements and athletes without asymmetry (p=0.62). However, low scores on specific elements of the FMS (deep squat) were related to the occurrence of specific injuries (ankle sprain).

CONCLUSIONS: A low composite FMS score (<14) did not predict injury in this group of Division III athletes. The small difference in mean FMS score between the injured and non-injured questions the utility of the composite score to identify those at risk of injury. Additional findings of this study suggest that individual scores from the seven movements that comprise the FMS, rather than the composite score, may be more predictive of who will sustain an injury and the type of injury sustained.

**Board #163 June 1 9:30 AM - 11:00 AM**

**A Prediction Equation for Determining Maximal Oxygen Uptake in Competitive Cyclists**

Frank Wyatt, Midwestern State University, Wichita Falls, TX.

(Purpose: To examine prediction accuracy of HR using the Borg Scale (RPE) multiplied by 10) under different protocols and workload intensities with a Chinese sample.

METHODS: 7 healthy males (22.88±0.83 yr) completed an incremental exercise (3 min at 50 Watts, followed by 50 Watt/3 min increase) to exhaustion on an electric braked bicycle, as well as each exercise at their 20, 40, 60, 80, and 100% VO$_{2\text{max}}$ intensities to steady state or exhaustion. HR and RPE by the Borg scale were measured at the end of each stage of incremental exercise and each steady exercise. The estimated HRs by Borg Scale (HR-e) were compared with the ones directly measured by Polara-RR400 using a correlated t-test.

RESULTS: Means and SDs of HR-e and HR-m were summarized as follows:

<table>
<thead>
<tr>
<th>HR-m</th>
<th>HR-e</th>
<th>HR-m</th>
<th>HR-e</th>
<th>HR-m</th>
<th>HR-e</th>
<th>HR-m</th>
<th>HR-e</th>
<th>HR-m</th>
<th>HR-e</th>
</tr>
</thead>
<tbody>
<tr>
<td>133.49</td>
<td>65.57</td>
<td>62.76</td>
<td>61.00</td>
<td>57.14</td>
<td>56.43</td>
<td>54.76</td>
<td>54.14</td>
<td>66.14</td>
<td>65.14</td>
</tr>
</tbody>
</table>

Comparison between HR-m and HR-e during incremental exercise:

<table>
<thead>
<tr>
<th>Comparison</th>
<th>HR-m (Mean ± SD)</th>
<th>HR-e (Mean ± SD)</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
<tr>
<td>40% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
<tr>
<td>60% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
<tr>
<td>80% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
</tbody>
</table>

Comparison between HR-m and HR-e during steady exercise:

<table>
<thead>
<tr>
<th>Comparison</th>
<th>HR-m (Mean ± SD)</th>
<th>HR-e (Mean ± SD)</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
<tr>
<td>40% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
<tr>
<td>60% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
<tr>
<td>80% VO$_{2\text{max}}$</td>
<td>133.49 ± 65.57</td>
<td>65.57 ± 62.76</td>
<td>t = 2.84, p = 0.00</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion**: The Borg scale could accurately predict subjects’ actual body status during steady exercise and low intensity(20% and 40% VO$_{2\text{max}}$) of incremental exercise for the Chinese young adults, but its predictive accuracy reduced at the high-intensity from 60% VO$_{2\text{max}}$ during incremental exercise.
Many persons use 1-RM bench press prediction equations to estimate 1-RM to save time and reduce the possibility of injury. However, little is known of how training status impacts the predictive accuracy of these equations.

**PURPOSE:** To investigate the effect of trained vs untrained status on the accuracy of 1-RM prediction equations.

**METHODS:** 40 male subjects, 20 trained (TR) and 20 untrained (UTR) (age=21.7 ± 2.3 yrs; height=179.9 ± 6.2 cm; weight= 86.2 ± 9.7 kg) served as subjects. All subjects were instructed on proper bench press technique prior to performing the 1-RM. Three to five days later an additional bench press test consisting of weight load x maximal repetitions to volitional fatigue was performed. The second test results were utilized to estimate 1-RM from ten prediction equations. Seven of the equations were taken from published material and three from the world wide web (W). Data were analyzed via a repeated measures ANOVA with a Tukey's post hoc follow-up.

**RESULTS:** UT and TR performed between three and seven repetitions using loads equivalent to 80 to 97% 1-RM. Five of the prediction equations produced estimates that were not significantly different (p>.05) from the actual 1-RM, and five equations overestimated 1-RM performance in both UTR and TR. The difference between predicted and actual 1-RM values for the same equations produced overestimations ranging from 2-6% in UT and from 3-5% in TR.

**CONCLUSIONS:** Some prediction equations for estimating 1-RM appear to be accurate while others tend to overpredict 1-RM performance. Training status does not appear to be a major factor impacting the predictive accuracy for selected equations.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Untrained</th>
<th>Trained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brzycki</td>
<td>86.0 ± 11.9</td>
<td>108.3 ± 19.7</td>
</tr>
<tr>
<td>MuscleNet (W)</td>
<td>83.3 ± 11.7</td>
<td>108.3 ± 19.7</td>
</tr>
<tr>
<td>NatPhys (W)</td>
<td>83.3 ± 11.7</td>
<td>108.5 ± 19.7</td>
</tr>
<tr>
<td>O'Connor et al.</td>
<td>83.6 ± 11.7</td>
<td>108.3 ± 19.8</td>
</tr>
<tr>
<td>Lander</td>
<td>84.1 ± 12.0</td>
<td>109.5 ± 20.0</td>
</tr>
<tr>
<td>Wathan</td>
<td>85.9 ± 7.4*</td>
<td>112.0 ± 20.5*</td>
</tr>
<tr>
<td>Musc&amp;Str (W)</td>
<td>86.0 ± 12.0*</td>
<td>112.1 ± 20.5*</td>
</tr>
<tr>
<td>Epley</td>
<td>86.3 ± 12.0*</td>
<td>112.1 ± 20.5*</td>
</tr>
<tr>
<td>Lombardi</td>
<td>87.4 ± 12.6*</td>
<td>112.9 ± 20.7*</td>
</tr>
<tr>
<td>Mayhew et al.</td>
<td>89.0 ± 12.9*</td>
<td>114.6 ± 21.0*</td>
</tr>
<tr>
<td>1-RM (kg)</td>
<td>84.0 ± 11.9</td>
<td>108.6 ± 19.5</td>
</tr>
</tbody>
</table>

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Maximum Bench Press (1-RM) performance is often used as a measure of strength. However, prediction equations from maximal repetitions and load lifted are frequently used to predict 1-RM to reduce the possible risk of injury involved with 1-RM testing.

**PURPOSE:** To determine the accuracy of ten prediction equations for estimating 1-RM from sub-maximal repetitions and load lifted.

**METHODS:** 235 subjects (age = 20.3 ± 1.8 yrs; height = 179.5 ± 7.4 cm; weight = 78.9 ± 12.8 kg) with various levels of training experience served as subjects. All subjects were instructed in proper bench press technique prior to determination of 1-RM. An additional bench press test consisting of maximal repetitions (range = 3 to 10) performed with submaximal loads until volitional fatigue was utilized to estimate 1-RM from the prediction equations. Seven of the equations were taken from published material and three from the world wide web (W). Data were analyzed via a repeated measures ANOVA with a Tukey’s post hoc test performed as needed. Alpha was set at p<.05 apriori.

**RESULTS:** Two of the prediction equations produced significantly different (p<.05), four equations over predicted (1.2-2.4%) while four under predicted (1.3-3.4%).

**CONCLUSION:** Although the results indicate that many rep-max prediction equations present significantly different estimates of 1-RM bench press, prediction errors are relatively small, hence allowing reasonable estimates of maximal strength in young men.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Predicted 1RM</th>
</tr>
</thead>
<tbody>
<tr>
<td>O'Connor et al.</td>
<td>84.8 ± 20.9*</td>
</tr>
<tr>
<td>MuscleNet (W)</td>
<td>86.2 ± 21.4*</td>
</tr>
<tr>
<td>Brzycki</td>
<td>86.2 ± 21.5*</td>
</tr>
<tr>
<td>NatPhys (W)</td>
<td>86.5 ± 21.5*</td>
</tr>
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<td>Lander</td>
<td>87.0 ± 21.6</td>
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<td>Lombardi</td>
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<tr>
<td>Epley</td>
<td>88.4 ± 21.9*</td>
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<td>Musc&amp;Str (W)</td>
<td>85.5 ± 20.9*</td>
</tr>
<tr>
<td>Wathan</td>
<td>88.8 ± 22.1*</td>
</tr>
<tr>
<td>Mayhew et al.</td>
<td>90.5 ± 22.1*</td>
</tr>
<tr>
<td>1-RM (kg)</td>
<td>87.4 ± 21.7</td>
</tr>
</tbody>
</table>

*p<.05
Purpose: To determine the aerobic parameters that best predict 10 kilometer (km) running performance.

Methods: On separate days 31 subjects completed a maximal incremental test on a treadmill for determination of gas exchange threshold (GET) and maximal oxygen uptake (VO₂max), and at least four constant speed tests to exhaustion on a treadmill for determination of the speed-duration relationship (critical speed (CS) and the finite distance that can be traversed above CS (ΔD)). On a different day each subject ran 10 km on an indoor 200 meter track.

Results: While 10 km time was significantly inversely correlated with absolute GET (r² = 0.143; p = 0.033) and relative GET (r² = 0.224; p = 0.007), absolute VO₂max (r² = 0.231; p = 0.006) and relative VO₂max (r² = 0.558; p < 0.0001), it was best correlated with CS (hyperbolic CS, r² = 0.777; p < 0.0001; 1/1 time CS, r² = 0.847; p < 0.0001). 10 km pace (10.4 ± 1.9 km·h⁻¹) was significantly slower than the hyperbolic CS (11.7 ± 2.0 km·h⁻¹) (p < 0.001) and the 1/1 time CS (12.3 ± 2.1 km·h⁻¹) (p < 0.001), but was not significantly different from the speed at GET (9.6 ± 2.1 km·h⁻¹) (p = 0.079), despite the lack of significant correlation between these two measures (r² = 0.101; p = 0.082).

Conclusion: CS best predicts the average velocity and elapsed time for a 10 km running test.

Purpose: To determine if high-resolution accelerometers (HRA) could be used to evaluate other laboratory measures (VO₂ and lactate threshold) to predict performance in collegiate cross country runners.

Methods: All subjects consented to procedures approved by EMU CHHS human subjects review committee. 7 NCAA Division 1 cross country runners (21.7 ± 1.4 yr; 67.8 ± 6.4 kg; 177.8 ± 5.1 cm, 67.4 ± 4.7 ml/kg/min) completed 3,000m and 10,000m performance trials (3kTT and 10kTT), and 1 incremental trial on a treadmill, which included wearing an HRA (Microstrain, VT) superficial to the L3 vertebra at the approximate center of mass. Blood lactate levels (Lactate Pro, JP) and metabolic gases (Jaeger, CA) were measured to determine pace at LT (LTP).

Results: Relationships between measured variables and 3kTT are presented elsewhere. Mean 3kTT and 10kTT times were 8.69 ± 0.15 and 31.5 ± 1.17 min, respectively. LTP (19.77 ± 0.90) was correlated to 10kTT (r=-0.880, p<.001) and 3kTT was correlated with 10kTT (r=0.698, p<.001). Linear stepwise regressions including LTP, 3kTT and other laboratory measures were excluded from the model.

Conclusion: Adding HRA parameters to other laboratory or shorter performance measures improves performance predictions for the 10k in collegiate distance runners over standard laboratory measures or shorter performances alone. Further research is needed to determine if shorter performances can be used in the prediction (e.g. 1500m), or performance can be predicted in longer events (e.g. marathon) using this approach.

Purpose: The purpose of this study was to determine if high-resolution accelerometers (HRA) could be used in conjunction with other laboratory measures (VO₂ and lactate threshold) to predict performance in collegiate cross country runners.

Methods: All subjects consented to procedures approved by EMU CHHS human subjects review committee. 7 NCAA Division 1 cross country runners (21.7 ± 1.4 yr, 67.8 ± 6.4 kg, 177.8 ± 5.1 cm, 67.4 ± 4.7 ml/kg/min) completed 3,000m and 10,000m performance trials (3kTT and 10kTT), and 1 incremental trial on a treadmill, which included wearing an HRA (Microstrain, VT) superficial to the L3 vertebra at the approximate center of mass. Blood lactate levels (Lactate Pro, JP) and metabolic gases (Jaeger, CA) were measured to determine pace at LT (LTP), VO₂max, and speed at VO₂max (VmaxSpeed).

Results: Root-mean-square (RMS) of HRA signal was examined in three planes of motion (VT, ML, AP) and the Euclidian scalar (RES). The ratio of RMS of each axial acceleration to RES was determined (VT max MLmax AP max), as well as the axial and RES accelerations to speed (VT, ML, AP, RES). Laboratory measures and performance data were compared by correlation and stepwise regression using SPSS 19 (IBM, NY).

Conclusion: Relationships between measured variables and 3kTT are presented elsewhere. Mean 3kTT and 10kTT times were 8.69 ± 0.15 and 31.5 ± 1.17 min, respectively. LTP (19.77 ± 0.90) was correlated to 10kTT (r=-0.880, p<.001) and 3kTT was correlated with 10kTT (r=0.698, p<.001). Linear stepwise regressions including LTP, 3kTT and other laboratory measures (VO₂, VO₂max) did not significantly improve relationships with 10kTT over LTP alone. When HRA parameters were added to LTP, 3kTT, and VO₂max, significant and substantially stronger relationships were obtained (r=0.993, p<0.001).

Conclusion: Adding HRA parameters to other laboratory or shorter performance measures improves performance predictions for the 10k in collegiate distance runners over standard laboratory measures or shorter performances alone. Further research is needed to determine if shorter performances can be used in the prediction (e.g. 1500m), or performance can be predicted in longer events (e.g. marathon) using this approach.

Purpose: The purpose of this study was to determine if high-resolution accelerometers (HRA) could be used in conjunction with other laboratory measures (VO₂ and lactate threshold) to predict performance in the 3000m among collegiate distance runners.

Methods: All subjects consented to procedures approved by EMU CHHS human subjects review committee. 7 NCAA Division 1 cross country runners (21.7 ± 1.4 yr, 67.8 ± 6.4 kg, 177.8 ± 5.1 cm, 67.4 ± 4.7 ml/kg/min) completed 3,000m and 10,000m performance trials (3kTT and 10kTT), and 1 incremental trial on a treadmill, which included wearing an HRA (Microstrain, VT) superficial to the L3 vertebra at the approximate center of mass. Blood lactate levels (Lactate Pro, JP) and metabolic gases (Jaeger, CA) were measured to determine pace at LT (LTP), VO₂max, and speed at VO₂max (VmaxSpeed).

Results: Relationships between measured variables and 3kTT are presented elsewhere. Mean 3kTT and 10kTT times were 8.69 ± 0.15 and 31.5 ± 1.17 min, respectively. LTP (19.77 ± 0.90) was correlated to 10kTT (r=-0.880, p<.001) and 3kTT was correlated with 10kTT (r=0.698, p<.001). Linear stepwise regressions including LTP, 3kTT and other laboratory measures (VO₂, VO₂max) did not significantly improve relationships with 10kTT over LTP alone. When HRA parameters were added to LTP, 3kTT, and VO₂max, significant and substantially stronger relationships were obtained (r=0.993, p<0.001).

Conclusion: Adding HRA parameters to other laboratory or shorter performance measures improves performance predictions for the 10k in collegiate distance runners over standard laboratory measures or shorter performances alone. Further research is needed to determine if shorter performances can be used in the prediction (e.g. 1500m), or performance can be predicted in longer events (e.g. marathon) using this approach.
RESULTS: The measured value of c constant was .0185 with no significant differences between ET, ST and MD athletes. The predicted (P) and experimental (E) results for the total cohort had significant correlations from .96 to .99 (p<0.01): EMANs (m/kg•1•s•1) [P(1.79 ± .24), E(1.78 ± .24)]; EMAS (m/kg•1•s•1) [P(0.80 ± .1), E(0.81 ± .11)] and RERIE [P(2.25 ± .36), E(2.23 ± .32)]. The RERI model predicted track and treadmill all out running performances to within an average of 2.26 ± 1.89 % (R2 = .99) and 2.95 ± 2.51 % (R2 = .99) respectively.

CONCLUSION: The RERI model may be accurate in predicting all out track and treadmill running performances for a wide range of distances from short, middle up to 5000m.

2899 Board #171 June 1 9:30 AM - 11:00 AM Predicting Mets And Activity Type From Accelerometer Counts Using Different Machine Learning Tools
Patty Freedson, FACSM1, Sarah Kozey-Keadle1, Kate Lyden2, John Staudenmayer1. 1University of Massachusetts, Amherst, MA. 2University of Massachusetts, Amherst, Amherst, MA. (P. Freedson: Honoraria; Actigraph,)

There are numerous machine learning tools available for processing and interpreting accelerometer output to estimate METs and activity type. However, it is not known if certain machine learning tools are superior for translating accelerometer signals into MET estimates or for identifying activity type.

PURPOSE: To compare the accuracy and precision of 4 machine learning methods in estimating METs and detecting activity type from accelerometer counts.

METHODS: Four machine learning tools (neural network [NNET], classification/regression tree [CRT], support vector machine [SVM], and random forest [RF]) were used to estimate activity METs and activity type (household, locomotion and sport activity) in 277 adults using signal features from the GT1M Actigraph accelerometer counts (1 sec epoch). Hold-one-out cross-validation procedures were used to test the accuracy and precision of each of the models using measured METs and observed activity types as the criterion measures.

RESULTS: The table below presents the bias and rMSE for estimated METs, the correlations between measured and estimated METs and the accuracy of activity type classification.

<table>
<thead>
<tr>
<th></th>
<th>Bias</th>
<th>MSE</th>
<th>Classification accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNET</td>
<td>0.003</td>
<td>1.44</td>
<td>95.6%</td>
</tr>
<tr>
<td>CRT</td>
<td>0.014</td>
<td>1.65*</td>
<td>94.4%</td>
</tr>
<tr>
<td>RF</td>
<td>0.004</td>
<td>1.47</td>
<td>95.3%</td>
</tr>
<tr>
<td>SVM</td>
<td>0.001</td>
<td>1.50</td>
<td>96.4%</td>
</tr>
</tbody>
</table>

*significantly different than NNET, RF and SVM, p<0.05

CONCLUSION: The significantly higher rMSE for CRT is due to the less flexible nature of CRT. In general, all machine learning tools are accurate and precise in estimating METs and identifying activity type categories in a lab setting. Future investigations will apply these tools to free-living conditions.

Supported by NIH RO1 CA121005

2900 Board #172 June 1 9:30 AM - 11:00 AM Estimated VO2max From The Rockport Walk Test On A Non-motorized Curved Treadmill
Rhiannon M. Senell, Ann C. Snyder, FACSM. University of Wisconsin - Milwaukee, Milwaukee, WI. (No relationships reported)

The Rockport Walk Test (RWT) is a field test used to estimate maximal volume of oxygen uptake (VO2max). It consists of a one-mile walk on a measured track. The purpose of this research project was to compare the power achieved during five five-minute intervals and one twenty-minute effort. Five five-minute intervals is a commonly used workout for competitive cyclists who periodically replace a workout with one twenty-minute effort to obtain important information about power, but at the expense of a more productive workout.

METHODS: Twenty-three healthy adults (females = 10; 19-44 years old) who were sedentary to recreationally active volunteered for the study. One trial of the RWT was performed on a measured indoor track and another on the CT on different days at random. Subjects were instructed to walk one-mile at a brisk, steady pace. Heart rate (HR) and completion time were used to calculate VO2max using 6 different general and gender specific equations from previous research. Subjects also performed a treadmill graded exercise test (GXT) which was used as the criterion measure for VO2max measurements. Correlation coefficients and prediction equations were used to test the accuracy and precision of each of the models using measured VO2max and observed values from the GXT through RM ANOVA, Pearson correlations (r), and Bland-Altman plots. The α was set at .05.

RESULTS: There was no difference between completion times for the RWT in the overground and CT conditions but the CT produced significantly higher HR’s. There was no difference between relative estimations of VO2max using the Kline et al. (1987) general and gender specific equations on the RWTC when compared to the Dolgener et al. (1994) equation on the RWTO (p = .561 and .335). There was no difference in the absolute estimations of VO2max for the RWTC with the Kline et al. (1987) general equation and the RWTO with the Dolgener et al. (1994) general equation (p = .204). All VO2max estimations were significantly different from observed VO2max except for the estimation produced by the relative general Kline et al. (1987) equation on the RWTO. Despite high correlations (r = 0.75-0.91) the RWTC underestimated VO2max.

CONCLUSION: The RWTC underestimates VO2max but may be beneficial if a new equation were created specifically for the CT.

2901 Board #173 June 1 9:30 AM - 11:00 AM Predicting Twenty-Minute Power from Five Five-Minute Intervals in Competitive Cyclists
Steven J. Albrechtsen, Jason R. Boynton. University of Wisconsin, Whitewater, WI. (No relationships reported)

PURPOSE: The purpose of this research project was to compare the power achieved during five five-minute intervals and one twenty-minute effort. Five five-minute intervals is a commonly used workout for competitive cyclists who periodically replace a workout with one twenty-minute effort to obtain important information about power, but at the expense of a more productive workout.

METHODS: Nine cyclists competing at the category 3 level or above completed five five-minute intervals (5x5) separated by five minutes of recovery between intervals and one twenty-minute effort. Five five-minute intervals is a commonly used workout for competitive cyclists who periodically replace a workout with one twenty-minute effort to obtain important information about power, but at the expense of a more productive workout.

RESULTS: Correlating the average 5x5 (327.78±31.70 W) with the average 1x20 (309.66±30.28 W) in units of Watts resulted in a correlation coefficient of 0.9650 along with the following prediction equation: Average 1x20 (W) = 0.9218 [Average 5x5 (W)] + 7.5162. Correlating the average 5x5 (4.39±0.47 W/kg) with the average 1x20 (4.16±0.47 W/kg) in units of Watts/kg resulted in a correlation coefficient of 0.9747 along with the following prediction equation: Average 1x20 (W/kg) = 0.99868 [Average 5x5 (W/kg)] - 0.1721.

CONCLUSION: The results of this research project established the relationship between five five-minute intervals as a training technique to prepare for competition and one twenty-minute effort as a field test to evaluate training status with the intent of optimizing training to use five five-minute intervals as both a training technique and to evaluate training status without the need to interrupt the training schedule with one twenty-minute effort.
It is accepted that college students form their adult health behaviors during their college years. Educating first year students in respect to the importance of healthy behaviors can have a positive effect on their future.

**PURPOSE:** This investigation’s purpose was to analyze 3 academic years worth [6 semesters] of fitness and wellness assessments completed by first year students during a health and wellness class at a small public liberal arts institution.

**METHODS:** As a portion of each student’s course work, a wellness survey and fitness assessment was completed using a MicroFit computerized assessment package. A total of 332 males and 468 females were included in this cohort over the 6 semesters. Student who did not complete the entire assessment are not included in this analysis.

**RESULTS:** The wellness profile suggests that all students exercise 2-3 times per week, have fair eating habits, are not safety conscious and are exposed to moderate levels of stress. However, they are less likely to use tobacco products. The table illustrates fitness assessment data. Aside from the systolic reading for males, values are normal. Although BMI estimates are overweight for males, the corresponding % fat suggests a more active population. Est. max VO2 values are skewed high. The YMCA protocol was used for prediction and may have overestimated.

**CONCLUSIONS:** This population reported low participation in exercise which one would anticipate a lower VO2. Based on these observations, first year students should be exposed to more educational and interventional programs involving exercise, proper nutrition and stress management programming. The Health and Wellness class addresses a variety of behaviors including the above.

<table>
<thead>
<tr>
<th>SBP/DBP</th>
<th>BMI</th>
<th>% Fat</th>
<th>EST. VO2 [mL/kg/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALES</td>
<td>122±11/97±7 48.1</td>
<td>24.3±2.9</td>
<td>13.2±4.7</td>
</tr>
<tr>
<td>FEMALES</td>
<td>112±10/97±6 46.1</td>
<td>25.8±6.2</td>
<td>24.0±6.2</td>
</tr>
</tbody>
</table>

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**Board #174 June 1 9:30 AM - 11:00 AM**

**A Retrospective Analysis Of Wellness And Fitness Assessments In College Freshman**

Amanda J. Peterson¹, William F. Simpson, FACSM¹, Glenn R. Carlson¹, Cooper Aerobics Center at Craig Ranch, McKinney, TX. ¹University of Wisconsin-Superior, Superior, WI.

(No relationships reported)

Current literature suggests that physical inactivity is one of the leading causes of death in the United States. With this understanding there is a growing interest in the mechanism responsible for the drive to be physically active.

**PURPOSE:** While there have been several genomic and gene expression studies, there has been no data presented regarding differential protein expression between high and low active subjects.

**METHODS:** Thus, we extracted proteins from nucleus accumbens of previously phenotyped high active male C57L/J mice (n=3), low active male C3H/HeJ mice (n=3), high active C3C5 F2 male mice (n=3), and low active C3C5 F2 male mice (n=3). The F2 cohort served as a control to aid in the identification of changes in proteins only related to physical activity. The differential expression of the extracted proteins was determined using 2D-DIGE and DeCyder software (pc 0.05). Candidate proteins were digested with trypsin and the peptides were analyzed by mass spectrometry for protein identification.

**RESULTS:** We identified four proteins that were expressed differently between the high active and low active mice: L-lactate dehydrogenase B, calcineurin subunit B type 1, and heat shock proteins HSP90-alpha and beta.

**CONCLUSION:** These data provide a clearer framework to investigate the mechanism responsible for voluntary physical activity.

Supported by NIH RO1 AR050885

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**Board #175 June 1 11:00 AM - 12:30 PM**

**Two Dimensional Differential Gel Electrophoresis Analysis of the Nucleus accumbens in High and Low Active Mice.**

David P. Ferguson, Lawrence J. Dangott, J. Timothy Lightfoot, FACSM. Texas A&M University, College Station, TX.

(No relationships reported)

**CONCLUSION:** These findings suggest PA ancestry (independent of direct PA) has a limited influence on aspects of body composition and glucose metabolism in multiple generations of mouse offspring, but in a generation- and sex-specific manner.

This work was supported by NIH grants HD062868 and AG000268.
CONCLUSIONS: Doping is particularly difficult to combat when it involves pharmaceuticals and therapeutic techniques that are still in development. With the very recent reports on successful gene therapies for several diseases, the likelihood for abuse of gene transfer techniques in elite sports is rapidly increasing. It is therefore very important to develop valid detection techniques for indicating the transfer of DNA (tDNA), with ultimate sensitivity and specificity.

METHODS: To date, three slightly different procedures have been developed, two using a real time PCR based approach and one using a primer-internal, intron-spanning PCR approach (sPCR), each reported to reliably detect tDNA with high sensitivity. The specificity of these techniques, however, is still a matter of debate. Here we present a novel one-tube nested sPCR approach that minimizes the chances for cross-contamination and shows increased sensitivity compared to non-nested PCR techniques. To further reduce the occurrence of false-positives based on cross-contamination, a multi-functional 19bp extended erythropoietin standard (EPO) was cloned which can be easily differentiated from EPO tDNA and can be used as an internal or external positive control.

RESULTS: The method described here combines the advantages of the three currently developed detection techniques for the detection of EPO gene doping in terms of sensitivity, specificity, the number of procedural steps and the chances for cross-contamination.

CONCLUSIONS: We hope that the sensitivity of the currently developed molecular biological detection techniques in combination with their ability to allow long-term detection will deter athletes from using gene transfer doping techniques.

RESULTS: HFD feedings significantly increased BW (wks 8-18), and body fat percentage (~70%) (P<0.05). Tumorigenesis was greatly enhanced by HFD; tumor volume in HFD was ~50% greater than CON at 18wks (P<0.05). HFD consumption increased tumor expression of CD206 (1.4 fold), VE GF (1.5 fold), IL-6 (~3 fold), and TNF-a (1.2 fold) compared to CON.

PURPOSE: To comprehensively identify changes in skeletal muscle gene expression networks and their associations with changes in measures of glucose tolerance and other metabolic traits before and after this 12-week RT intervention.

METHODS: 18 sedentary, overweight young adult men (age = 21 ± 2 years, BMI = 31 ± 3 kg/m^2) completed 12 weeks of RT. 3x/week, and were assessed for changes in markers of metabolic health and underwent an oral glucose tolerance (OGTT). Skeletal muscle biopsies were collected from the vastus lateralis before and after the intervention. Global mRNA levels were measured using the Illumina HumanHT Expression BeadChip. Weighted Gene Co-expression Network Analysis (WGCNA) was used to construct gene networks (comprised of multiple clusters/modules of genes) based on their degree of co-expression. Correlations were based on change (post- minus pre-intervention) values.

RESULTS: We identified 3 distinct modules of genes by hierarchical clustering of gene co-expression values. Summary expression values based on the average change in expression of the component genes of each module were correlated with changes in several traits. One module showed positive correlations with oxidized LDL cholesterol (r=0.51, p=0.04), glucose area-under-the-curve (AUC) from OGTT (r=0.45, p=0.07), insulin AUC (r=0.52, p=0.03), and QUICKI (r=0.62, p=0.01). Enrichment analysis using DAVID (http://david.abcc.ncifcrf.gov) indicated that this module was highly enriched for genes involved in cell signaling, extracellular matrix, and cell adhesion. Module genes with the strongest correlations with oxidized LDL levels included RAB32 (r=0.73), ITGB5 (r=0.68), CTGF (r=0.67), and CMTM3 (r=0.66); for insulin AUC, AEBP1 (r=0.74), EIF4A1 (r=0.70), and ANXA2 (r=0.68); and for QUICKI, WBP5 (r=0.81), LIMA1 (r=0.77), EIF5 (r=0.76), and KCTD12 (r=0.74).

CONCLUSIONS: We identified a set of genes enriched for cell signaling/adhesion, whose expression levels were related to the effects of RT on glucose tolerance and insulin resistance traits.

CONCLUSIONS: The use of vivo-morpholinos transiently silenced Vmat2 with no difference between wheel running and locked wheel groups. This data suggests that wheel-running does not increase the clearance of vivo-morpholinos.

CONCLUSIONS: The purpose of this study was to determine the effects of HFD feedings on tumorigenesis in the C3(1)SV40Tag breast cancer mouse model. High fat diet (HFD) induced obesity increases the risk for breast cancer (BrCa); obese women have a greater risk of developing breast cancer and of dying from the disease than healthy women. However, few well supported mechanistic explanations in regards to the relationship between HFD induced obesity and BrCa exist.

METHODS: Female C3(1)SV40Tag mice were assigned to a dietary treatment group (n=14-15), beginning at 4 wks of age: control (CON) diet (AIN76A), or high fat diet (HFD). The CON diet contained 11.5% kcal fat while the HFD diet had 41% kcal fat. All diets were identical in vitamin and mineral content. Body weight (BW) was measured weekly, and mice were examined bi-weekly for palpable tumors, from which tumor number and volume was recorded. At 18wks of age mice were sacrificed and all visible tumors were counted, measured, and excised. Total tumor number and volume as well as BW were analyzed using a one-way repeated measures ANOVA and pro-tumoral factors were further analyzed using Student’s T-Tests. Significance was set at P<0.05.

RESULTS: HFD feedings significantly increased BW (wks 8-18), and body fat percentage (~70%) (P<0.05). Tumorigenesis was greatly enhanced by HFD; tumor volume in HFD was ~50% greater than CON at 18wks (P<0.05). HFD consumption increased tumor expression of CD206 (1.4 fold), VEGF (1.5 fold), IL-6 (~3 fold), and TNF-a (1.2 fold) compared to CON.

CONCLUSIONS: These data confirm the negative influence of HFD consumption on breast cancer in a transgenic mouse model and further provide evidence of a relationship between HFD and pro-tumoral factors related to tumor associated macrophages, angiogenesis and inflammation within the tumor microenvironment.
Role of Ginseng extracts on Inflammatory Makers in the Adipose Tissue of Exhaustive Exercised Rats

Yu-Yu Kao¹, Hsien-Tang Lin¹, Ming-Fen Hsu¹, Feng-Chih Hsu¹, Mallikarjuna Korivi¹, ¹Taipei Physical Education College, Taipei, Taiwan. ²National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. (Sponsor: Kuo Chia-Hua, FACSMD)

(No relationships reported)

PURPOSE: The present study was purposed to investigate the effect of ginseng extracts (Dammaran Oligo-Saponins, DS) against exhaustive exercise-induced changes in inflammatory markers in the adipose tissue of rat.

METHODS: Sprague Dawley rats (n=80) were divided into 4 groups: placebo (0.9% saline), DS20 (0.1 mg/kg bodyweight), DS60 (0.6 mg/kg b.w.) and DS120 (120 mg/kg b.w.), and treated with respective doses of DS for 10 weeks. After the last dose half number of rats from each group (n=10) performed exhaustive exercise, and epididymal fat was collected immediately after exercise. mRNA levels of inflammatory markers including interleukin-1β (IL-1β), IL-6, IL-10, tumor necrosis factor-α (TNF-α), leptin and adiponectin were analyzed.

RESULTS: Exercise significantly increased the mRNA levels of IL-10, leptin and adiponectin in placebo group compared to non-exercise rats. In contrast, IL-1β and IL-6 mRNA expressions were down-regulated, while, TNF-α mRNA was not significantly changed after exhaustive exercise. Interestingly, exercise-induced elevated IL-10 mRNA expression was significantly decreased in DS-treated groups with all doses.

CONCLUSIONS: Findings from this study concludes that oral administration of DS (20 mg/kg) may control the exhaustive exercise-induced inflammation. This study also suggests that high dosage (120 mg/kg) may have negative impact on inflammatory system.

The Effect of Living High Training Low on Skeletal Muscular UPP and Protein Catabolism

Ming Ye¹, Junping Li², Dongdong Li³, Zhen Ni². ¹Capital University of Physical Education and Sports, Beijing, China, ²Beijing Sports University, Beijing, China. (No relationships reported)

Previous researches showed that hypoxia can promote skeletal muscular protein degradation, the Ubiquitin-Proteasome Pathway (UPP) plays an important role in protein catabolism. Ubiquitin ligases Muscle ring finger 1 (Murf-1) and Muscle Atrophy F-box (MAFbx) can be regarded as markers of skeletal muscular protein degradation and UPP.

PURPOSE: To study the possible mechanism and influence of living high training low on skeletal muscular UPP and protein degradation.

METHODS: 160 Male SD rats were divided into 4 groups randomly: control group(C), normal exercise group(E), hypoxic group (H) and living high training low group (HiLo). Each group was divided into 1, 7, 14 and 28 days group. C group lived under normoxic circumstance; H group was exposed to normal pressure hypoxia for 10h/d, oxygen concentration was 13.6%; E group was performed treadmill exercise of 20m/min, 1h/d; the HiLo group’s hypoxia exposure and exercise mode were as the same as H and E respectively. Murf-1 and MAFbx were tested by Q-PCR. Protein ubiquitination was tested by Western Blotting, 3-methylhistidine (3-MH) and corticosterone were tested by HPLC and ELSA respectively.

RESULTS: (1) Compared with C, Murf-1 mRNA of E, H and HiLo on the 1st day, Murf-1 mRNA of HiLo on the 7th day and Murf-1 mRNA of E, H and HiLo on the 14th and 28th day all significantly (P < 0.05). (2) The change of skeletal muscular MAFbx mRNA was nearly the same as Murf-1 mRNA. (3) Protein ubiquitination of the E, H and HiLo at first increased and then decreased, and they increased on the 7th day, then decreased gradually, on the 14th day they declined as the same level of the 1st day. (4) Compared with C, 3-MH of H on the 14th day and 3-MH of E on the 28th day increased (all P<0.05), and 3-MH of HiLo on the 28th day increased (P<0.01). (5) Compared with C, the corticosterone of E, H and HiLo increased on the 1st day (all P<0.05), and they increased on the 7th, 14th, and 28th day too (all P<0.01).

CONCLUSIONS: Living high training low perhaps promotes the secretion of corticosterone significantly, which activates UPP and increases skeletal muscular protein ubiquitination, Murf-1 mRNA and MAFbx mRNA, which increase skeletal muscular protein degradation and 3-MH obviously. It shows that living high training low can activate UPP and enhance protein catabolism. Supported by KM200910029002.
RESULTS: The mean±SD end-exercise HR was 108±10, 125±19, 116±13, and 133±17 bpm for the four conditions. Thus, compared with the control condition (23°C, 20.9% O2) heat alone increased HR 17 bpm, hypoxia alone increased HR 8 bpm, while heat-hypoxia increased HR 25 bpm. Likewise, end-exercise RPE was 9.8±1.5, 10.8±2.0, 10.4±1.6, and 11.6±2.1 for the four conditions, respectively. Thus, compared with the control condition, heat alone increased RPE 1.0 units, hypoxia alone increased RPE 0.6 units, while heat-hypoxia increased RPE 1.8 units. The mean arterial oxygen saturation was 96% during the two normoxic trials and 93% (P < 0.05) during the two hypoxic trials. The mean end-exercise core temperature ranged between 37.7 and 37.9°C and was not significantly different for the four trials.

CONCLUSIONS: The results of the current study strongly suggest that the separate heat- and hypoxia-induced augmentations in HR and RPE during prolonged exercise are additive when the two stressors are combined. The additive effects were apparent even though there was no difference in core body temperature between the four conditions, suggesting that hyperthermia was not the mediating factor. The heat stress and degree of hypoxia used in the study were moderate and equal to what many athletes and military personnel experience on a regular basis. Thus, the practical applications of the current findings are widespread.

This work was supported by the U.S. Navy Bureau of Medicine and Surgery under Work Unit No. 61033. The views expressed are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release; distribution is unlimited. This research was conducted in compliance with all applicable federal regulations governing the protection of human subjects (SDSU IRB Protocol #536053).

2913  Board #185  June 1  9:30 AM - 11:00 AM Impact Of Varying Levels Of Simulated Altitude On Balance
James Schoffstall, Melissa Gogain, Taylor Clay. Liberty University, Lynchburg, VA. (Sponsor: Mel Williams, FACSMM)

(NO relationships reported)

PURPOSE: The purpose of this study was to examine the effect of exposure to varying levels of simulated altitude on static and dynamic balance.

METHODS: Twenty subjects (9 males and 11 females; age: 21.2 ± 8.9 yrs) performed a static and dynamic balance test using a Biodex Balance System SD at various levels of simulated altitude (base 260 m (20.9% O2); 1500 m (17.2% O2); 3000 m (14.2% O2); 4500 m (11.8% O2); and 6000 m (9.8% O2)). Altitude was simulated by creating a hypoxic environment using two Higher Peak hypoxic air generators feeding into a large 2-way valve attached to a V2 Mask. Statistical significance was determined through the use of repeated measures ANOVA, with post hoc pairwise comparisons.

RESULTS: The SpO2 (%) levels were significantly different (p<0.05) among the assessed simulated altitudes: base (98%), 1500m (96%), 3000m (89%), 4500m (83%), and 6000m (75%). The subjects’ HRs (bpm) were significantly different (p<0.05) among the assessed simulated altitudes: base (77 bpm), 1500m (84 bpm), 3000m (87 bpm), 4500m (95 bpm), and 6000m (106 bpm). A significant difference (p<0.05) was noted in the static postural stability test between the 1500m level and the 6000m level for the overall score, and the anterior/posterior score. While significant differences were not observed between any of the other trials, the data demonstrated a trend for an increasingly poor balance score with higher altitudes. During the limits of stability dynamic balance test no significant differences were noted for either time total to completion or score. During the 6000m trial, 7 of the 20 subjects were unable to complete the testing due to abnormalities (headache, dizziness, nausea, or other signs of distress). A significant difference for SpO2% existed between the subjects who were (77%) and were not (69%) able to complete the 6000m trial.

CONCLUSIONS: Based on the results of this study extreme simulated altitudes (6000m) can have a negative impact on static balance, which is not seen at lower simulated altitudes (1500 to 4500m).

This study was supported by funds from The Center for Research and Scholarship Fund of Liberty University.
METHODS: Fourteen (8 males and 6 females) Atayal tribe (ATA) and 18 (10 males and 8 females) Han race (HAN), who lived in sea level (age: 19.8 ± 1.2 yrs vs. 20.4 ± 0.9 yrs, height: 168.9 ± 8.8 cm vs. 163.4 ± 6.4 cm, weight: 65.3 ± 15.2 kg vs. 56.1 ± 8.4 kg, VO2 peak: 37.6 ± 8.4 ml/min/kg vs. 41.5 ± 7.0 ml/min/kg, peak power: 180 ± 56.7 watts vs. 172 ± 26.2 watts), were exposed to 2,400 m of altitude (ALT) or sea level (SEL), and stressed by ergometer exercise (70-75% VO2 peak 45 min + 90% VO2 peak to exhaustion). Plasma indicators showing oxidative damage in time courses (testing: immediately after, post 10 min, post 60 min, post 120 min and post 240 min of exercise) were analyzed. Repeated measures of ANOVA were used and the statistical significance was set at p<0.05.

RESULTS: Main effects showed that significantly lower thiobarbituric acid reactive substance (TBARS) levels in ATA than in HAN in both environments (SEL: ATA vs. HAN 7.68 ± 0.67 µM vs. 9.70 ± 0.90 µM; ALT: ATA vs. HAN 8.31 ± 0.89 µM vs. 10.07 ± 0.74 µM, p<0.05), and so was glutathione peroxidase activity (SEL: ATA vs. HAN 60.70 ± 7.29 U/mL vs. 89.24 ± 11.64 U/mL; ALT: ATA vs. HAN 57.98 ± 5.99 U/mL vs. 79.35 ± 10.67 U/mL, p<0.05) and lactate values (SEL: ATA vs. HAN 2.30 ± 0.26 mM vs. 3.18 ± 0.31 mM; ALT: ATA vs. HAN 2.74 ± 0.27 mM vs. 3.48 ± 0.29 mM, p<0.05). However, TGSH/GSSG values were higher in ATA than in HAN (SEL: ATA vs. HAN 0.14 ± 0.01 vs. 0.12 ± 0.01; ALT: ATA vs. HAN 0.14 ± 0.01 vs. 0.12 ± 0.01, p<0.05). There were no differences between ATA and HAN in other indicators including carbonyl proteins, superoxide dismutase and catalase activities, nitric oxide, creatine kinase activity.

CONCLUSION: Atayal tribe seems to have better capability of anti-oxidation peroxisomes in response to endurance exercise at altitude and may correlate with stronger non-enzymatic antioxidant capability.

Supported by Taiwan NSC grants 99-2410-H-034-055.

2917 Board #189 June 1 9:30 AM - 11:00 AM
Contribution Of Oxygen Cost Of Breathing To Changes In Running Economy After Altitude Training
Jonathon L. Stickford, Abigail S. Laymon, Daniel P. Wilhite, Joseph W. Duke, Robert F. Chapman, FACSM. Indiana University, Bloomington, IN.
(No relationships reported)

Several studies have documented improvements in running economy following altitude training in elite runners, but the underlying mechanism remains elusive. It has been theorized that the hypoxic stimulus and resulting added ventilation encountered during chronic hypoxic exposure may improve the oxygen cost of breathing upon return to sea level.

PURPOSE: To examine the extent to which possible changes in running economy following altitude training can be explained by changes in respiratory muscle oxygen consumption.

METHODS: Six male distance runners completed a 28-d altitude training intervention at 2,150m following a "Live High - Train Low" training model. Prior to altitude acclimation, running economy was examined by measuring maximal oxygen uptake (VO2max) and ventilation (VEmax) while running at 16, 18, and 20 km/h on a treadmill at sea level. The following day, runners performed a eupneic voluntary hyperpnea test mimicking the same levels of VEmax, breathing frequencies, and tidal volumes observed during the previous day's running economy test for the determination of respiratory muscle VO2 (VO2rm). The same tests were performed on days 1 and 2 following return from altitude.

RESULTS: Running VO2 decreased (p<0.05) at every speed upon return from altitude compared to pre-altitude levels. The change in VO2 from pre-to-post-altitude was 0.38 ± 0.12 L·min^-1, 0.38 ± 0.12 L·min^-1, and 0.50 ± 0.09 L·min^-1 at 16, 18, and 20 km/h, respectively. The changes corresponded to a decrease of 11.0 ± 3.3%, 9.9 ± 3.0%, and 11.7 ± 1.9% from pre-altitude VO2 measurements at 16, 18, and 20 km/h, respectively. No changes from pre- to post-altitude were observed in VEmax at any speed. Though VO2rm remained unchanged following the altitude training period, mean values remained significantly lower post-altitude than pre-altitude for 23.4%, 25.9%, and 27.5% of the improvement in running economy at 16, 18, and 20 km/h, respectively.

CONCLUSIONS: Decreases in the oxygen cost of breathing accounts for approximately one-quarter of the improvement in running economy in elite distance runners after altitude training. The data suggests that the added ventilation with chronic training at altitude acts as an additional training effect for the respiratory musculature, which may contribute to altitude training-mediated performance improvements.

2918 Board #190 June 1 9:30 AM - 11:00 AM
Expiratory Flow Limitation Mitigates Increases In Exercise Ventilation In Elite Distance Runners After Altitude Training
Joseph W. Duke1, Jonathon L. Stickford1, Abigail S. Laymon1, Daniel P. Wilhite1, Timothy D. Mickleborough, FACSM2, Joel M. Stager2, James Stray-Gundersen, FACSM3, Benjamin D. Levine, FACSM4, Robert F. Chapman, FACSM5. Indiana University, Bloomington, IN. Institute of Exercise and Environmental Medicine, Dallas, TX.
(No relationships reported)

Ventilatory acclimatization with chronic exposure to altitude typically results in a gain in the ventilatory response to exercise at any workload. However, a large proportion of elite endurance athletes demonstrate expiratory flow limitation (EFL) during heavy exercise (EFL) in healthy volunteers, and are thus mechanically constrained from increasing exercise ventilation (VE) at high workloads. Whether EFL mitigates increases in VE at sea level, after chronic acclimatization to altitude, is unknown.

PURPOSE: To determine the extent of EFL, affects changes in VE from pre- to post-altitude in elite distance runners.

METHODS: Seventeen elite male distance runners were categorized into flow limited (FL; n = 9) and non-flow limited (NFL; n = 8) groups based on the percent of the tidal flow-volume loop that met the maximal flow-volume envelope during the final minute of a maximal graded exercise test at sea level (FL= 51.5 ± 4.8%; NFL = 0%). Subjects completed 28 of training at moderate altitude (2,150m or 2,500m) using the "Live High-Train Low" model. Prior to and immediately upon return from altitude, subjects performed a maximal graded exercise test to quantify VEmax and maximal oxygen uptake (VO2max). Isocapnic hypoxic ventilatory response (HVR) was measured pre- and post-altitude. Statistical significance was accepted when p < 0.05.

RESULTS: HVR significantly increased in both FL and NFL after altitude training, demonstrating augmented ventilatory chemoresponsiveness. After altitude training, NFL significantly increased VEmax at 80% (107 ± 5 vs 116 ± 5 L·min^-1), 90% (135 ± 8 vs 145 ± 8 L·min^-1), and 100% (165 ± 10 vs 184 ± 9 L·min^-1) of VO2max. However VEmax did not change in FL after altitude training at 80% (103 ± 2 vs 103 ± 4 L·min^-1), 90% (121 ± 5 vs 127 ± 4 L·min^-1), or 100% (161 ± 6 vs 160 ± 7 L·min^-1) of VO2max. FL did not increase VEmax (77.1 ± 1.5 vs 77.7 ± 1.1 mL·kg^-1·min^-1) from pre- to post-altitude, whereas NFL demonstrated a significant increase (75.5 ± 1.6 vs 79.8 ± 1.3 mL·kg^-1·min^-1).

CONCLUSIONS: Despite similar increases in ventilatory chemoresponsiveness in both groups, FL did not increase VEmax at any workload following altitude training. This is likely due to mechanical constraints imposed by expiratory flow limitation, which may hold implications for training and exercise performance during and after altitude training.

2919 Board #191 June 1 9:30 AM - 11:00 AM
Ventilatory Mechanics During Maximal Exercise After Altitude Training in Elite Distance Runners
Daniel P. Wilhite, Abigail S. Laymon, Jonathon L. Stickford, Joseph W. Duke, Joel M. Stager, Timothy D. Mickleborough, FACSM, Robert F. Chapman, FACSM. Indiana University, Bloomington, IN.
(No relationships reported)

Ventilatory acclimatization with chronic exposure to altitude typically manifests as an increase in both peripheral chemoreceptor sensitivity and exercise ventilation (VE). However, many elite distance runners experience mechanical limitations to VE at high altitude, affecting operational lung volumes. How ventilatory acclimatization affects ventilatory mechanics after altitude training has not yet been characterized.

PURPOSE: To determine the effect of 28 days of 'live high-train low' (LHTL) altitude training on measures of ventilatory mechanics during exercise in a group of elite distance runners.

METHODS: Six elite male distance runners (VO2max=79.5 ml/kg/min) completed a 28 d LHTL altitude training intervention at 2150m. All testing procedures took place in the week prior to departure, and again 1-2 d after returning to sea level. For each session, subjects completed an isocapnic hypoxic ventilatory response (HVR) test, followed by a graded treadmill exercise test to exhaustion. VEmax, tidal volume, breathing frequency, degree of respiratory flow-limitation (EFL), end-expiratory lung volume, end-inspiratory lung volume, and duty cycle were measured during the last minute of the maximal exercise test. Subjects with 50% or more EFL were considered flow-limited.

RESULTS: During maximal exercise, 5 of the 6 subjects were flow-limited (59 ± 7%). From pre- to post-altitude training, the HVR slope significantly increased (p<0.05) from 0.34 to 0.75 L/min/%SaO2, indicating an increase in ventilatory chemoresponsiveness. However, there was no significant change (p>0.05) in VEmax from pre- to post-altitude (157 ± 3 ± 11.1 to 158.7 ± 16.8 L/min). Additionally, there were no significant changes (p>0.05) in lung volumes or values for variables describing ventilatory mechanics after altitude training.

CONCLUSIONS: The inability of altitude-mediated ventilatory acclimatization to manifest as an increase in VEmax during maximal exercise in the elite runners is likely due to the high number of flow-limited subjects in our sample. The absence of a change in operational lung volumes, despite a strong increase in ventilatory chemoresponsiveness, may reflect a balance between a mechanical limitation to expiratory flow production at lower lung volumes and the minimization of inspiratory muscle work at higher lung volumes.

761
CONCLUSIONS:

Chronic high altitude exposure leads to an increase in hypoxic ventilatory response (HVR), as an index of the ventilatory chemosensitivity to hypoxia. Moreover, recent study has shown that HVR increased after three nights in hypoxic exposure at 2650m1). In Japan, most of altitude training is performed in 2000m or less. However, no study has been made to clarify the changes in ventilatory chemosensitivity for short-term exposure at an altitude of less than 2000m.

PURPOSE: In field work, the purpose of this study was to investigate the effect of altitude training with short-term exposure at 1800m on ventilatory chemosensitivity.

METHODS: Five males and one female student endurance runners (mean age = 16.5 ± 1.0 years) participated in this study. Subjects carried out altitude training at 1800m for four days including three nights in a row. In order to estimate a changes in ventilatory chemosensitivity, HVR and hypercapnic ventilatory response (HCVR) were measured three times in each subject; 1) before altitude training (Pre); 2) after altitude training (Post); 3) one week after the cessation of altitude training (De).

RESULTS: HVR increased after altitude training (0.259 ± 0.093 l/min/%Pre, 0.544 ± 0.306 l/min/%Post, 0.370 ± 0.242 l/min/%De) (Pc ≤ 0.05). HCVR didn’t change after altitude training (1.408 ± 0.575 l/min/torr Pre, 1.672 ± 0.408 l/min/torr Post, 1.637 ± 0.391 l/min/torr De).

CONCLUSION: These results show that altitude training at 1800m for four days raise hypoxic chemosensitivity, but not affect hypercapnic chemosensitivity.

REFERENCES
PURPOSE: The purpose of this study was to determine whether or not the Hart Power educational curriculum affected the health content knowledge and physical activity levels of elementary children.

METHODS: Two certified elementary physical education teachers and their students (n= 180) at two different schools in Taiwan participated in the study. One teacher and school were involved as a treatment group and received the health-related fitness program for ten weeks which was adapted from American Heart Association’s Heart Power educational curriculum that is a descendant of the Heart RX Program developed in 1985. The other used as a comparable group and receive a traditional physical education. The Heart Health Cognitive Test (HHCT) was used to assess knowledge change in pre-test, post-test, and follow-up test. The System of Observing Fitness Instruction Time (SOFIT) was used to determine student’s activity levels.

RESULTS: The results indicate a) students who received the health-related fitness program were more knowledgeable than the students who did not receive; b) For the physical activity levels, no statistically significant difference was found between two groups.

CONCLUSION: Physical education is a class in which children should be able to reach recommended amounts of physical activity for a healthier lifestyle. Teachers may need to modify existing strategies and curriculum models to assist students to be physically active as recommended for that healthy lifestyle. It is unknown how the Healthy People 2012 objectives will impact physical education, but many policy makers now are aware of the benefits of regular physical activity. Meanwhile, if schools are to carry the major responsibility for activity promotion for youth, changes will need to be made. These changes could increase the frequency and length of physical education classes, or provide the after school program to enhance their level of physical activity.

2924 Board #196 June 1 11:00 AM - 12:30 PM Characteristics Associated With Risk Factor Reduction Following Heart Health Intervention In Urban Teenagers Paul S. Fardy, FACSM, Henry Wang, Ann Azzollini. Queens College, Flushing, NY. (No relationships reported)

Early onset of coronary disease (CD) and risk factors (RF) make a compelling case for school-based intervention. High prevalence of CD and RF in African American and Latino adults illustrates a special need for early intervention in these populations.

METHODS: To determine characteristics associated with RF reduction in urban teenagers following a school-based heart health program, Physical Activity and Teenage Health (PATH), an after school fitness and mentoring program by college students completely offset the drop in academic performance in Latino middle school students. The original 6th grade cohort consisted of a total of 33 students (18 girls and 15 boys) selected from a single charter school at risk for obesity and/or low academic achievement. After 6 quarters (1.5 yrs) 28 of the original 33 remain enrolled and actively participating (85%).

PURPOSE: To determine the impact of moderate and vigorous daily fitness programming and mentoring on overall academic achievement as indicated by cumulative GPA in Latino middle school students.

METHODS: Exercise physiology students developed and implemented daily training protocols with 6 wk macrocycles focusing on aerobic, lower extremity strength, power or cross-training/game-like activities under the guidance of faculty. Training consisted of 1 hour daily/5 days per week with most students participating at least 3 days per week then 1 hour of academic play including relays. Annual measurements included PACER, sit-ups, curl-ups, broad jump, and hand grip dynamometry to progress programs and provide feedback to individual students. De-identified and coded GPA data was provided by the school and analyzed by ANOVA p<0.05.

RESULTS: Significant RF reduction (P<0.05) was observed for boys and girls in Sp, Dp, BF, BMI and CVF. Magnitude of RF reduction was associated with pre-intervention PA, CVF, BMI and BF.

CONCLUSION: Greatest RF reduction was consistently observed in subjects who were least active, least fit, and most overweight. Findings are important in developing intervention program strategies for urban teenagers and illustrate the need for varying teaching methods according to fitness and fitness.

2925 Board #197 June 1 11:00 AM - 12:30 PM Impact Of After School Fitness And Mentoring Program On Gpa In Latino Middle School Students. Paula E. Papanek, FACSM, Marquette University, Milwaukee, WI. (No relationships reported)

The Youth Empowered to Succeed program (YES) was designed to provide afterschool fitness and college mentors to assist with homework and as peer educators to Latino middle school students. The original 6th grade cohort consisted of a total of 33 students (18 girls and 15 boys) selected from a single charter school at risk for obesity and/or low academic achievement. After 6 quarters (1.5yrs) 28 of the original 33 remained enrolled and actively participating (85%).

PURPOSE: To determine the impact of moderate and vigorous daily fitness programming and mentoring on overall academic achievement as indicated by cumulative GPA in Latino middle school students.

METHODS: Exercise physiology students developed and implemented daily training protocols with 6 wk macrocycles focusing on aerobic, lower extremity strength, power or cross-training/game-like activities under the guidance of faculty. Training consisted of 1 hour daily/5 days per week with most students participating at least 3 days per week then 1 hour of academic mentoring. Boys and Girls were trained and mentored separately. Training consisted of body weight support, med ball, game simulations, plyometric based programing that emphasized a sense of play including relays. Annual measurements included PACER, sit-ups, curl-ups, broad jump, and hand grip dynamometry to progress programs and provide feedback to individual students. De-identified and coded GPA data was provided by the school and analyzed by ANOVA p<0.05.

RESULTS: Significant RF reduction (P<0.05) was observed for boys and girls in Sp, Dp, BF, BMI and CVF. Magnitude of RF reduction was associated with pre-intervention PA, CVF, BMI and BF.

CONCLUSION: Greatest RF reduction was consistently observed in subjects who were least active, least fit, and most overweight. Findings are important in developing intervention program strategies for urban teenagers and illustrate the need for varying teaching methods according to fitness and fitness.

2926 Board #198 June 1 11:00 AM - 12:30 PM Girls Learning Interrelated Techniques Targeting Environmental Risks (GLITTER): Feasibility of a Pilot Obesity Intervention Michelle B. Stockton1, Barbara S. McClanahan1, Tammy Overacker2, 1University of Memphis, Memphis, TN. 2University of Arkansas, Fayetteville, AR. (Sponsor: Heather Chambless, FACSM) (No relationships reported)

PURPOSE: Preadolescent girls are a priority population for obesity prevention efforts. The purpose of this study was to determine the feasibility of a multi-systemic home-based behavioral intervention targeting the prevention of excessive weight gain in girls aged 8-10 years.

METHODS: A one-group pre-test/post-test design was used to determine the feasibility and efficacy of a multi-component home-based 12-week intervention targeting obesity in girls. The objective of the intervention was to determine how obesity made sense for each girl by systematically evaluating the socioecologic factors that influence body mass index (BMI), diet, and physical activity and to tailor the strategies for change to specific identified needs. The primary outcomes were BMI %ile and body fat percent at 6-months of follow-up. Secondary outcomes were diet and physical activity behaviors.

RESULTS: Of the 18 girls and families recruited, 14 completed the study (78% retention rate). At baseline, the girls were an average age of 9.6 years (SD = 0.6) and had an average BMI of 25.7 kg/m2 (SD = 4.8). At 6 months’ follow-up, average BMI percentiles decreased from the 94th to the 92nd percentile and body fat percent decreased from 39.3% to 38.02%. Although changes were in the expected direction, the differences in pre/post BMI percentile and body fat percent were not significant (p = 0.31; 0.45 respectively). Diet and physical activity behaviors changed in the expected direction. Physical activity levels increased from 3.1 (SD = 1.9) days of physical activity per week to 3.4 (SD = 1.7). There was also an increased consumption of fruits and vegetables and a decreased consumption of junk food. All of the parents reported that they enjoyed the program, their health promotion specialist, and the convenience of the home-based program. Parents also reported a high satisfaction with the amount of sessions and phone calls. Overall the parents indicated that the program helped them become aware of diet and physical activity behaviors necessary and specific to their daughter and family.

CONCLUSIONS: This home-based intervention targeting girls and their families is a promising and feasible obesity prevention program. Specifically, identifying multi-leveled strategies of ‘best fit’ for the families appears to have impact on the health of the girls.
Board #199  June 1  11:00 AM - 12:30 PM
Group Randomized Trial Of A Novel Physical Activity Program To Increase Physical Fitness And Motor Skills In Children

PURPOSE: To compared changes in physical fitness, motor skill performance and body composition after a modified 8-week novel structured physical education program “Gameday” when disseminated in teacher lead format (TL), a physical education specialist format (PESL) versus a control (C).

METHODS: 8-week single blinded group randomized trial, 217 children (age 4.2 ±0.2) were randomly assigned to 1) Control (C;n=47); 2) Teacher Led physical activity (TL;n=76), or 3) Physical Education specialist led physical activity (PESL;n=94). Participants in the TL and the PESL groups received 100 minutes of physical activity per week. The C received standard curriculum over the same period. The following were measured pre and post intervention: Level of motor skill was assessed using the 11-point Movement Assessment Battery for Children. Physical Fitness was assessed using the Fitnessgram®. Body composition was assessed using BMI, BMI percentiles and waist/hip circumference. ANCOVA with post-hoc pairwise comparisons assessed Across intervention group effects.

RESULTS: A significant overall intervention effect was found for trunk lift (P<0.01), sit and reach (P<0.01), kick (P=0.008), ball bounce (P=0.007), leap (P=0.004), punt (P<0.001), and Two - hand strike (P=0.039).

CONCLUSIONS: The Gameday program appears promising as a population-based approach to increasing physical fitness and enhancing motor skills performance in children.

Board #200  June 1  11:00 AM - 12:30 PM
High-intensity Training And Cardiometabolic Risk Marker Changes In Adolescents: Project FFAB (Fun Fast Activity Blasts)
Kathryn L. Taylor1, Alison L. Innerd1, Liane B. Azevedo1, Susan Bock2, Alan M. Batterham, FACSM1, 1Teesside University, Middlesbrough, United Kingdom, 2Durham University, Durham, United Kingdom.

Low-volume, high-intensity exercise holds promise for cardio-metabolic health promotion, but sustainable interventions must be practical and engaging.

PURPOSE: To determine the impact of a school-based, high-intensity exercise intervention on cardio-metabolic risk markers in 13-15 year olds.

METHODS: We recruited 102 adolescents (64 male) from four schools. In an exploratory controlled before-and-after design, two schools were assigned to the Intervention condition (n=41) and two to the Control (n=61), matching for socioeconomic status. The intervention comprised four sets of 45 × maximal effort exercise (boxing, dance, soccer and basketball drills) with 90 s rest between sets, up to three times a week for 10 weeks. The number of sets was increased by one every two weeks. Control group participants maintained their usual routine. Outcomes (before and after) were blood lipids and glucose, waist circumference, C-reactive protein, blood pressure, physical activity levels (7-day accelerometry), Evenson cutpoints), aerobic fitness (stage fitness test), and carotid artery intima-media thickness. The difference in the change from baseline (intervention minus control) was estimated for each outcome, with sex, the baseline value, and maturity offset as covariates. Triglyceride values were first log-transformed prior to analysis. We adopted a magnitude-based inferences framework, calculating the probability (Q) that the true population effect was greater than the minimum important difference (Cohen’s d of 0.2 standard deviations).

RESULTS: Compliance was indicated by 75% of the intervention group completing at least 70% of the scheduled sessions. There was a mean reduction (intervention vs. control) in triglycerides of 24% (90% confidence interval, 11 to 35%). The probability (Q) that the true population effect was greater than the minimum important difference was 0.96 - “very likely to be” important. Mean waist circumference reduced by 2.7 cm (1.4 to 4.1 cm) - “likely to be” important (Q = 0.78). Mean daily moderate to vigorous physical activity increased by 14.3 minutes (-0.4 to 28.9 minutes; “likely to be” important, Q = 0.84). There was no substantial effect on any other outcome.

CONCLUSION: Interventions of this type might be feasible for targeting aspects of cardio-metabolic health in adolescents.

Board #201  June 1  11:00 AM - 12:30 PM
High Intensity Aerobic Training Improves Quality Of Life In Obese Adolescents
Mara C. Lofranzo-Prado1, James O. Hill1, Humberto Jose G. Silva2, Larissa S. Albuquerque2, Lisiany C. Nascimento3, Wagner L. Prado1, 1Federal University of Pernambuco, Recife, Brazil, 2University of Colorado, Denver, CO, 3University of Pernambuco, Recife, Brazil.

Obesity has adverse physical, social and psychological consequences that can negatively affect quality of life (QOL). However, nowadays data regarding to the effects of exercise intensity on QOL in obese adolescents are limited.

PURPOSE: To verify the effects of aerobic training intensity on QOL in obese adolescents submitted a 12 weeks of multidisciplinary intervention.

METHODS: Sample size was composed by 36 obese adolescents (15.46±1.56y), BMI 34.48±3.88kg/m², from both genders, enrolled in multidisciplinary therapy (physical, psychological, nutritional and clinical). Adolescents were randomly allocated in two experimental groups - Low exercise intensity - subjects exercised on a treadmill at intensity corresponding to 20% bellow ventilatory threshold 1 (VT1); High exercise intensity - subjects exercised on a treadmill at VT1 intensity. All exercise sessions were isocaloric (350Kcal) and 3 times each week. QOF was assessed by Generic Questionnaire for Evaluation of Quality of Life ‘Medical Outcomes Study SF-36’. Data were analyzed by means of scores and compared by two-way ANOVA, and Duncan’s test as post-hoc.

RESULTS: Both exercise intensities decreased body mass, body mass index and fat mass and increased fat free mass (p£0.00). Table 1 shows the domains of QOF.

CONCLUSION: High intensity aerobic training is more effective than low intensity to improve QOL in obese adolescents. Supported by CNPq Grant (APQ-477955/2009-6).
Blood flow during isometric and concentric contractions has been shown to increase substantially in a healthy population immediately following exercise, however microvascular blood flow after eccentric contractions have not been studied. Eccentric contractions cause reversible muscle damage, therefore changes in blood flow could be observed over the inflammatory phase in the first 48 hours following exercise.

**PURPOSE:** To examine the effects of unilateral, eccentric exercise to the gastrocnemius on microvascular perfusion over 48 hours.

**METHODS:** An IV was placed in the antecubital vein for the delivery of the contrast agent (microbubbles) to 18 healthy subjects (3 Males, 15 Females; Age: 22.2 ± 2.2 years; Height: 166.0 ± 11.9 cm; Weight: 69.4 ± 25.0 kg). Subjects performed unilateral eccentric exercises on a randomly selected leg. Heel-lowering exercises were performed off of a step to the beat of a metronome in the sequence of 50 repetitions, 5 minutes rest, 30 repetitions. Microvascular perfusion (blood volume [dB]), blood flow [dB/sec] and blood flow velocity [sec⁻¹]) was measured before, immediately (within 5 minutes) and 48 hours after the eccentric exercise using contrast-enhanced ultrasound.

**RESULTS:** Blood volume and flow both significantly increased immediately and 48 hours after exercise (p<0.05). Baseline measurements were 5.88 ± 1.33 dB and 2.34 ± 0.41 dB/sec and increased to 12.20 ± 3.11 dB (42%) and 4.53 ± 1.05 dB/sec (80%), respectfully after exercise. At 48 hours, compared to baseline, blood volume and flow were still elevated to 9.64 ± 2.53 dB (28%) and 3.74 ± 0.80 dB/sec (54%), respectfully. These results yielded high effect sizes immediately (blood volume ES = 2.51 (1.64-3.39) and blood flow ES = 2.89 (1.95-3.82)) and 48 hours after exercise (blood volume ES = 1.86 (1.08-2.64) and blood flow ES = 2.20 (1.37-3.03)). There was no change in blood flow velocity from baseline (1.41 ± 0.06 sec⁻¹) to post-exercise (.36 ± .04 sec⁻¹) and at 48 hours (.38 ± .03) (p<0.05).

**CONCLUSIONS:** Following eccentric exercise, we observed an increase in blood flow and blood volume within the microvasculature of the gastrocnemius over 48 hours. Supported by NIH Grant RR00847 and the Curry School of Education at the University of Virginia.
ultrasound diathermy (USD). Each subject processed 30 repeated bouts of eccentric exercise with 80% MVC level after passive warm-up. Serum CK, MVC, ROM and CIR were measured before, immediately after exercise and at 2nd, 4th, 7th, and 10th days post-exercise.

RESULTS: CK on 4th day post exercise had significant difference from pre-test in CON (2.61±0.77 vs. 2.01±0.18, p<0.05) and HP (2.27±0.30 vs. 1.96±0.16, p<0.05) groups, but not in USD (2.19±0.26 vs. 1.97±0.19, p=0.05). MVC in CON was lower than HP and USD in each day (fig.1). ROM of elbow joint in all groups showed significant decrease after eccentric exercise (p<0.05), especially the CON.ROM in USD and HP groups showed significant decrease after eccentric exercise only on 2nd day post exercise. There were significant difference between USD and the other groups on 4th, 7th,10th day. A custom-designed PCR array was used to compare mRNA expression between legs.

CONCLUSION: USD and HP have better muscle strength and performance than CON. According to the recovery procedure, USD took lesser damage on muscles than HP and CON. USD had lesser swelling than HP and CON in recovery stage after exercise.

2934 Board #206 June 1 9:30 AM - 11:00 AM
Alterations in Neuromuscular Junction Morphology Following Contraction-induced Injury: Exploring Neurochemical Contributions to Force Loss
Stephen J.P. Pratt1, Chris W. Ward2, Sameer B. Shah3, Richard M. Lovett1, 1University of Maryland School of Medicine, Baltimore, MD. 2University of Maryland School of Nursing, Baltimore, MD. 3University of California San Diego School of Medicine, San Diego, CA. (Sponsor: Ed McFarland, FACSM)

High force lengthening contractions are associated with muscle damage, which is often defined within the context of the assay used to examine it. No one finding can account for the changes in contractility after injury, but considerable attention has been dedicated to myofiber damage in an attempt to understand mechanisms underlying force loss. The neuromuscular junction (NMJ) may display alterations in neuron-dependent changes in synaptic organization.

PURPOSE: To compare the NMJ morphology in healthy and injured muscles induced by lengthening contractions.

METHODS: We used a recently described injury model. Unilateral injury to the quadriceps was induced by 30 maximal lengthening contractions through an 80o arc of knee motion in Sprague-Dawley rats (n=6). Injured and contra-lateral non-injured muscles were held for immunolabeling and staining by snap freezing and longitudinal sectioning (50 μm), or by perfusion fixation and whole mount. Light microscopy was used to identify cell membranes to ensure that the totality of the sampled NMJs were within the borders of the myofiber. Motor neurons were labeled with anti-neurofilament antibodies. The pre-synaptic NMJ was identified by labeling with SV2 (synaptic vesicles) and the post-synaptic acetylcholine receptors (AChRs) were identified by alpha-bungarotoxin staining. Sections were imaged and analyzed using Image J software to measure total perimeter, total area, stained perimeter and stained area of NMJs.

RESULTS: Quadriiceps injury was confirmed by a significant loss of isotropic force (37% ± 6%). This muscle injury resulted in altered NMJ dimensions; both pre- and post-synaptic images demonstrated a less continuous perimeter and a more fragmented appearance. Quantitatively, injury resulted in changes of NMJ total perimeter (decreased 23%), total area (decreased 19%), stained perimeter (decreased 19%), and stained area (increased 7%).

CONCLUSIONS: The data show that muscle strain injury causes morphological changes to the NMJs. Due to the short time course used here, changes in NMJ morphology among injured myofibers is likely not due to regeneration or a change in myofiber size. This focus toward the NMJ represents a paradigm shift from more prevalent myocentric perspectives on injury.

2935 Board #207 June 1 9:30 AM - 11:00 AM
Effect Of NSAID Use On Muscle Injury: A Systematic Review And Meta-Analysis
Brooke Adler, Laura B. Brown, Kimberly M. Morelli, Gordon L. Warren, FACSM. Georgia State University, Atlanta, GA.

There is debate as to whether non-steroidal anti-inflammatory drug (NSAID) use is beneficial following muscle injury. Some studies have even suggested that NSAID use may be detrimental to the injured muscle.

PURPOSE: Conduct a systematic review and meta-analysis of the research literature to determine if NSAID use decreases muscle injury as assessed by soreness, strength loss, and/or blood creatine kinase level.

METHODS: Searches for studies testing the effect of NSAID use on muscle injury were performed using 10 electronic databases (e.g., PubMed, Cochrane Library, EMBASE). This yielded 693 studies that were then screened and excluded if they did not meet the following inclusion criteria: >8 on PEDro scale, use of placebo, oral NSAID administration in human studies, injury to the injured muscle, and outcome measures of soreness, strength, or blood creatine kinase level. Thirty-two peer-reviewed articles were deemed suitable for analysis. Meta-analyses were run using a random-effects model and standardized mean differences (ES) calculated from data extracted from the articles.

RESULTS: For all studies and marker injury was used to f elicit a significant, small-to-moderate decrease in the markers of muscle injury (overall ES=0.29; p=0.003). Because heterogeneity of between-study ES was moderate to large (I² = 59%; p<0.001), moderator variables that could potentially explain this heterogeneity were probed using subgroup analysis or meta-regression. The only moderator variable exhibiting a significant effect was the injured muscle’s location (p<0.004); NSAID use was more beneficial in studies conducted on lower-extremity muscles compared to studies using upper-extremity muscles (subgroup ES of 0.54 vs. 0.01, respectively). No significant effect was found for the following moderator variables: type of outcome measure (p=0.49), crossover vs. independent-group studies (p=0.54), subject gender (p=0.28), human vs. animal studies (p=0.81), type of NSAID (p=0.39), NSAID dosage (p=0.09), duration of NSAID use (p=0.86), and when NSAID use began (p=0.65).

CONCLUSION: Overall, our analysis supports NSAID use for reducing the markers of injury after muscle injury. Additional research is required to determine why NSAID use appears to be more effective when lower-extremity muscles are injured.

2936 Board #208 June 1 9:30 AM - 11:00 AM
Smokers Exhibit Blunted Changes in Muscle NFkB Activity after Eccentric Exercise
Nina A. Moore, Stuart R. Chipkin, Priscilla M. Clarkson, FACSM. University of Massachusetts, Amherst, MA.

PURPOSE: For unknown reasons, smoking increases muscle damage and prolongs healing. We used an eccentric exercise (muscle damaging) model to determine potential mechanisms to explain this risk. Eccentric exercise results in alterations to gene expression leading to muscle regeneration through myogenic signaling. The transcription factor NFkappaB can stimulate myogenesis through proliferation and differentiation via canonical and non-canonical pathways, respectively. We hypothesized that smokers (SM) would have altered NFkappaB signaling after eccentric exercise, potentially explaining impaired muscle regeneration and increased risk for injury.

METHODS: Healthy, sedentary men, 10 SM and 9 non-smokers (NS) (23±1y), performed 100 maximal eccentric contractions with the non-dominant knee extensors (EX). 48h later, muscle biopsies were taken from both legs (vastus lateralis: non-exercised leg served as the control (CON)). A custom-designed PCR array was used to compare mRNA expression between legs, NFkappaB activity was quantified with antibodies against p65 (canonical) and Rel-B (non-canonical). Data are means±SEM.

RESULTS: Gene expression change after exercise was significantly different between NS and SM in 7 of 44 genes examined. The largest difference between NS and SM was IKKalpha expression with 2.3-fold upregulation vs. -2.0-fold downregulation, respectively (p=0.026). Since IKKalpha can activate NFkappaB signaling, we quantified NFkappaB activity. In the CON leg, SM activity was lower than NS for p65 (0.023±0.01 vs. 0.06±0.08 OD) but not Rel-B. In response to exercise NS had reduced p65 signaling (0.06±0.08 CON vs 0.01±0.05 EX) while SM had no alteration (0.023±0.01 vs 0.022±0.01). Rel-B signaling was increased in NS with exercise (0.04±0.02 CON vs 0.07±0.04 EX); however, this did not reach significance. SM Rel-B activity was not different with exercise (0.04±0.01 CON vs 0.04±0.01 EX).

CONCLUSIONS: In response to exercise: 1) IKKalpha mRNA was increased in NS but decreased in SM; 2) p65 activity decreased in NS while there was no change in SM. These data suggest impaired IKKalpha activation of NFkappaB p65 pathway and blunted myogenic signaling in SM and may indicate a mechanism through which smoking may impair muscle regeneration. Supported by a grant from the US Army Medical Research and Materiel Command.
2937 April 209 June 1 9:30 AM - 11:00 AM Does A Secondary Loss Of Strength Occur Following Induction Of Muscle Injury? Gordon L. Warren, FACSM, Amy K. Farthing, Bernene B. Pian, Sam R. Coley, Clint W. Satterfield, Chris D. Vlahos, James E. Lewis, Georgia State University, Atlanta, GA.

PURPOSE: To examine the effects of kinesiotaping application on muscle damage markers following eccentric muscle contractions.

METHODS: Total 32 healthy males who had not participated within the past 6 months were recruited. Each subject was randomly assigned to either control(CON, n=8), treatment only during exercise(KTEXE, n=8), treatment during exercise and immediately after exercise(KTEXPO, n=8), or treatment during exercise and 24 hour after exercise(KTEXP, n=8). Each subject performed 2 sets of 25 eccentric muscle contractions of the elbow flexors. Measurements included maximal isometric force(MVC), muscle soreness(SOR), range of motion(ROM), and serum creatine kinase activity at pre, post, 24, 48, 72 and 96 hours after exercise.

RESULTS: There was a significant group by time interaction in MVC where KTEXP had a less decrease in muscle strength and a faster recovery after exercise compared to CON and KTEXE(p=0.006). A significant group by time interaction was shown in SOR where KTEXPO and KTEXP had lower soreness compared to CON and KTEXE(p=0.001). In ROM, there was a significant interaction in flexed arm angle(p=0.027) but no significant group by time effect in relaxed arm angle(p=0.155). Additionally, a significant group by time interaction was shown in CK activity where KT24 had a lower increase in CK activity compared to KTEXE(p=0.045).

CONCLUSIONS: Application of kinesiotaping has demonstrated a positive effect on muscle damage markers following eccentric muscle contractions when the treatment was persistent for at least 24 hours compared to short period treatment.

2938 April 210 June 1 9:30 AM - 11:00 AM Ibuprofen Prolongs Functional Deficits after a Repeated Bout of Downhill Treadmill Running Michael S. Green, Tyler D. Martin, Amanda K. Benson, Benjamin T. Corona, Christopher P. Ingalls, FACSM, 1Troy University, Troy, AL. 2United States Army Institute of Surgical Research, Fort Sam Houston, TX. Georgia State University, Atlanta, GA.

PURPOSE: To determine the effect of NSAID (ibuprofen) supplementation on the adaptive response typically exhibited by skeletal muscle following novel eccentric contractions.

METHODS: Twenty-six male (n = 8) and female (n = 18) subjects (mean values ± SD; age = 22.2 ± 3.4; height = 1.68 ± 0.10 m, weight = 71.0 ± 16.8 kg, body fat = 24.5 ± 8.0 %) performed two downhill treadmill runs (DTR1, DTR2) separated by 14d. After DTR1 only, subjects received either ibuprofen (1,200 mg·d\(^{-1}\); n = 13) or placebo (n = 13) in a randomized, double-blind, gender-balanced manner for 3d. Maximum voluntary isometric quad strength (MVC) and serum creatine kinase activity (CK) were assessed at baseline, and immediately, 1, 2, and 3d post-DTR1 and DTR2.

RESULTS: DTR1 induced a significant and similar degree of lower extremity muscle injury in both treatment groups. Groups combined exhibited 13.6 ± 1.3, 10.6 ± 1.6, and 6.4 ± 1.6 % MVC deficits immediately, 1, and 2d post-injury, respectively, with full recovery 3d post-injury. Also, CK (826 ± 183 U·L\(^{-1}\)) peaked for both groups 2d post-injury. Following DTR2, the placebo group exhibited an immediate MVC deficit (9.0 ± 2.0 %) but was fully recovered 1d post-injury; evidence of the well-established repeated bout effect. Meanwhile, although the ibuprofen group exhibited a similar deficit (10.1 ± 2.0 %) in MVC immediately post-DTR2 compared to placebo, MVC remained significantly reduced by 7.3 ± 2.4 and 5.1 ± 2.3 % 1 and 2d post-injury, respectively, and did not fully recover until 3d post-injury. Although not affected by treatment condition, CK was lower at all times post-DTR2 compared to post-DTR1.

CONCLUSION: Consumption of 1,200 mg·d\(^{-1}\) of ibuprofen for 3d following an initial novel bout of eccentric contractions significantly diminished the well-established neuromuscular adaptation (repeated bout effect) that commonly occurs following injurious exercise. Athletes should use caution when utilizing NSAIDs to treat lower extremity muscle pain.

2939 April 211 June 1 9:30 AM - 11:00 AM Effect Of Kinesiotaping On Muscle Damage Parameters Following Eccentric Muscle Contractions Kyu-Wan Lee, Seung-Hwan Kim, Jooyoung Kim, Joohyung Lee. Kookmin University, Seoul, Korea, Republic of. (No relationships reported)

It is well known that repetitive eccentric muscle contractions induce muscle damage. Kinesiotaping has been designed for better blood flow and removal of fatigue materials in athletic performance. Also, it has been claimed to be useful to reduce pain but the mechanism is still unclear.

PURPOSE: To investigate the effect of kinesiotaping application on muscle damage markers following eccentric muscle contractions.

METHODS: Searches were performed using 4 electronic databases (i.e., PubMed, CINAHL, Cochrane Library, and OpenSigle). Search terms included: skeletal muscle AND (injur* OR damag*) AND (strength OR force OR torque). 106 peer-reviewed articles were deemed suitable for analysis. Meta-analyses were run using a random-effects model and standardized mean differences calculated from data extracted from the articles.

RESULTS: For all studies combined, a moderate increase in strength was found to occur immediately post-injury and days 1, 2 and/or 3 post-injury (overall effect size [ES] = 0.40, p<0.0001). Strength was also found to increase progressively from day 1 to day 3 post-injury (p<0.0001; ES of 0.27, 0.50, and 0.65 for days 1, 2, and 3, respectively). Because heterogeneity of between-study ES was large (F = 84%; p = 0.0001), moderator variables that could potentially explain this heterogeneity were probed using subgroup analysis or meta-regression. There was no significant difference in overall ES between studies using humans and those using animals (p=0.81). Additionally, there were no significant differences among studies using differing muscle groups (p=0.22). The only moderator variable showing a significant effect was gender (p=0.01); studies utilizing females exhibited a slower rate of strength recovery after injury (overall ES = 0.29) compared to males (overall ES = 0.35).

CONCLUSION: Overall, our analysis does not support the occurrence of a secondary loss of strength following muscle injury. In fact, the data indicate that a significant increase in strength occurs over the first 3 days after injury.

2940 April 212 June 1 9:30 AM - 11:00 AM Eccentric Contractions of Gastrocnemius Induce Sciatic Nerve Injury in Wistar Rats Kihyuk Lee, Koji Kobayashi, Riki Ogawawara, Arata Tsutaki, Eisuke Ochi, Koichi Nakazato. 1Nippon Sport Science University, Tokyo, Japan. 2University of Tokyo, Tokyo, Japan. 3Meiji Gakuin University, Kanagawa, Japan. (No relationships reported)

Muscle strain injury is considered to be caused by severe eccentric contractions (ECs). In our study on rat gastrocnemius (GST) muscle, we showed that ECs with a larger range of motion and/or faster angular velocity cause functional and histological damage to the muscle. Although GST crush injury not only induces damage in the muscle but also in the nerve, whether ECs of the GST muscle induce nerve tissue injury has not yet been determined. We hypothesized that ECs with faster angular velocity induced connecting nerve damage, as observed during crush injury.

PURPOSE: To examine the effects of GST ECs on sciatic nerve by using an animal model.

METHODS: Wistar rats were randomly divided into the following 3 groups; control (n = 6), fast EC group (FAST; angular velocity: 180°/sec; n = 12), and slow EC group (SLOW;angular velocity: 30°/sec; n = 12). Animals in the 2 EC groups were further divided into 2 groups as day 3 and day 7 groups (n = 6 in each group). Twenty ECs were performed using electrical stimulation of the GST and simultaneous forced dorsiflexion of the ankle joint (from 0° to 45°). For confirming functional deficit, isometric tetanic forces were measured at predetermined

767
times (i.e., days 1, 2, 3, 5, and 7) after the ECs. On days 3 and 7 after the ECs, the sciatic nerve branches were harvested and analyzed using western blotting. A 2-way ANOVA followed by a post hoc test was performed to compare the isometric tetanic forces and the results of western blotting.

**RESULTS:** A significant tongue deficit was observed from days 1 to 7 after the ECs in the FAST as compared to the SLOW (day 1: 13% and day 7: 20% [p < 0.05]; day 2: 31%, day 3: 22%, and day 5: 27% [p < 0.01]). The level of myelin sheath protein zero (p0) on day 7 FAST was significantly lower than those in the other groups (day 7 FAST vs. day 7 SLOW: 0.2-fold, p < 0.05; day 7 FAST vs. day 3 FAST: 0.5-fold, p < 0.05). A significantly higher level of macrophage-related protein (ED1) was also observed on day 7 FAST as compared to the day 3 FAST (day 7 FAST vs. day 3 FAST: 20.2-fold, p < 0.05). TrkC level in the day 7 FAST was also significantly higher than those in the other groups (day 7 FAST vs. day 7 SLOW: 3.3-fold, p < 0.05; day 7 FAST vs. day 3 FAST: 9.6-fold, p < 0.05).

**CONCLUSIONS:** The fast ECs of the GST muscle induced myelin sheath damage, macrophage invasion, and TrkC expression in the sciatic nerve, suggesting a nerve injury.

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**2941**

**Board #213**

**June 1**

**9:30 AM - 11:00 AM**

**Mild Eccentric Exercise Increases HSP 72 Content In Adult And Late Middle-Aged Rats**

Catherine E. Amara, Evan J. Lewis, Andrew H. Ramsook, Marius Locke. *University of Toronto, Toronto, ON, Canada.* (Sponsor: Ira Jacobs, FACSFM)

*No relationships reported*

Heat Shock Proteins (HSPs) are thought to protect cells from protein damaging stressors by stabilizing denatured or unfolded proteins. In response to the stress of exercise, the ability to increase HSP 72 content has been shown to be intensity-dependent and appears to be diminished with advanced age. Furthermore, HSP 72 content is higher in slow-twitch versus fast-twitch muscle and might offer increased cellular protection in slow twitch muscle in response to stressors, including aging.

**PURPOSE:** To determine whether a relatively mild exercise stress is sufficient to elicit an increase in HSP 72 content in the vastus intermedius (VI) and white gastrocnemius (WG) and whether this response is similar in adult (A) and late middle-aged (LMA) rats.

**METHODS:** 30 adult (6 months) and LMA (24 months) F344BN rats were divided into groups of 6: control (C), level exercise (16m/min - sacrificed immediately post-exercise (L0) or after 48 hours (L48) and eccentric exercise (16m/min - 16 degree decline) sacrificed immediately post-exercise (E0) or after 48 hours (E48). SDS-PAGE followed by Western Blotting was performed to assess muscle HSP 72 content. A nested ANOVA with a Tukey post hoc analysis was used to determine significant difference (p< 0.05) between groups.

**RESULTS:** For both age groups and in both muscles, no change in HSP 72 content was observed at L0 or E0. At E48, but not L48, HSP 72 content was increased in the VI for both A and LMA rats compared to level and control groups, respectively, with no differences between age groups observed. Pooled data from both age groups revealed a 20% increase in HSP 72 content at E48 compared with control. We did not detect constitutively expressed or exercise-induced HSP 72 for any group in the WG.

**CONCLUSIONS:** Even mild eccentric exercise is capable of increasing HSP 72 content in the VI and this adaptive response is preserved into late middle-age.

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**2942**

**Board #214**

**June 1**

**9:30 AM - 11:00 AM**

**The Effects Of High Powered Laser Therapy On Muscle Repair**

Matthew Christopher Kostek, Diana Delgado. *University of South Carolina, Columbia, SC.*

*No relationships reported*

High powered laser therapy is an emerging modality used in rehabilitation; however its effectiveness in enhancing healing skeletal muscle has not been previously investigated.

**PURPOSE:** The purpose of this study was to determine the effect of high powered laser treatment on markers of muscle damage and repair.

**METHODS:** Male and female subjects (n=16) were recruited for this study and underwent a muscle damage protocol standardized in our laboratory. Participants underwent exercise induced muscle damage (20 sets of 10 repetitions of eccentric contractions of the vastus lateralis) using an isokinetic dynamometer. Damage was confirmed by creatine kinase assays (300% increase, (No relationships reported)

**RESULTS:** A significant torque deficit was observed from days 1 to 7 after the ECs in the FAST as compared to the SLOW (day 1: 13% and day 7: 20% [p < 0.05]; day 2: 31%, day 3: 22%,

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**2943**

**Board #215**

**June 1**

**9:30 AM - 11:00 AM**

**Mesenchymal Stem Cells Contribute to Vascular Growth in Skeletal Muscle in Response to Eccentric Exercise**

Heather D. Huntsman, Carmen Valero, Kai Zou, Nicole Zachwieja, Marni D. Boppart. *University of Illinois at Urbana-Champaign, Champaign, IL.* (Sponsor: Jeff Woods, FACSFM)

*No relationships reported*

Tissue health is critically dependent on vascularization to support growth and function following injury. In addition to multiple implications in the regenerative potential of other tissues, mesenchymal stem cells have been shown to promote vessel formation both *in vivo* and *in vitro*. Our recent work has established that transgenic overexpression of the α7 integrin in skeletal muscle (α7Tg) can enhance the presence of Sca-1+CD45 mesenchymal stem cells (mMSCs) which facilitate myogenesis.

**PURPOSE:** The purpose of this study was to determine the extent to which angiogenesis is increased in α7Tg muscle following acute or repeated bouts of eccentric exercise and elucidate a role for mMSCs in this event.

**METHODS:** mMSCs were isolated from α7Tg muscle by fluorescent activated cell sorting (FACS) and pericyte markers were examined by flow cytometry. Wild type (WT) and α7Tg mice (5 wk) were subjected to single or multiple bouts (3xwk, 4 wks) of downhill running exercise. Additionally, Dil-labeled mMSCs were injected into WT mice. Measures of angiogenesis and vessel growth were evaluated by immunohistochemistry.

**RESULTS:** A large percentage of isolated mMSCs were positive for pericyte markers. Dil-labeled mMSCs injected into WT muscle migrated to the vascular niche and incorporated directly into vessels. Although capillary/fiber ratio, capillary density and tortuosity index did not increase, the number of large vessels was significantly increased in α7Tg muscle following single and repeated bouts of exercise (p<0.05; 3-fold for repeated bouts) and in WT muscle receiving mMSC transplantation (p<0.05; 48%).

**CONCLUSION:** This study demonstrates that mMSCs contribute to vascular growth in skeletal muscle in response to eccentric exercise, and that this adaptation is coordinated with increased myogenesis previously reported. Well orchestrated responses similar to this may be a key mechanism in the successful regeneration of several tissue types. Supported by grants from the National Science Foundation, and the Ellison Medical Foundation.

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**2944**

**Board #216**

**June 1**

**9:30 AM - 11:00 AM**

**Differential Expressions Of Tendon-related Markers After Fast/slow Velocity Lengthening Constrictions In Rat Gastrocnemius Muscle**

Eisuke Ochi, PhD1, Koichi Nakazato, PhD2. 1Meiji Gakuin University, Yokohama, Japan. 2Nippon Sport Science University, Tokyo, Japan.

*No relationships reported*

Although muscle strain injury is one of most important issues in sports medicine, there is little known about the molecular events on regeneration process and embryonic formation in vivo injured muscle.

**PURPOSE:** The purpose of this study was to examine the effects of lengthening contractions (LCs) on tendon-related markers signaling pathways. We hypothesized that tendon-related markers are up-regulated for the recovery from muscle injury.

**METHODS:** We employed our originally developed device with two LC modes to modulate the intensity in rat gastrocnemius muscle. Male Wistar rats (n = 18) were randomly divided into fast velocity LCs group (FAST, 180deg/s, n = 6), slow LCs group (SLOW, 30deg/s, n = 6), and control group (control, n = 6). The FAST and SLOW rats were anesthetized with isoflurane.
(aspiration rate, 450ml/min, concentration, 2.0%). The triceps surae muscle of the right hindlimb was then electrically stimulated with forced isokinetic dorsiflexion (30°/s and from 0 to 45°). Tissue contents and localizations of tenomodulin, scleraxis, and myostatin were measured by western blotting and immunohistochemistry. The mRNA expression of type I collagen alpha 2 (colla1a2) and moxhaw was evaluated using real time reverse transcriptase polymerase chain reaction. One-way ANOVA was used to compare the body mass, muscle mass, protein and mRNA analysis.

RESULTS: No significant changes were observed in both body mass and hindlimb muscles between three groups. The torque was significantly lower in FAST than in SLOW (day2; 59.9±17.2 vs. 101.5±22.9 mNm, P < 0.01). Tenomodulin and myostatin and colla2 mRNA showed significantly enhanced expression in FAST than in the other two groups (tenomodulin; ∼2.5 fold, P < 0.01, myostatin; ∼3.8 fold, P < 0.01, colla1a2; ∼8.5 fold, P < 0.05). Immunohistochemical staining in FAST, but not in SLOW, was mainly localized in connective tissues between muscle fibers. On the other hands, scleraxis and moxhaw mRNA in SLOW was significantly higher than that in control (scleraxis; ∼2.7 fold, P < 0.01, moxhaw; ∼6.7 fold, P < 0.05).

CONCLUSIONS: We conclude that fast LCs cause an increase in connective tissue fibrosis through the activated myostatin signaling pathway. In addition, the present results suggest that the severity of LCs-induced damage cause different expressions of tendon-related markers.

E-35  Free Communication/Poster - Neuroscience
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

Board #217   June 1  11:00 AM - 12:30 PM
Effects Of Cardiorespiratory Fitness On Brain Responses To Visual Food Images
Nero Evero, Laura Hackett, Robert D. Clark, Suzanne Phelan, Todd A. Hagobian. California Polytechnic State University, San Luis Obispo, CA. (Sponsor: Andrew Subudhi, FACSM)

CONCLUSION: We observed that cardiorespiratory fitness levels play a role in the effects of exercise on activity in frontal and visual brain regions involved in food processing. These data appear to suggest that LF individuals have a greater suppressive affect in brain regions that regulate appetite.

Board #218   June 1  11:00 AM - 12:30 PM
Effects Of Parental Physical Activity On Hippocampal Gene Expression In C57BL/6 Mice
Andrew C. Venezia, Lisa M. Guth, Michael P. Marinin, Efestan P. Beltran, Esper E. Spangenberg, Stephen M. Roth, FACSM. University of Maryland, College Park, MD.

CONCLUSION: These findings indicate that parental voluntary wheel running does not affect offspring neurotrophin and/or growth factor gene expression in the mouse hippocampus. This work was supported by NIH grant HD062868.

Board #219   June 1  11:00 AM - 12:30 PM
The Effect of Endurance Exercise and SIRT Activation on Brain Function on Rats Artificially Selected to High or Low Running Capacity
Zsolt Radak,1 Linda Sarga,2 Lauren Koch,2 Steve Britton2, Istvan Boldogh1,1 Semmelweis University, Budapest, Hungary. 2University of Michigan, Ann Arbor, MI. 1UTMB, Galveston, TX. (Sponsor: Li Ji J, FACSM)

CONCLUSION: Sirtuins are NAD+-dependent protein deacetylases and suggested regulators of aging, fat and sugar metabolisms and brain function. Resveratrol, an activator of SIRT1 has been shown to reduce plaque pathology in a transgenic model of Alzheimer diseases, and knock out of this enzyme significantly impair brain function. Here tested the role exercise and resveratrol treatment on brain function on low and high running capacity rats.

METHODS: In the present study we tested the effects of resveratrol on rats selectively bred over 24 generations for intrinsic aerobic high running capacity (HRC) or low running capacity (LRC). HRC and LRC animals were supplemented with either vehicle control or resveratrol (1000 mg/kg, oral dosing in every second day) for 4 months. Biochemical measurements were done from the hippocampus.

RESULTS: Exercise training over improved balance in both the HCR and LCR animals as measured by rotaerd test (10-15% amelioration/groups), while in open field tests, LCR rats supplemented with resveratrol has increased exploratory behavior compared with control group. In the new object recognition LCR rats had better performance compared to HCR animals and opposite was true for long term memory. Histochemistry data showed that resveratrol alone and with exercise increased neurogenesis in both groups. While the acetylation of by 8-oxoguanine DNA glycosylase (OGG1) 8-oxoG repairing enzyme was higher in LCR groups than in HCR animals and this correlated well with the activity of SIRT1. Western blots assays show that acetylated lysine and OGG1 levels were decreased in the resveratrol-fed animal.
CONCLUSIONS: One of the objectives of the study was to test whether regular training could overcome the health problems caused by genetic setup of LCR rats. Our data show, that regular exercise is a powerful tool to prevent genetics associated metabolic problems. Moreover, our data revealed that resveratrol selectively affects brain performance. It appears that life-style modification, physical activity and/or nutrition beneficially effects physiological performance. The biochemical analysis of hippocampus suggest that some of the beneficial changes in the brain could be mediated through SIRT1, which could included DNA repa...
RESULTS: Electroencephalographic activity within prefrontal and parietal brain regions showed increases with exercise intensity and decreases post-exercise. Prefrontal O2Hb and HbDiff increased with increasing exercise intensity, but showed no change (O2Hb left + right, HbDiff right) or even a further increase (HbDiff left) following exercise. O2Hb increased within parietal regions during and post-exercise, whereas HbDiff first increased but then decreased from the 2nd last to the last measurement during exercise and increased again following exercise.

CONCLUSION: Localized EEG activity and NIRS derived O2Hb and HbDiff levels responded differently during incremental bicycle exercise. This indicates that NIRS activity may not accurately reflect electrocortical activity and that brain NIRS data during exercise should be interpreted with caution.

**2953**  Board #225 June 1  11:00 AM - 12:30 PM

**Catechol-O-Methyltransferase Genotype Influences Cognitive Performance and Concussion History in College Football Players**

Mark H. Sundman1, Eric E. Hall, FACSM1, Robert A. Gardner1, Walter R. Bixby, FACSM2, Paul C. Miller1, Stephen E. Folger1, Matthew C. Kostek2, Bradley S. Gordon1, Kenneth P. Barnes1. 1Eton University, Elon, NC. 2University of South Carolina, Columbia, SC.

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PURPOSE: To investigate association between COMT and executive cognitive function in student-athletes and how certain genotypes affect concussion history.

METHODS: 18 college football players (age 18.07 years) were genotyped for COMT. Participants then performed cognitive tests using Immediate Post-Concussion Assessment Cognitive Testing (ImPACT). ImPACT obtains concussion history and measures cognitive function by using several neuropsychological tests involving word discrimination, attention span, response variability, working memory and recall, and reaction time.

RESULTS: 7 subjects were Met/Met genotype and 11 were Val/Met. Met/Met subjects scored higher on verbal memory test (p = 0.329), visual memory test (p = 0.080), and visual motor test (p = 0.163). Results also show that only 14% of Met/Met subjects reported history of concussions while 27% of Val/Val subjects reported suffering at least one concussion.

CONCLUSIONS: While data collection is ongoing, our preliminary data supports previous findings that the Val allele decreases cognitive performance and increases risk of concussions. Partially supported by a grant from American Medical Society for Sports Medicine.
Hamstring strain injuries (HSI) are the predominant non-contact injury in many sports. Eccentric hamstring muscle weakness following intermittent running has been implicated within the aetiology of HSI. This weakness following intermittent running is often greater eccentrically than concentrically, however the cause of this unique, contraction mode specific phenomenon is unknown.

**PURPOSE:** To determine if this preferential eccentric decline in strength is caused by declines in voluntary hamstring muscle activation.

**METHODS:** Fifteen recreationally active males completed 18 × 20m overground sprints. Maximal strength (concentric and eccentric knee flexor and concentric knee extensor) was determined isokinetically at the velocities of ±180°.s⁻¹ and ±60°.s⁻¹ while hamstring muscle activation was assessed using surface electromyography, before and 15 minutes after the running protocol.

**RESULTS:** Overground intermittent running caused greater eccentric (27.2 Nm; 95% CI = 11.2 to 43.3; p=0.0001) than concentric knee flexor weakness (9.3 Nm; 95% CI = −6.7 to 25.3; P=0.6361). Following the overground running, voluntary activation levels of the lateral hamstrings showed a significant decline (0.08%; 95% CI = 0.045 to 0.120; P<0.0001). In comparison, medial hamstring activation showed an increased level of activation following intermittent running (0.12%; 95% CI = 0.049 to 0.030; P = 0.0102).

**CONCLUSIONS:** Eccentric hamstring strength is decreased significantly following intermittent overground running. Voluntary activation deficits in the biceps femoris muscle are responsible for some portion of this weakness. The implications of this finding are significant because the biceps femoris muscle is the most frequently strained of all the hamstring muscles and because fatigue appears to play an important part in injury occurrence.

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**ECCENTRIC WEAKNESS FOLLOWING INTERMITTENT RUNNING**

**PURPOSE:** Eccentric hamstrings weakness following intermittent overground running has been implicated within the aetiology of HSI. This weakness following intermittent running is often greater eccentrically than concentrically, however the cause of this unique, contraction mode specific phenomenon is unknown.

**METHODS:** Ten trained runners completed two track sessions: a high-intensity session (HI) of 5×2000m following pacing lights (~75% of peak incremental test speed, mean final RPE = 16.4) and a low-intensity session (LO) of 5×2000m at <75% MHR and < RPE 13 (mean speed = 56% of peak, mean final RPE = 11.1). Stride time series were generated from peak ground contact and toe off. Thorax and pelvis range of motion (ROM) were calculated from initial ground contact to toe off. Pearson correlation coefficients were used to determine the relationship between strength and ROM (p<0.05). Differences between male and female athletes were tested with mixed design ANOVAs (p<0.05).

**RESULTS:** Isokinetic hip extension and abduction torque had significant inverse correlations to thorax ROM during stance phase of running (r=-0.49; abduction r=-0.44). Female runners had significantly decreased normalized strength (hip extension 1.8±0.4Nm/kg p<0.05; hip abduction 1.3±0.2Nm/kg; pelvic drop 8.9±1.9°; thorax 22.6±3.5°).

**CONCLUSIONS:** Increased hip strength resulted in decreased ROM for both pelvic drop and trunk rotation during the stance phase of running in collegiate athletes.
vGRF, and thereby the frequency content of the impact shock, may also differ. Changes in the amplitude of each frequency contained in the impact shock wave may affect how the body attenuates these frequencies.

**PURPOSE:** To determine the difference in shock attenuation between the RF and running footfall patterns.

**METHODS:** Ten natural RF runners and 10 natural FF runners ran on a treadmill at 3.5 m/s for 3 minutes with each footfall pattern. Piezoelectric accelerometers were affixed to the frontal bone of the head and the distal antero-medial tibia. Acceleration data were collected at 1200 Hz. A DFT was performed on 15 consecutive stance phases then normalized to 1 Hz bins. The degree of shock attenuation was calculated with a transfer function by: $10\log_{10}(PSD_{head}/PSD_{tibia})$. A mixed factor ANOVA was used to assess differences in attenuation at frequencies 1 - 50 Hz (n = 0.05).

**RESULTS:** RF running resulted in a gain of the head signal components relative to the tibia at frequencies between 1 - 2 Hz (p < 0.05) whereas FF running resulted in a gain at frequencies between 4 - 6 Hz. Attenuation was greater during RF running for frequencies between 5 - 11 Hz, 14 - 20 Hz and 42 - 47 Hz (p < 0.05). FF running resulted in an insignificant increase in attenuation of frequencies between 25 - 29 Hz.

**CONCLUSIONS:** Increased attenuation of the head signal components relative to the tibia at frequencies between 10 - 20 Hz may reflect the increased amplitude of the impact peak in the RF pattern. The differences in kinematics and muscular demands between RF and FF running may explain the increased attenuation of the impact shock wave in RF running. Passive mechanisms, such as absorption of frequencies by the heel fat pad, bone and other tissues, may be responsible for the increased degree of attenuation in high frequency components with FF running. Alternatively, active mechanisms responsible for attenuating low frequency components may not provide sufficient attenuation to maintain head stability.

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**Result reporting**

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2959 Board #231 June 1 9:30 AM - 11:00 AM

**Age and Performance Related Differences in Adolescent Running Biomechanics**

Richard W. Kruse, John Henley, Chris Church, Ryan Bober, Daveda Taylor, Nancy Lennon, Kathleen O’Brien, Freeman Miller. Alfred I. duPont Hospital for Children, Wilmington, DE.

(No relationships reported)

Several studies have focused on associations between biomechanical gait abnormalities and prevalent running injuries. Few have looked at the changes that occur due to natural development and training. Young or untrained runners may have natural characteristics that pre-dispose them to injury and these tendencies may disappear as the runner gains experience.

**PURPOSE:** The purpose of this study is to determine the biomechanical differences associated with age and performance in children.

**METHODS:** Sixty-six subjects (29 boys, 37 girls), unjured for prior 6 months, ages 8-20 years old participated in the study. Subjects were stratified by age into three groups: 8-11, 12-14, and 15-20 years old. The older subjects (14-20) were separated stratified by self-reported mile performance as good (≤ 5 min/mile), average (≤ 6 min/mile), and poor (> 6 min/mile unreported). Kinetic and kinematic data was obtained for each subject during over-ground running at 9 mph (± 5%). Steady state was determined by ensuring that the braking and propulsion ground reaction forces fell within 25%.

**RESULTS:** With age, cadence decreases (192 ± 13 steps/min to 166 ± 9 steps/min; p < 0.05) and step length increases (254 ± 18 cm to 294 ± 19 cm; p < 0.05). Normalized joint variability decreased with age, although this was not significant (1.6 ± 2. young, to 1.0 ± 4. old). Age correlated with a shift from hip flexion power in youth as a primary means of propulsion (5 ± 2 N to 3 ± 1 N; p < 0.05) to ankle power in older runners (8 ± 2 N to 12 ± 2 N; p < 0.05). Older age also correlated with greater knee flexion range of motion (24 ± 4° to 28 ± 5°; p < 0.05). This effect was consistent with increased knee flexion absorption power (6.8 ± 3 N to 12 ± 4 N; p < 0.05). Loading rate was significantly higher in younger runners (120 ± 41 N/BWS) than older runners (88 ± 27 N/BWS). Good self-reported milers had lower cadence (162 ± 8 steps/min vs. 168 ± 10 steps/min) and a longer stride (305 ± 14 cm vs. 286 ± 18 cm) than poor milers. Good milers trended toward less joint variability than poor milers, although this was not significant. Finally, the loading rate was significantly greater in faster milers (98 ± 23 N/BWS) than slower milers (77 ± 28 N/BWS).

**CONCLUSION:** Running biomechanics differ with age and performance level particularly in height-related, variability, and power generation variables.

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2960 Board #232 June 1 9:30 AM - 11:00 AM

**Whole Body Kinematic Compensatory Mechanisms Are Magnified As Runners Fatigue Over 10 Km At Race Pace**


(No relationships reported)

During a 10 km run at race pace, changes in lower extremity mechanics have been reported in male runners however mechanical changes over 10 km in female runners is unknown. Upper body mechanics at race pace has not been reported in either gender.

**PURPOSE:** To examine whole body running mechanics in female distance runners during a simulated 10 km race on a treadmill.

**METHODS:** Nine female distance runners (age: 32 ± 4.2 years; ht: 166.7 ± 7.4 cm; wt: 57.8 ± 7.0 kg; VO2max = 3.24 ± 0.50 L/min) completed a graded exercise test (Day 1); 10 km time trial (Day 2) and simulated 10 km treadmill run (Day 3). Treadmill speed was 95% of average running velocity of the Day 2 time trial. Reflective markers were placed bi-laterally and kinematic data was sampled at 120Hz at 50 m (BASE), 4450 m (MID) and 9950 m (END) using a 6-camera optoelectronic motion capture system. Bi-lateral mechanical measures calculated: stride frequency, maximum elbow flexion and maximum knee flexion (swing phase).

**RESULTS:** Stride frequency decreased for both the right and left legs (BASE to MID by 1.27strides/min for both and by 1.66 strides/min from MID to END (p<0.05). Overall maximum knee flexion during swing phase increased for both the right and left legs (BASE in END by 4° (p<0.05). Although not significant, maximum elbow flexion increased for both left and right limbs (BASE left: 137.6±6.7°; END left: 145.1±6.7°; BASE right: 134.6±11.6°; END right: 146.0±10.7°; P<0.05) CONCLUSION: These results indicate that changes in mechanics occur throughout the simulated 10 km run and these changes are magnified as runner’s fatigue. Mechanical changes such as these may be compensatory in nature. Increased elbow flexion may have assisted propulsion by increasing the amount of lift acting on the body and ultimately increasing the individual’s total flight time. This, combined with increased knee flexion, seem to be key coping strategies to maintain pace with fatigue induced step frequency decreases.

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2961 Board #233 June 1 9:30 AM - 11:00 AM

**Muscle Activity During Running With Different Body Weight Support Mechanisms**

John A. Mercer, FACSM;1 John A. Mercer, FACSM;2 Bryon Applequist;1 Kenji Masumoto;2 1UNLV, Las Vegas, NV, 2Fukuoka Prefectural, Fukuoka, Japan.

(No relationships reported)

There are different mechanisms to provide body weight (BW) support during running. For example, deep water running (DWR) provides 100% BW support whereas a lower body positive pressure (LBPP) treadmill (e.g., Alter-G) can provide varying levels of body weight (BW) support. However, muscle activity during running with different BW support mechanisms is not fully understood.

**PURPOSE:** To compare lower extremity muscle activity during DWR and running using a LBPP treadmill with different amounts of BW support.

**METHODS:** Subjects (6 females, 2 males; 40±6.5 years; 173±7.2 cm; 66.9±11.7 kg) completed DWR and LBPP treadmill running conditions. LBPP was set to provide BW support such that the subjects weighed 60% and 80% of BW. Two styles of DWR were used: high knee (DWR-HK) and cross-country (DWR-CC). Prior to testing, preferred stride frequency (PSF) at a self-selected speed was determined running on a treadmill (no BW support). Both of the LBPP treadmill conditions (i.e., 60% and 80% of BW) were done at the self-selected speed and PSF and each DWR condition (i.e., DWR-HK and DWR-CC) at PSF. Muscle activity was recorded from the rectus femoris (RF), biceps femoris (BF), gastrocnemius (GA), and tibialis anterior (TA) of the right lower extremity using telemetry surface electromyography (EMG). Average EMG (AVG) and root mean square (RMS) were calculated for each muscle across 15-s. Repeated measures analysis of variance were used to compare SF and EMG among conditions.

**RESULTS:** SF was not different between conditions (80.6±9.2, 83.5±11.5, 78.8±8.2, 81.0±6.1 strides/min for DWR-HK, DWR-CC, 60% and 80% of BW conditions, respectively; p>0.05). Although not significant, maximum elbow flexion increased for both left and right limbs (BASE left: 137.6±6.7°; END left: 145.1±6.7°; BASE right: 134.6±11.6°; END right: 146.0±10.7°; P<0.05) CONCLUSION: The mechanism of BW support nor style of DWR influenced GA or TA muscle activity during running at the same SF. However, RF and BF muscle activity were influenced not only by the mechanism of BW support but also the style of DWR.
Running on a treadmill (TM) that artificially reduces body weight (BW) via differential air pressure (DAP) has been shown to reduce (i) vertical ground reaction forces, (ii) muscular activity, and (iii) metabolic cost; but gait mechanics may be altered depending on the level of BW support. These findings explain the potential use of DAP TMs for both injury rehabilitation and performance enhancement. Despite the obvious applications, the relationship between BW support and spatiotemporal (stride rate, stride length) mechanics is not clearly understood. In order to improve training prescription and running mechanics specificity from DAP TMs to overground running, the current investigation systematically investigated the effects of BW support level on spatiotemporal running mechanics.

PURPOSE: To determine the effects of body weight support in a DAP treadmill on the spatiotemporal gait mechanics in male distance runners.

METHODS: Ten well-trained male runners (age 20.4 ± 2.0 yrs; height 1.78 ± 0.08 m; mass 63.9 ± 6.0 kg; years of competitive running 8.3 ± 2.4) voluntarily ran at a self-selected sub-maximal pace for 34 continuous minutes on a DAP TM at different levels of BW (100%, 90%, 80%, 70%, 60%, and 50%). BW was either systematically reduced (n=5) from 100% to 50% or increased (n=5) from 50% to 100%. Following each 5-minute segment, a 1-minute run segment at ±5% BW was allocated to ease the transition before the next BW level. Heart rate (HR), ratings of perceived effort (RPE), and high-speed sagittal plane video (210 Hz) were collected for each trial. Stride rate (SR), stride length (SL), and stance-to-swing cycle times (SS) were computed for each segment from video analysis. All dependent variables were compared using repeated-measures ANOVAs with post hoc tests in PASW Statistics 18.

RESULTS: SR and SL, normalized to leg length, was significantly different for all loading conditions (p < .04) with the exception of 60% compared to 70% BW (p = .12,.13). CONCLUSIONS: In a group of well-trained male distance runners, SR was significantly decreased and SL was significantly increased as the simulated BW was reduced in 10% increments.Clinicians and coaches utilizing DAP TMs should be aware of the resulting gait timing alterations and consider devices, such as a metronome, to increase cadence as BW support is increased.
2965  Board #237  June 1  9:30 AM - 11:00 AM
Vertical Acceleration To The Ground Can Be A Greater Component Contributing To Higher Sprinting Performance
Takeshi Oyama,1 Yoshihara Fujieda,2 Hisataka Ambe,1 Junpei Hayashi,1 Kenichi Suijo2, Hiroshi Yamauchi1, Kazuo Urata,3 1Gunnma Prefectural Maebashi Nishi High School, Gunma, Japan. 2Tokyo Gakugei University, Tokyo, Japan. 3Division of Health and Sport Education, The United Graduate School of Education, Tokyo Gakugei University, Tokyo, Japan. 4Department of Preventive Medicine and Public Health, Tokyo Medical University, Tokyo, Japan. 5Part-time Lecturer, Faculty of Sciences, Toho University, Chiba, Japan. 6Casio Computer Co., LTD., Tokyo, Japan.

(No relationships reported)

Background The top running speed of 100 m sprints are yielded by the accumulated accelerations of the first half to the goal. It is unfortunately impossible for us human beings to transmit all muscle powers directly into horizontal drive due to our body joint structure.

PURPOSE: In this study we investigated the changes of 3-dimensional accelerations (2a vertical to the ground, Ya vertical to X and horizontal to the ground, Xa horizontal to the ground and Yb toward the goal) of the sprinting athletes.

METHODS: Subjects of 13 Japanese male high school athletes underwent a single time-trial of 100 m sprint, wearing a triaxial accelerometer on their center of the gravity in the lower abdominal area. All through 100 m distance, 5 sets of split times and speeds were recorded at each 20 m section (the 1st section of 0-20 m as S1, the 2nd 20-40 m S2, the 3rd 40-60 m S3, the 4th 60-80 m S4 and 5th 80-100 m S5). Based on their total 100 m sprinting time, the upper 7 participants who showed better results were defined as the Faster and the other 6 as the Slower.

RESULTS: Compared the measured accelerations between the Faster and the Slower, Za of the Faster was statistically greater than that of the Slower at S1 (-1.691.42 ± 373.76 m/s² vs. -2.498.77 ± 341.19 m/s² p<0.05). The Faster also demonstrated tendencies of higher Za than those of the Slower at S1 (-1.686.72 ± 407.57 m/s² vs. -2.633.97 ± 372.05 m/s² p<0.1) and S2 (-1.667.65 ± 374.15 m/s² vs. -2.423.58 ± 341.55 m/s² p<0.1) respectively. On the other hand, Xa produced no significant differences at all sections. Discussions These findings indicate that it is difficult to predict the sprinters performance by only using horizontal acceleration data. We should consider that vertical acceleration, which is supposed to be a product of reaction force from the ground by transferring energy of the runners’ body weight and their leg muscle strength to the ground, can be a greater component contributing to higher sprinting performance.

CONCLUSION: Vertical acceleration to the ground can be a greater component contributing to higher sprinting performance.

E-37  Free Communication/Poster - Spine
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

2966  Board #238  June 1  11:00 AM - 12:30 PM
History of Low Back Pain affects Pelvis and Trunk Rotation During a Lift-Lower Task
Joseph F. Seay, Shane G. Sauer, Peter N. Frykman, Tanja Roy, US Army Research Institute of Environmental Medicine, Natick, MA.

(No relationships reported)

Low Back Pain (LBP) is common, with most cases resolving within 2 weeks. Research has shown increased risk of LBP in healthy (pain-free) athletes with a history of LBP (HBP). Bending at the waist and twisting is an occupational risk factor for LBP, however few studies have explored differences in lifting mechanics between healthy people with and without HBP; insight into these differences could elucidate adaptations that occur due to LBP.

PURPOSE: To compare transverse plane range of motion of the trunk (ROM_t) and pelvis (ROM_p) during a sustained asymmetric repetitive task between a HBP group and a group with no history of LBP (NBP).

METHODS: N=18 Soldiers (n=9 men/group) participated in a box lift-lower task. A 11-kg box with handles was lifted for 10 min at 12 cycles/min. The box started at ankle height in front of the volunteer, was lifted to a shelf 45° off-center at waist height, and lowered to the start position. Lifting side was alternated during the trial. Kinematic data were collected during min 1 and 9 (min1, min9). 2-way ANOVA (Group X Time) were performed for ROM_t and ROM_p. Effect sizes (ES) were calculated as the mean difference relative to a pooled SD.

RESULTS: ROM_t and ROM_p were similar at min1. At min9, HBP group did not change, however these ROM both decreased in NBP group (Fig 1). ES > 1.0 further indicated large practical differences.

CONCLUSIONS: Differences between groups over time demonstrate residual consequences of LBP in an occupational scenario, even though the HBP group was pain-free for > 6 months prior to data collection. The decreased axial ROM over time may represent a lack of adaptability in the HBP group compared to those who never had LBP, and may lend insight as to why individuals with HBP are at increased risk for re-injury.

2967  Board #239  June 1  11:00 AM - 12:30 PM
Lumbar Spine Kinematics in Marine Corps Soldiers Carrying Heavy Loads
Ana E. Rodriguez-Soto1, Andrew Jensen2, Rebecca Jaworski2, Karen Kelly1, Lawrence Frank1, Samuel R. Ward1. 1University of California, San Diego, La Jolla, CA. 2San Diego State University, San Diego, CA. 3Naval Health Research Center, San Diego, CA.

(No relationships reported)

Higher incidence of lumbar spine pain, perhaps due to heavy load carriage, has been observed in US military troops.

PURPOSE: To measure kinematic changes in the lumbar spines of Marines carrying heavy loads. We hypothesized that heavy loads would induce increased lumbar lordosis and disc compression.

METHODS: Sagittal T2 MR images of the lumbar spine were acquired on a 0.6T vertical MRI scanner in 8 active-duty Marines. Each Marine was scanned without load (BL), immediately after donning body armor and a backpack (total 50.8 kg), after 45 min of standing with the load (SL), after walking for 45 min with load (WL), and after 45 min of side-lying recovery. Custom loading task at L4-L5 (BL=12.2±3.3°, SL=3.9±4.0°, WL=4.9±4.2°) and L5-S1 (BL=10.6±3.9°, SL=2.9±1.2°, WL=3.6±2.1°), suggesting that reduced lordosis was driven by L4-L5 and L5-S1 lordosis was reduced during the SL (46.0±10.6°) and WL (38.6±17.5°) tasks compared with the unloaded task (52.3±11.6°). Sagittal intervertebral angles were significantly reduced in each

RESULTS: The overall position of the spine was significantly more horizontal during the SL (53.5±8.7°) and WL (54.5±5.2°) tasks compared with the unloaded task (85.2±3.3°). Lumbar lordosis was reduced during the SL (46.0±10.6°) and WL (38.6±17.5°) tasks compared with the unloaded task (52.3±11.6°). Sagittal intervertebral angles were significantly reduced in each

CONCLUSIONS: Heavy load carrying induced lumbar spine flexion and only anterior disc compression, contrary to our initial hypothesis. These findings suggest a postural strategy aimed at centralizing a heavy posterior load over the base of support. This strategy may minimize intervertebral compression, but it may also make the lumbar spine susceptible to shear-load-induced injuries. (US ARMY RDECOM N6311610MP00182)
Numerous anatomical changes occur during pregnancy that may be related to gait alterations, which in turn may be related to increased reports of lumbar and pelvis pain during pregnancy. While other researchers have reported changes in hip and ankle biomechanics, none have quantified torso kinematics related to the “waddling gait” that pregnant women are anecdotally said to exhibit.

PURPOSE: The purpose of this study was to examine the effects of pregnancy on torso mechanics during gait.

METHODS: Data were collected on 29 pregnant subjects in the mid-second and third trimesters and on 40 control women. An 8 camera motion capture system (120 Hz) was used to collect data of subjects walking at their freely chosen speed along an 8 meter laboratory runway. Subjects wore a modified Helen Hays marker set. Right foot heel strike (RHS) and left foot toe off (LTO) were determined from 3D marker data (1080 Hz). The 3D angles of the thorax (i.e. upper torso) and pelvis were determined at RHS. The frontal plane movement of the C7 marker and the range of motion of the thorax and pelvis during gait were determined between RHS and LTO. An ANOVA was performed to determine if differences existed between pregnant women in their second trimester, third trimester, and controls (α=0.05).

RESULTS: There was significantly (p<0.01) more frontal plane motion of C7 between the third trimester (6.5 ± 2.7 cm), second trimester (5.6 ± 1.9 cm), and controls (4.7 ± 1.8 cm) during the stride. At RHS, the sagittal plane position of the thorax was more extended (p<0.01) as pregnancy advanced (third trimester: -6.6 ± 4.5°, second trimester:-3.5 ± 5.1°, Con: 1.7 ± 5.1°). No other differences in thorax and pelvis mechanics were noted.

CONCLUSIONS: Pregnant women demonstrated more frontal plane motion of C7 during gait, particularly in the third trimester. Because no differences in frontal plane angles of the thorax and pelvis were seen between groups, this movement of C7 is likely due to a side-to-side shifting of the body rather than a leaning. Pregnant women demonstrated a backward leaning of the thorax, which is likely to counterbalance a forward position of the center of mass due to increasing abdominal size. 2Funding: NIOSH K08 004858.
Oblique (EO) and Erector Spinae (ES). Two methods were used for onset determination differing on threshold calculation. Method A threshold was determined by the baseline activity recorded between two maximum voluntary contraction (MVC) whereas method B calculates the mean of EMG activity before the beginning of BackSwing [-1000–500 ms]. After calculation some restrictions were established to onset calculation: a) search for onset begins 150 ms before DownSwing and 150 ms before BackSwing for left EO; b) 50 samples window will move forward until its’ mean is higher than threshold throughout the ascending parts of the signal. Visual inspection was performed.

RESULTS: Repeated measures three factors ANOVA showed significant differences (p<0.01) between muscles for the two methods, but there were no differences in the clubs used (p=0.521). Paired-Sample T test showed similar results between methods for RA (left - p=0.180 right - p=0.320). Furthermore, both methods were appropriate for this muscle, representing the percentage of maximum EMG peak (PM) of 19% and 9% for left and right sides, respectively (left A -19±13%PM B - 19±13%PM; Right A - 9±17%PM B - 9±17%PM). EO showed the greatest inter and intra subject variability with significant differences (p<0.01) between methods. In this muscle the onset was calculated at lower levels which could represent an anticipation of the true onset (left A - 11±4%PM B - 6±2%PM; right A - 5±5%PM B - 4±5%PM). ES showed significant differences between methods (p<0.001) with method A revealing better accuracy then method B that determined the onset at a higher percentage of the maximum of activation (left A - 5±3%PM B - 21±13%PM; Right A - 6±5%PM B - 26±12%PM).

CONCLUSIONS: Both methods are applicable to RA and the baseline MVC threshold is more accurate for ES. The OE shows high variability and both methods anticipate its onset calculation. In the EMG analysis of golf swing, onset calculation should be adjusted to each trunk muscle.

2972  Board #244  June  11:00 AM - 12:30 PM  
Base A Concept For Health Promotion In Logistic Workers With Manual Box Lifting Activities  
Bettina Wollfesn1, Heiko Lex2, Klaus Mattes2; 1University of Hamburg, Hamburg, Germany; 2University of Bielefeld, Bielefeld, Germany.  
(No relationships reported)  
Common occupational health problems are musculoskeletal disorders, especially low back pain. Increased reports of back symptoms are associated with physical demands of work, like lifting many heavy weights during a short time period especially when lifting is executed not ergonomically.

PURPOSE: The study examined a workplace intervention (BASE concept) to reduce physical stesses of manual lifting processes in a logistic company. It was conducted in three stages: description of the implementation (1), evaluation of outcome-effects of the ergonomic box lifting technique after a 10 week intervention (2) and examining learning and lasting effects (after 3 months) of workers’ knowledge and behaviour with regard to health orientated box lifting.

METHODS: Video analysis and questionnaires were used in stage (1) for a breakdown analysis. Stage (2) and (3) collected intervention effects with a controlled pre-post design (t1-t3; N=51 male logistic workers; 37.8±10.8 y.) The lifting process was evaluated with the PILE-Test. A 3-way ANOVA (group x weight lifting (kg) x repeated measurement) checked the intersections within common limits of significance (95% confidence interval). The cognitive representation of ergonomic object lifting was assessed by the structural dimension analysis of mental representation (with a critical value at λcrit = .88).

RESULTS: The breakdown analysis revealed common problems of repeated manual lifting processes like low back pain (65%). The workers who participated in the intervention showed a more ergonomic movement (F (5,51); p = .02) initiated by a more functional cognitive representation in long term memory (λcrit = 1.0).

CONCLUSIONS: The BASE concept can be described as an intervention which improves ergonomic lifting successfully with lasting effects. We suggest that especially this group of employees, with little motivation to participate in health prevention interventions, benefit from the whole methodological approach of this intervention.

2973  Board #245  June  11:00 AM - 12:30 PM  
The Effects of Kinesio Taping on Muscular Endurance of Deep Neck Flexors: A Pilot Study  
Yen-Cheng Lee1, Chich-Haung Yang2, Lan-Yuen Guo1; 1Kaohsiung Medical University, Kaohsiung, Taiwan; 2Tzu Chi University, Hualien, Taiwan.  
(No relationships reported)  
Kinesio taping (KT) has been in clinical use for many years. However, previous studies did not have a clear conclusion in relation to the effects of KT for muscular performance. Previous researches mentioned that poor posture of neck may alter the muscular moment arm and the endurance was deteriorated as consequence. This present study examined whether the KT had the effect on changes in muscle length of the deep neck flexors in attempt to alter muscular endurance.

PURPOSE: To investigate the effects of KT on muscular endurance of deep neck flexors.

METHODS: Six healthy participants, three males (mean age 20.0±1.0 years) and three females (mean age 22.0±4.3 years) were recruited in this study. Custom-designed neck strength measure instrument, with examined between days and within days reliability as ICC=0.968-0.988, was used to measure the muscular endurance of deep neck flexors in two conditions (KT and without KT). KT was applied on levator scapulae and upper trapezius, subjects were asked to maintain maximal voluntary contraction (MVC) of craniovertebral flexion till fatigue. We quantified muscular endurance by investigating muscle fatigue time which defined the time of the muscle moment drop to 50% of its peak value. Wilcoxon Signed-Rank Test was used to compare the differences of muscle fatigue time and muscle strength between the two taping conditions.

RESULTS: The mean muscle fatigue time without KT was 26.3±22.0 seconds and with KT was 26.6±27.0 seconds. There was no significant difference between two taping conditions (p>0.05). There was also no significant difference on mean peak muscle moment between two conditions (p>0.05), 46.3±17.1 kg-cm vs. 48.0±14.0 kg-cm as without KT vs. with KT respectively.

CONCLUSION: The application of Kinesio taping over the upper trapezius and levator scapulae may not be a useful taping method to enhance the muscular endurance of deep neck flexors.

2974  Board #246  June  11:00 AM - 12:30 PM  
Changes in Lumbo pelvic Mechanics Following Ultrasound Guided Nerve Block in the Superior Gluteal Nerve  
Carmen G. Cooper1, Karen Kendall2, Chirag Patel2, Michael B. Pohl1, Preston Wiley1, Carolyn Emery1, Reed Ferber4; 1Running Injury Clinic, University of Calgary, Calgary, AB, Canada; 2FootHills Hospital, University of Calgary, Calgary, AB, Canada; 3University of Kentucky, Lexington, KY; 4Sports Medicine Centre, University of Calgary, Calgary, AB, Canada.  
(Sponsor: Louis Osternig, FACSM)  
(No relationships reported)  
The Trendelenburg test (TT) has been described as a functional screening measure of ipsilateral hip abductor (HABD) strength and as an indicator of contralateral frontal plane pelvic stability. Few studies have specifically tested this hypothesis and no study has used a nerve block procedure to evaluate the function of the HABD.

PURPOSE: To assess the effect of superior gluteal nerve inhibition, and subsequent reduced function of the HABD, on the frontal plane kinematics of the pelvis during the TT and while walking.

METHODS: Baseline HABD maximal voluntary isometric contraction (MVC) data were collected on 7 male subjects (median (interquartile range): 31yrs (22 to 32yrs); 176cm (168 to 181cm); 74kg (67 to 81kg)) with a force dynamometer. Baseline biomechanical data were measured using retro-reflective markers placed on the pelvis during a standardized 30° TT and while level treadmill walking at 1.34 m/s. An ultrasound-guided nerve block (UNB) of the right superior gluteal nerve was performed and MVC and biomechanical measures were repeated.

Variables of interest included contralateral magnitude of pelvic drop (cMDP) during the TT and contralateral pelvic excursion (cPE), calculated from 10 consecutive footfalls during walking. Post UNB MVC output was calculated as a percent change from baseline. Digitization was completed using Vicon Motus v9 software. Non-parametric statistical analyses using Wilcoxon signed-rank tests determined differences, if any, following the UNB.

RESULTS: A 52% reduction in HABD MVC was measured following the UNB (Baseline: 3.3 (3.0 to 4.0); UNB: 1.8 (1.7 to 2.4); p=0.02). No differences were found in cMDP (Baseline: 0.4 (0.1 to 1.7); UNB: 1.4 (3.1 to 0.8); p=0.99) during the TT, or cPE (Baseline: 5.5 (4.6 to 6.3); UNB: 6.4 (4.8 to 6.7); p=0.13) while walking.

CONCLUSIONS: No significant changes in frontal plane pelvic kinematics were measured despite a significant drop in HABD MVC during the TT or while walking. These results suggest that the HABD may not be the primary frontal plane stabilizers of the pelvis. Further study is needed to determine if TT is adequate as a functional screening measure for HABD strength and frontal plane stability of the pelvis.
Gymnasts often experience back pain due to added loads and sport specific demands. It is important to develop protocols to decrease back pain in order to allow athletes to perform at optimal levels.

PURPOSE: To correlate multifidus muscle cross-sectional area (CSA) to low back pain in Hungarian gymnasts.

METHODS: Thirteen gymnasts (males n=2, females n=11, age: 21.5 ± 1.8 years, body mass: 62.3 ± 9.5 kg, height: 1.7 ± 0.8 m) were analyzed using ultrasound imaging. Participants completed a back functional index and self-reported history of back pain. Gymnasts were divided into two groups, those with and those without back pain. From a prone position, cross-section images of the right (R) and left (L) multifidus at all lumbar spinal levels were captured from video clips of each participant at rest and during contraction. Researchers capturing the images and measuring CSA were blinded to the participant group assignment. Muscle CSA was measured when the athlete was fully relaxed; clips of the muscle during contraction were used to help determine the muscle borders. The muscle borders were indicated by tracing the fascia surrounding each muscle and cross sectional area was computed by the ultrasound software. Differences in groups were determined by ANOVA, alpha at .05.

RESULTS: There is a significant difference in CSA between those gymnasts with and without back pain (p = .025), but not between R and L sides (p = .81) within groups.

CONCLUSIONS: Gymnasts with low back pain demonstrated smaller multifidus CSA than their pain-free counterparts. A study involving elite cricket players reported similar results. Specific strengthening of multifidus may be warranted.

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<th>Lumbar Level</th>
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2976 Board #248 June 1 11:00 AM - 12:30 PM

Relationship Of Back Muscular Endurance With Anthropometric Measures In Firefighters

John M. Mayer, Ren Chen, Simon Dagenais, James L. Nuzzo, Joe L. Verna, William S. Quillian, FACSM. University of South Florida, Tampa, FL.

PURPOSE: Assess the relationship between various anthropometric measures and back muscular endurance in firefighters.

METHODS: Assessments were conducted in full duty, healthy, career firefighters without low back pain from Tampa Fire Rescue (Florida, US) who participated in a randomized controlled trial. Anthropometric measures included height, body weight, body fat percentage assessed with BodPod, and thickness of the abdominal and lumbar multifidus muscles assessed with ultrasound. Isometric muscular endurance was assessed for the back with the Modified Biering Sorensen Test and core with the Plank Test. Relationships between variables were explored using Pearson’s correlation.

RESULTS: 96 firefighters (87 male, 9 female) enrolled in the study. For back muscular endurance, significant (p < 0.05) correlations were noted with age (r = -0.29), body weight (r = -0.45), body fat percentage (r = -0.46), thickness of the transverse abdominis, internal and external oblique abdominis, and L4-L5 multifidus muscles (r = -0.32 to r = -0.41). These correlations were also noted for core muscular endurance, with a r of -0.32 to r = -0.46.

CONCLUSIONS: Both increased body weight and body fat percentage were correlated with decreased muscular endurance of the back. Future research is needed to assess the impact of improving body composition on back muscular endurance to reduce the risk of low back pain.

A high incidence and prevalence of lumbar intervertebral disc degeneration (LDD) was found in combative sports with high demands on the spine. Similarly, low back pain (LBP) also occurs in combative sports. Although there are many relevant factors for LBP, it should be noted that LBP has been associated with cross-sectional areas (CSAs) of trunk muscles. However, little is known about an association between LDD and CSAs in combative athletes.

PURPOSE: This study examined whether the presence of LDD affects the size and symmetry of CSAs of trunk muscles in combative sports athletes.

METHODS: Participants in this study were 151 collegiate combative sports athletes. A total of 755 lumbar intervertebral discs from L1/2 to L5/S1 in 151 athletes were assessed using MRI and a comprehensive grading system of LDD (grades I-V). All 151 athletes were divided into 2 groups: LDD and non-LDD. CSAs of trunk muscles at the L3/L4 disc level were measured on MRI. CSAs were calculated using an image analysis software, and grouped into 5 large areas because they had poorly defined borders. Each of the 5 areas was represented by the same CSA on MRI. Images of the right (R) and left (L) multifidus at all lumbar spinal levels were captured from video clips of each participant at rest and during contraction. Researchers capturing the images and measuring CSA were blinded to the participant group assignment. Muscle CSA was measured when the athlete was fully relaxed; clips of the muscle during contraction were used to help determine the muscle borders. The muscle borders were indicated by tracing the fascia surrounding each muscle and cross sectional area was computed by the ultrasound software. Differences in groups were determined by ANOVA, alpha at .05.

RESULTS: CSAs of trunk muscles in the LDD group were significantly smaller than those in the non-LDD group (rectus abdominis: p<0.05; obliques: p<0.05; quadratus lumborum: p<0.01; erector spinae: p<0.001). Furthermore, CSAs were significantly asymmetrical between the left and right sides in the LDD group (obliques: p<0.05; quadratus lumborum: p<0.001).

CONCLUSION: This study suggested the association between the presence of LDD and atrophy and asymmetry of trunk muscles in combative sports athletes.
The purpose of this study was to compare intervertebral foramen diameter in the lumbar spine in the neutral standing position to that of an appropriately fit recumbent bike, hybrid bike, and diamond racing frame.

**METHODS:** Single participant was used to obtain lateral radiographs of intervertebral foraminal diameters both standing and on three bicycle formats. Subject was placed on an appropriate fit recumbent bike, hybrid bike, and diamond racing bike. MSK radiologist was incorporated to standardize angling of x-ray beam and analysis of data collection.

Images were analyzed on the Philips iSite PACS system including measurement of the lumbosacral angle and the cross sectional area (CSA) of the intervertebral foramina at L3-4, L4-5, and L5-S1. The lumbosacral angle was taken as the angle between lines drawn along the vertical axis of L5 and S1. The freehand region of interest (ROI) tool was used to measure the CSA by tracing the osseous borders of the foramen on the lateral radiograph. The lateral radiograph provides a summation of the right and left foramen when the osseous borders are traced along the posterior vertebral line, pedicles, and articular facets of each intervertebral foramen level.

**RESULTS:** Cross sectional area measurements were recorded. Cross sectional area was lowest in standing at all measured disk levels. L5-S1 was smallest level in standing and on all bikes tested. Recumbent bike foraminal cross sectional area was lower than the other two tested bicycles at L4-5 and L5-S1.

Lumbosacral angle measurements were also recorded. Lumbosacral angle measurements were similar between the tested bikes but higher in all bikes relative to the standing position. There was a statistically different measurement in intervertebral foramen diameter of the bicycles when compared to standing.

**CONCLUSIONS:** Bicycle design and fit does influence intervertebral foramen anatomy.

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**E-38**

**Free Communication/Poster - Sports Science III: Individual Sports**

**June 1, 2012 7:30 AM - 12:30 PM**

**ROOM:** Exhibit Hall

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**2978**

**Board #250**

**June 1 11:00 AM - 12:30 PM**

**Bicycle Design Influence on Lumbar Spinal Anatomy**

Stephen T. Jones, MD, Philip J. Blount, MD, FACSM, Daniel T. Hankins, MD, Britney N. Tubbs, Allen R. Moore, William T. Rosenblatt. **University of MS Medical Center, Jackson, MS.**

(No relationships reported)

**PURPOSE:** The purpose of this study was to compare intervertebral foramen diameter in the lumbar spine in the neutral standing position to that of an appropriately fit recumbent bike, hybrid bike, and diamond racing frame.

**METHODS:** Single participant was used to obtain lateral radiographs of intervertebral foraminal diameters both standing and on three bicycle formats. Subject was placed on an appropriate fit recumbent bike, hybrid bike, and diamond racing bike. MSK radiologist was incorporated to standardize angling of x-ray beam and analysis of data collection.

Images were analyzed on the Philips iSite PACS system including measurement of the lumbosacral angle and the cross sectional area (CSA) of the intervertebral foramina at L3-4, L4-5, and L5-S1. The lumbosacral angle was taken as the angle between lines drawn along the vertical axis of L5 and S1. The freehand region of interest (ROI) tool was used to measure the CSA by tracing the osseous borders of the foramen on the lateral radiograph. The lateral radiograph provides a summation of the right and left foramen when the osseous borders are traced along the posterior vertebral line, pedicles, and articular facets of each intervertebral foramen level.

**RESULTS:** Cross sectional area measurements were recorded. Cross sectional area was lowest in standing at all measured disk levels. L5-S1 was smallest level in standing and on all bikes tested. Recumbent bike foraminal cross sectional area was lower than the other two tested bicycles at L4-5 and L5-S1. Lumbosacral angle measurements were also recorded. Lumbosacral angle measurements were similar between the tested bikes but higher in all bikes relative to the standing position. There was a statistically different measurement in intervertebral foramen diameter of the bicycles when compared to standing.

**CONCLUSIONS:** Bicycle design and fit does influence intervertebral foramen anatomy.

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**2979**

**Board #251**

**June 1 9:30 AM - 11:00 AM**

**Chronic Trends and Limits to Running Performances and Physiological Attributes of World Record Holders**

R. Hugh Morton. **Massey University, Palmerston North, New Zealand.** (Sponsor: Glenn A Gaesser, FACSM)

(No relationships reported)

The International Amateur Athletic Federation provides readily accessible data on the progression of ratified world records over the years in running events at distances from 100m to the marathon for both men and women.

**PURPOSE:** To investigate trends and limits to performances and physiological attributes of world class runners.

**METHODS:** In one dimension, for any given distance the chronological trend can be well modeled by a simple single exponential decline towards an ultimate finite limit. In the other dimension, for any given point in time existing records provide information on the physiological performance attributes of the “composite” records holder. These attributes are estimated using the 3-parameter critical power model of human bioenergetics, in which a linear feedback system links maximal voluntary effort to the declining energy availability as the race progresses. In both dimensions an indicator variable can be incorporated to account for gender differences. In so doing, for both men and women, predictions are made for records at common distances and at year ten intervals for the next fifty years; ultimate records are estimated and compared with estimates made in the past by others; and the physiological attributes of the composite ultimate super male and female runners are compared to both current composite and individual values.

**RESULTS:** Women’s records have been improving at a faster rate than men’s, and have stabilised at around 90% relative to men’s. Ultimate forecasts are consistent with those made by other investigators. Aerobic power as represented by critical speed has been increasing significantly over the years, women always below men, and relativity is now stable at around 90%. Anaerobic power as represented by maximal instantaneous velocity trends similarly, but current relativity is around 95%. On the other hand, anaerobic (distance) capacities have been declining over the years; much more so for women than men, and are now about equal.

**CONCLUSION:** Although both male and female running performances have improved significantly over the years, parallel improvements in only two of three estimated physiological parameters occurred, while the third declined. This counter-intuitive inverse relationship is perhaps not unexpected as it has been observed in other exercise settings.

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**2980**

**Board #252**

**June 1 9:30 AM - 11:00 AM**

**Skill Differences for Elite Sprint Freestyle Competitive Swimmers**

Tetsuya Tanaka1, Yutaka Yoshimura2, Michio Yasukawa1, Kazuo Oishi2. 1Chuo University, Tokyo, Japan. 2Rikkyo University, Tokyo, Japan.

(No relationships reported)

Recently the techniques of competitive swimmers have been analyzed during the start phase and the turn phase to improve performance. However, in most cases these techniques have been assessed subjectively with no quantitative evidence.

**PURPOSE:** The purpose of this study was to analyze skills of streamlining and dolphin kicking during the turn phase and provide quantitative evidence of their value or lack of same.

**METHODS:** The subjects were 6 elite Japanese sprint freestyle competitive swimmers. All were members of the winning team at the 2011Japan collegiate swimming championship. A speed meter that measures a subject’s forward velocity by pulling a fine wire over a generator (Maglischo, 2003) was used. This speed meter recorded their intracyclic velocity changes during a 15m maximum effort freestyle swim following a turn. The swim included an underwater dolphin kicking phase of approximately 5m (5.18±2.07m). An underwater video analysis system was also used to check their streamlining, kicking, and stroking techniques. Based on the video data, the authors derived the length of the kicking cycle and the rate of rise during it.

The rate of rise was determined as the velocity divided by the maximum water depth which was then multiplied by the dolphin kicking time. Both the rate of rise and the distance per kick (DPK) were measured for each of the 6 swimmers from the collected data.

**RESULTS:** There was a significant relationship between the time required to traverse 15m after the turn (8.21±0.44sec) and DPK (0.79±0.07m/kick) for all of the 6 swimmers (r=-0.89, P=0.017). There was also a significant (r=-0.86, P=0.028) relationship between the time to 15m and the rate of rise (0.22±0.09m/sec). Namely when the DPK and rate of rise were greater, the

**CONCLUSIONS:** Improvement in DPK and the rate of rise during dolphin kicking may be important factors for improving swimming times to 15m following turns. Reference: Maglischo, E. W. (2003) Swimming Fastest. Human Kinetics.
**Board #251**  June 1  9:30 AM - 11:00 AM

A Descriptive Profile of Musculoskeletal Testing of Elite Junior Tennis Players

Todd S. Ellenbecker¹, Mark S. Kovacs², Tetsuro Sueyoshi², Physiotherapy Associates Scottsdale Sports Clinic, Scottsdale, AZ. ²Kennesaw State University & United States Tennis Association Player Development Incorporated, Kennesaw, GA. (Sponsor: T. Jeff Chandler, FACSM)

(No relationships reported)

The use of musculoskeletal testing to prevent injury and enhance performance is an integral part of the comprehensive care of elite athletes by sports medicine professionals. Sport-specific descriptive data aids in the interpretation of these tests and helps to define characteristic adaptations inherent in certain homogeneous populations.

**PURPOSE:** The purpose of this study is to present the descriptive findings of a sport specific musculoskeletal profile in elite junior tennis players.

**METHODS:** Since 2003, 140 male (M) (mean age 17.5) and 141 female (F) (mean age 16.6) players without injury underwent musculoskeletal testing to measure strength and flexibility using a standardized testing protocol by one tester. These tests included stabilized measurement of hip and shoulder ROM,okinetic strength testing, one leg stability test, hypermobility index, and scapular evaluation. Bilateral extremity testing was performed to formulate both dominant (D) and nondominant (ND) extremity profiles. Descriptive statistics were used to produce separate male and female profiles.

**RESULTS:** The average number of years of competitive tennis play was 8.72 M & 7.04 F. 73% M & 98% F used a 2 handed backhand. Consistent with prior reports, both (M) and (F) players had less (D) arm internal rotation range of motion (ROM) and greater external rotation ROM. Nearly symmetrical hip ROM was measured bilaterally. 20% of the M and 59% of the F were positive for hypermobility using the Beighton Index. M players failed the one-leg stability test at a rate of 65% on the D limb and 67 on the ND limb with 55% of F failing the test on their D limb and 64% on their ND limb. Visually identified scapular pathology was identified on the D arm 73% in M and 64% in F as opposed to 55% M and 46% on the ND extremity. Grip strength was greater on the dominant arm in both M and F players. Characteristic patterns of external and internal rotation strength were measured. Data presented in Table 1 below.

**CONCLUSIONS:** These data show specific musculoskeletal adaptations in elite tennis players as well as present the rate of positive tests findings (test failure) indicating increased injury risk. These data are meant to further the understanding and aid in the interpretation of musculoskeletal testing in elite junior tennis players.

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**Board #254**  June 1  9:30 AM - 11:00 AM

Strength: Volume Ratio For The Forearm In Climbers And Non-climbers

Vanessa España Romero¹, Phillip B. Watts, FACSM². ¹Northern Michigan University, Marquette, MI. University of South Carolina, Columbia, SC. ²Northern Michigan University, Marquette, MI.

(No relationships reported)

Many climbers and coaches perceive the strength in the muscles that control finger position critical to high-level performance. It has also been recognized that handgrip strength is higher in rock climbers than non-climbers. It is well accepted that muscle cross-sectional area or mass is directly related to maximum force capability, however, whether applied experience in rock climbing affects the relationship between muscle size and maximal strength is not known. The purpose of this study was to examine if a strength: size ratio for the forearm differed between climbers and non-climbers.

**METHODS:** Twenty-eight experienced climbers (age = 25±2.9 y) and 26 active adults non-climbers (age = 21±1.7) volunteered as subjects. Height and weight body were evaluated. Maximal handgrip strength (HG) was measured by dynamometry and finger force (FF) via a piezoelectric force sensor fitted with a plate to accept the distal digits of four fingers. Resting forearm volume (FAV) was determined via water displacement.

**RESULTS:** Significantly higher HG and FF were found in both hands for climbers compared with non-climbers expressed both in kg and kg per body weight (P<0.01). Significant differences were not found for FAV between climbers (1311.6 ± 397.3 mL and 1283.9 ± 380.1 mL for right and left hands respectively) and non-climbers (1382.1 ± 556.7 mL and 1352.6 ± 548.3 mL for right and left hands respectively) for either right hand or left hand (P>0.05). However, the ratio of HG to FAV (HG:FAV) and the ratio of FF to FVA (FF:FFA) were significantly higher for climbers versus non-climbers for both hands (P<0.01).

Right FAV was significantly correlated with height (r=0.42, P<0.05), weight (r=0.59, P<0.01), and right and left handgrip strength (r= 0.55, P<0.01 and r = 0.46, P <0.05, respectively) in climbers. However, right FAV was only correlated with weight in the non-climbers. Similar results were found for left FAV.

**CONCLUSIONS:** The higher HG and FF in climbers relative to non-climber controls supports a specificity of training effect on the associated muscle groups. That the ratios of handgrip strength to forearm volume and finger force to forearm volume are higher for climbers vs. controls suggest that neural factors instead of hypertrophy may account for much of the strength differences between climbers and non-climbers.

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**Board #255**  June 1  9:30 AM - 11:00 AM

Perceived Stress and Salivary Cortisol in Collegiate Track and Field Athletes. A Pilot Study.

Cynthia Ferrara, FACSM, Laura Donigian, Julie Lorden, Matthew Read, Joshua Turner. University of Massachusetts Lowell, Lowell, MA.

(No relationships reported)

**PURPOSE:** The purpose of this pilot study was to examine changes in perceived stress and salivary cortisol levels in four student track and field athletes over an eight month period. We hypothesized that perceived stress and salivary cortisol levels would be higher during the in season compared to the off season and salivary cortisol levels would be related to perceived stress.

**METHODS:** Measurements of psychological stress (Recovery-Stress Questionnaire for Athletes, RESTQ-S2) and saliva samples for measurement of salivary cortisol were collected weekly. In season and off season values for each athlete individually and for the group were compared by t-tests and relationships between stress values and salivary cortisol were examined using Pearson correlations. Results are presented as mean±SEM. Statistical significance was set at p<0.05.

**RESULTS:** From September to April, a total of 101 saliva samples and 90 RESTQ-S2 surveys were collected and analyzed. Athletes who completed at least 60% of the surveys and saliva collections (1 male and 3 females) were included in the final analysis, which included 69 saliva samples and 77 RESTQ-S2 surveys. Salivary cortisol levels were elevated but not statistically higher during the in season compared to the off season, when considering individual athletes or overall averages (6.1±0.7 vs. 5.0±0.9 nmol/L, p=0.3, respectively). General, emotional, and social stress values were not statistically higher during the in season compared to the off season (1.4±0.2 vs. 1.4±0.2, 1.6±0.2 vs. 1.5±0.2, 1.9±0.3 vs. 1.7±0.2, respectively, for the overall averages). Salivary cortisol levels were not significantly associated with general, emotional, or social stress values.

**CONCLUSIONS:** The results of this pilot study suggest that salivary cortisol levels may increase in athletes during the in-season compared to off-season. Levels of perceived stress may not be associated with salivary cortisol, a physiological marker of stress. Additional studies are needed with a larger sample size and to determine effective ways to monitor perceived and physiological stress in athletes, and the effects of stress on performance and risk of injury or illness.

Supported by UMass Lowell School of Health and Environment Creativity grant and Graduate Student Association grant.

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**Board #256**  June 1  9:30 AM - 11:00 AM

Changes In Locomotor, Respiratory And Autonomic Nervous Systems During Simplified Tai Chi Exercise

Kaiyu Xiong, Ruini Yang, Hui He. Beijing Sport University, Beijing, China.

(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the influence of age and training level on locomotor, respiratory and autonomic nervous system during tai chi exercise.

**METHODS:** Forty adults including young group(Y, 20-24 years old) and older group(O, over 55 years old) was divided into high level(H) group and control(C) group with 10 subjects in each one. Subjects in high level group had tai chi for 15 years, and those in control group for 1-3 years. Test synchronously biomechanics and dynamic parameters, electromyography, cardiopulmonary function and heart rate variability indexes by QUALISYS, portable electromyography instrument, Cortex and Polar during three times simplified Tai chi exercise.

**RESULTS:** (1) Average discharge rate of lateral deltoit in H group was apparently higher than C group(P<0.05, P<0.01) during Grasp the peacock’s tail (the third session of simplified Tai chi/exercise); (2)Average RR interval, RLX baseline, SD1 and RMSDD in young adults’ high level group(YH) were significantly higher than young adults’ control group(YC)(P<0.05), but...
there was no significantly difference between older adults’ high level group (OH) and older adults’ control group (OC); (3) Low Frequency (LF)/High Frequency (HF) in recovery period was lower than exercise period in YH group (180.1±42.4 vs. 346.6±75.9) and OH group (186.3±67.7 vs. 345.0±107.4), but higher in YC group (346.6±109.0 vs. 216.0±62.5) and OC group (316.3±59.6 vs. 202.6±62.2); (4) Tidal volume and expiratory time in YH group were significantly higher than YC group (P<0.05, P<0.01), and respiratory rate was significantly lower than YC group (P<0.05). There was no significant change between OH group and OC group; (5) Average RR interval was in high correlation with indexes of gaseous metabolism in H group (P<0.01).

**CONCLUSION**: There are important influences on respiratory and autonomic nervous systems in training level, and age can have effect heart rate variability indexes.

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**2985 Board #257 June 1 9:30 AM - 11:00 AM**

**The Use of Session-RPE Method for Quantifying Training Load in Elite Taekwondo Athletes.**

Erika Casolino1, Cristina Cortis2, Carlo Minganti1, Corrado Lup1, Laura Capranica1, 1University of Rome Foro Italico, Rome, Italy. 2University of Cassino, Cassino, Italy. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

In general, heart rate (HR) responses are used to control the internal training load (ITL) in different sports. A more practical method to monitor ITL is based on subjective ratings of perceived exertion (RPE) in relation to the duration of the training session (Session-RPE).

**PURPOSE**: The aim of the present study was to evaluate the convergent validity between two methods for quantifying ITL in elite taekwondo athletes: the Edward’s ITL method based on HR and the Foster’s Session-RPE method based on subjective evaluation of efforts, respectively.

**METHODS**: Twenty-eight elite black belt taekwondo athletes (F = 11; M = 17; age: 23.0±3.3 yr; body mass: F = 59.4±7.3 kg, M = 71.9±10.7 kg) with at least 5 yr of training experience consisting of 2 hr session1 for 6 days1 week1 participated in the study. Over 6 weeks, 36 training sessions (6 training sessions week1; duration range: 22-113 min) were monitored obtaining 279 HR and RPE recordings.

**RESULTS**: Significant (P<0.05) correlations emerged between Session-RPE and Edward’s ITL for individuals (range: 0.50-0.97), group (r = 0.58), and training objectives (i.e., technical/tactical: r = 0.49; physical conditioning: r = 0.48).

**CONCLUSION**: The present findings support the use of Session-RPE as a valid tool for quantifying the internal training load of elite taekwondo athletes during regular training sessions. In considering that Session-RPE can be easily administered without requiring expensive apparatus, coaches could profit of this method to monitor the individual responses of athletes to their training plans.

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**2986 Board #258 June 1 9:30 AM - 11:00 AM**

**The Effect of Ability and Technique on VO2 and Heart Rate Drift in Rock Climbers**

Simon M. Frier1, Tabitha Dickson2, Nick Draper1, Gavin Blackwell1, Lee Stoner1, 1University of Canterbury, Christchurch, New Zealand. 2University of Massey, Wellington, New Zealand. (Sponsor: Kevin K. McCully, FACSM)

(No relationships reported)

Previous research has speculated that the disproportionate rise in heart rate for a given VO2 seen in rock climbing may be due to anxiety or nervousness, an increased amount of time spent in isometric contraction or the presence of the metaboreflex.

**PURPOSE**: To examine technique, physiological and psychological factors which affect the VO2: heart rate relationship in intermediate, advanced and elite rock climbers.

**METHOD**: The current study measured rest frequency, total static time and the percentage of static time which was spent resting as well as anxiety, heart rate and VO2 responses in intermediate (n=12), advanced (n=19) and elite (n=15) rock climbers. All climbers performed at or near their maximum self reported on-sight grade (19/22/25+ Ewebank respectively).

**RESULTS**: Findings revealed a non-significant differences (p>0.05) between intermediate, advanced and elite climbers for pre climb heart rate, state anxiety and self confidence. The intermediate climbers displayed a disproportionate rise in heart rate for VO2 throughout the climb whereas advanced and elite climbers showed an initial elevation before mimicking the linear relationship seen in their VO2max trials. Significant differences (P<0.05) were observed between intermediate, advanced and elite groups for rest frequency, total static time and the percentage of static time which was spent resting.

**CONCLUSION**: Our findings suggest anxiety plays no part in the observed disproportionate rise in heart rate during rock climbing. The sufficient amount of rest time during climbing appears to help maintain the heart rate: VO2 relationship similar to that seen during a VO2max trial.

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**2987 Board #259 June 1 9:30 AM - 11:00 AM**

**Effects Of Autonomic Tone On Short Versus Long Distance Performances In Swimmers**

Martina A. Maggioni1, Arsenio Veicsteinas2, Pietro L. Invernizzi1, Claudio Ciapparelli1, Paolo Castiglioni1, Giampiero Merati1, 1University of Milan, Milano, Italy. 2DDS Sport Center, Settimo Milanese, Italy.

(No relationships reported)

Whatever the swimming specialty, swim training programs generally consist of high volume, which may shifts the heart rate (HR) autonomic control towards vagal predominance. Although it is accepted that an enhanced parasympathetic tone may improve performance on long distances, it is poorly known whether it may affect performance on short distances.

**PURPOSE**: To evaluate resting autonomic tone and swimming performance on short and long distances in highly trained swimmers.

**METHODS**: Two groups of national-level swimmers (all males, crawl specialists) were evaluated: short (S: 50-100 m; n=13; 24±3 yrs) and long (L: 1500 m; n=9; age 19±1 yrs) distance specialists. All swimmers belonged to the same team and were similar for training level. Beat-by-beat HR was recorded at rest in the morning, in supine position, by a HR monitor for 15 minutes. HR variability indexes were calculated from raw data (RMSD, pNN50, indexes of vagal tone) and frequency (LF, Low Frequency and HF, High Frequency as absolute values and in normalized units (nu); LF/HF ratio, index of sympathovagal balance) domains. The anaerobic threshold was evaluated by an incremental swimming test with lactate measurements.

**RESULTS**: The percentage of swimmers who showed resting bradycardia tended to be higher in L (78%) than in S (54%) group. HRV indexes did not significantly differ between groups: RMSD 67.2±3 vs 66.1±11 ms, pNN50 40±17 vs 44±10%, LFnu 62.3±12.3 vs 54±4.14±8, HFnu 37.6±12.3 vs 45±6.14±8, LF/HF 2.1±1.9 vs 1.5±1.0 (S vs L group, respectively). In S group, 50 m best time correlated positively (p=0.05) with RMSD (r=0.64), pNN50 (r=0.73) and absolute HF power (r=0.64), and negatively with LFnu (r=0.56), but not with anaerobic threshold. On the contrary, in L group 1500 m did not correlate with RMSD, pNN50 and absolute HF power (although negative trends were perceived), negatively correlated with absolute LF power (r=-0.65 p=0.05), positively correlated to LFnu (r=0.72, p=0.02), and tended to increase with anaerobic threshold.

**CONCLUSION**: L swimmers were not more hypervagotonic than S swimmers, and such adaptation tended to be positively associated with anaerobic threshold. Conversely, high vagal tone appeared somehow detrimental on short swimming performance, as it negatively predicts performance on 50 m events, whereas anaerobic threshold did not.

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**2988 Board #260 June 1 9:30 AM - 11:00 AM**

**Sex Differences In Marathon Performance With Advanced Age: Nature Or Nurture?**

Alyssa Stevens, Sandra K. Hunter, FACSM. Marquette University, Milwaukee, WI.

(No relationships reported)

The sex difference in marathon performance increases with age however the influence of participation rates of men and women are not established.

**PURPOSE**: To determine: (1) if the sex difference in finishing place of marathon performance (1st-10th place) altered with advanced age, and (2) the association of participation ratios with the sex difference in running velocity.

**METHODS**: Running times of the first 10 placed men and women finishers and the numbers of men and women finishers who competed in the New York City (NYC) Marathon were analyzed. Online data was retrieved for 31 yrs (1980 to 2010). The running times of 3850 men and 3363 women were included in the analysis.
RESULTS: The men were faster than women across all age groups (13.9%, P<0.001). Velocity decreased across the age groups (5.1 m/s for 20-29 yrs and 2.9 m/s for 70-79 yrs for the top finisher, P<0.001). The sex difference in running velocity increased across age groups (P<0.05) and decreased across the 31 yrs but more so for the older age groups (age x year, P<0.05). The sex difference in velocity increased with the place of the runner (11.0% for 1st place to 15.5% for 10th place) consistently for all age groups (P<0.05). The widening sex difference between 1st and 10th place was due to greater decrements in velocity of women compared with men (10th place was 81.5 ± 7.2% vs 86.5 ± 6.7% of top finisher). The sex difference in velocity with place also decreased across years between 1980 and 2010 (12.8% to 9.9%, P<0.05). The ratio of men to women finishers decreased from 6.8 in 1980 to 1.8 in 2010. The ratio however, decreased more for the older age groups than the younger across years (age x year, P<0.05). The men to women ratio in 1980-1985 to 2006-2010 changed from 4.0 to 1.0 for the 20-29 yrs and 23.6 to 5.9 for the 70 to 79 yrs. Importantly, there was a positive association between the ratio of men to women finishers within a 10 year age group over the 31 years and the sex difference in velocity (r=0.57, r²=0.33, P<0.05).

CONCLUSION: The widening sex difference in performance with increased place of the finishers is due to the greater relative decline in velocity of the women across place compared with the men. Furthermore, sex differences in marathon running times over the last 31 years were predicted by participation rates of men and women, especially with advanced age.

2989 Board #261
June 1
9:30 AM - 11:00 AM
Comparison of Running Economy Between Sexes in Ultra-Marathon Runners and Marathon Runners
Laura Christine Streep, San Francisco State University, San Francisco, CA. (Sponsor: Marilicie Kern, FACSM)

No relationships reported

Many researchers have examined sex differences in running economy (RE) in short, middle, and marathon distance runners. However, few investigations have focused primarily on sex differences in RE in ultra-marathon (UMar) runners (>42.2km) and marathon (Mar) runners.

PURPOSE: To investigate sex differences in RE in UMar and Mar runners.

METHODS: Maximal oxygen consumption (VO2max) was measured via a graded exercise test in all participants. Oxygen consumption was then measured in male (M) and female (F) UMar and Mar runners (Age range: 24-60; Mar-M: 60; Mar-F: 70; UMar-M: 90; UMar-F: 60) during 6 minutes of treadmill running at: 1) 6 mph and 1st grade and 2) 80% of VO2max and 1st grade. RE was calculated as mL.O2.kg-1.min-1. Heart rate (HR) and rating of perceived exertion (RPE) were recorded during each condition. An independent t-test was used to examine differences in variables between the male runners (UMar-M and Mar-M) and female runners (UMar-F and Mar-F). All tests were considered significant at the 0.05 level.

RESULTS: The males ran faster than the females at 80% of VO2max (13.74±0.44 vs. 11.94±0.45 km/hr, P<0.01). Although there were no significant sex differences in RE at 80% of VO2max (M: 198.61±3.40, F: 209.89±5.19 mL.O2.kg-1.min-1, P=0.074), RE at 6mph was significantly different between the sexes with the male runners exhibiting superior RE compared to the females (M: 192.80±3.41, F: 204.72±4.35 mL.O2.kg-1.min-1, P=0.038). The males had a significantly higher HR during 80% of VO2max compared to the females (163.40±2.65 vs. 150.77±3.26 bpm, P<0.01), but there was no sex difference in HR at 6mph (M: 129.2±2.9, F: 133.7±4.2 bpm). Furthermore, the males had a significantly higher maximal HR compared to the females (183.92±1.1 vs. 175.02±2.9 bpm, P=0.016). RPE did not significantly differ between sexes at either intensity (80%: M: 13.7±0.3, F: 13.2±0.5, P=0.40; 6mph: M: 8.93±0.3, F: 10.2±0.6, P=0.052).

CONCLUSION: The finding that RE is greater at 6mph in male UMar and Mar runners suggests that male runners are more economical at a sub-maximal speed compared to the females.

2990 Board #266
June 1
9:30 AM - 11:00 AM
Heart Rate Variability in Orthostatic Test During Different Training Periods in Elite Swimmers
Esa Hynynen,1 Xavier Iglesias,2 Belén Feriche,1 Carmen Calderón,1 Xavier Ábalos,2 Jairo Vázquez,3 Anna Barrero,1 Lara Rodríguez,2 Benjamín D. Levine, FACSM,6 Ferran A. Rodríguez, FACSM,1 1KIHU - Research Institute for Olympic Sports, Jyväskylä, Finland, 2INEFC, University of Barcelona, Barcelona, Spain, 3FCAFyD, University of Granada, Granada, Spain. 1Sierra Nevada High Altitude Training Center, Granada, Spain. 2JEEMUT. Southernwestern, Dallas, TX.

No relationships reported

This study investigated the effects of intensified training and tapering on HRV in elite swimmers.

METHODS: Eleven elite swimmers (7 F and 4 M, age 17.9 ± 1.9 y) lived and trained for 8 weeks before national championships qualifying for European championships. This follow-up period was divided to following microcycles: preparatory general, intensified training, preparatory specific, pre-competition and competition periods. RR-intervals were recorded during rest as an anticipatory effect of competition period.

RESULTS: The total number of Uchikomi was 53±3 and post effort right and left HGS =53±11 and 55±6 Kg, respectively. Peak values for HR, [La-] during judo combat and can be used to predict the judoists’s performances.

CONCLUSIONS: Comparable cardiological demands were recorded during judo combat by Ahmad et al. (1999). This would suggest that the UFT is representative of the effort provided during judo combat and can be used to predict the judoists’s performances.
CONCLUSIONS:

Only tendencies for higher XO activity (p = 0.245) and uric acid concentrations (p = 0.181) were evidenced in plasma. Pre-/post 1RM analyses revealed no significant changes in both CK and strength/resistance exercise. Financial support: FA PESP, CAPES & CNPq (Brazil).

RESULTS:

Metabolites of iron homeostasis and purine metabolism have been currently suggested as accurate biomarkers of redox metabolism during resistance exercise. Abrupt drops in performance, exacerbated inflammation processes, and injury risks are notoriously associated to excessive production of ROS in athletes.

PURPOSE:

To investigate the acute effects of wearing a supportive elastic device during a high load bench press on strength, average power output, average bar velocity, and the reliability of those measures in resistance trained males.

METHODS:

Eleven men aged 18-35 years completed 4 testing sessions, each separated by 1 week and at the same time of day. On visit 1, subjects were familiarized with the use of the elastic device and on the 2nd visit were assessed for 1RM bench press strength, bar velocity, and power. During the 3rd and 4th visits, subjects reproduced their original 1RM efforts wearing the elastic supportive device. Then the bench press loads were increased until a new 1RM value was obtained (SS 1RM). Average bar velocity and average power output was also determined for each trial. Reliability was assessed by paired t-tests and Pearson correlation coefficients between visits 3 and 4, and differences across the 3 testing visits were assessed by repeated measures ANOVA with statistical significance set at p≤0.05.

RESULTS:

Reliability for SS 1RM was excellent between visits 3 and 4 (r=0.981, p≤0.001) and the means were within 2.1 kg (p=0.124). For measures of power, the correlations for bar velocity and average power were low and non-significant; there were also no differences between means between the two days. Significant improvement for 1 RM (p≤0.001) was found with a 15.1% increase, but no differences for velocity and power between visit 2 and visits 3 and 4. The correlation between each individual’s 1RM percentage increase and their original 1RM was low and non-significant. When comparing the original SS 1RM in different lifting situations (visits 2, 3, and 4), both average bar velocity (p≤0.001) and average power output (p≤0.001) significantly increased.

CONCLUSIONS:

These results suggest that using the elastic device can significantly increase the bench press training loads and power in a reliable and consistent manner.

 Board #265  June 1  9:30 AM - 11:00 AM
Higher Iron Content And Antioxidant Depletion In Plasma Of Athletes After 1RM/strength Test.
Tatiana G. Polotow,1 Douglas Ganzini,2 Cristina V. Vardaris,3 Marina Santana,3 Lilian C. Torres,1 Tarcísio M. Prado1, Tacito P. Souza-Junior2, Marcelo P. Barros1.
1Cruzeiro do Sul University, São Paulo, Brazil, 2National Institute of Environmental Health Sciences, NC, WA, 3Federal University of Parana, Curitiba, Brazil.
(Sponsor: Tania Pithon-Curi PhD, FACSMM)

One-repetition maximum test (1RM) has been long used as an appropriate method of measuring isotonic muscle strength. Regarding oxidative stress, augmented xanthine oxidase activity in cytosol of muscle cells is apparently more related to overproduction of reactive oxygen species (ROS) during strength exercises than mitochondrial processes. Thus, key metabolites of iron homeostasis and purine metabolism have been currently suggested as accurate biomarkers of redox metabolism during resistance exercise. Abrupt drops in performance, exacerbated inflammation processes, and injury risks are notoriously associated to excessive production of ROS in athletes.

PURPOSE:

This work aimed to evaluate the role of iron and uric acid in the plasma redox status of young athletes after strength exercise.

METHODS:

Young college athletes (n = 11; age 23.1 ± 2.6 years; height, 174.1 ± 6.9 cm; weight 78.2 ± 8.2 kg) performed a 1RM test for chest press (pectoralis major extension) after a standard warming protocol (5 min-general warm up, 5 min-upper body stretching, and 1 set of 10 repetitions at estimated 60% 1RM). Blood samples (10 mL) were collected immediately before and 5 min after the 1RM test (pre-/post effect), and glomerular filtration rate and limitation (XO) and creatine kinase (CK) activities, and Trolox-equivalent antioxidant capacity of plasma (TEAC) were compared to total iron, heme-iron, uric acid, and thiobarbituric acid reactive substance (TBARS, biomarker of lipid oxidation) concentrations in plasma.

RESULTS:

Significant higher glomerular filtration (ca. 10%; p = 0.0432) and iron content in plasma (84%; p = 0.011) were related to 63% lower TEAC levels (p = 0.0067) after the 1RM test. However, only tendencies for higher XO activity (p = 0.245) and uric acid concentrations (p = 0.181) were evidenced in plasma. Pre-/post 1RM analyses revealed no significant changes in both CK and TBARS indexes.

CONCLUSIONS:

Iron-related oxidative stress conditions were imposed by maximal strength effort in young subjects, culminating in severe depletion of antioxidant capacity in plasma. Although immediate oxidative lesions were not observed, further analyses are necessary to evaluate long-term effects. Purine metabolism is still suggested as a potential source of ROS during strength/resistance exercise. Financial support: FAPESP, CAPES & CNPq (Brazil).

 Board #266  June 1  9:30 AM - 11:00 AM
An Analysis Of The Physiological Demands Of Race Riding Using A Horse Racing Simulator
Sarah Jane Cullen1, Adrian McGoldrick2, Gillian O Loughlin1, Gregory May3, Paul L. O Connor4, Giles D. Warrington, FACSM3. 1Dublin City University, Dublin 9, Ireland. 2Turf Club, The Curragh, Ireland.

Despite the international popularity of horse racing, the physiological demands of this challenging sport remain largely unknown. Paramount to all jockeys is the need to chronically maintain a low body mass, necessary to attain the stipulated competition riding weights, whilst maintaining a sufficient level of physical conditioning in order to compete in several races each day.

PURPOSE:

To determine the physiological demands of simulated race riding.

METHODS:

Eighteen male trainee jockeys (age 16 ± 1yr; height 1.67 ± 0.05m; body mass 55.68 ± 5.5kg; BMI 19.88 ± 1.65kgm-2; % body fat 8.13 ± 1.65%) performed a maximal incremental cycle ergometer test starting at 60W and using 25W increments to volitional exhaustion for determination of maximal oxygen consumption (VO2 max) and maximum heart rate (HRmax). Two race simulation trials were then completed on a horse racing simulator at a velocity of 30km/h. Trial 1: a simulated race for the typical time duration to cover a race distance of 1400m. Trial 2: a simulator riding test to exhaustion. A recovery period of 5 minutes was provided between each trial. Physiological function was assessed through measurement of respiratory metabolic measures and heart rate.

RESULTS:

Mean VO2 max during the incremental cycle ergometer test was 57.11 ± 4.72 ml/kg/min, with the mean ventilatory threshold (VT) occurring at 81.2 ± 5.4% VO2 max and HRmax was 188 ± 12 beats/min. During the simulated race over 1400m (Trial 1), peak oxygen consumption (VO2 peak) was 75 ± 11% of VO2 max while peak heart rate (HRpeak) was recorded as 86 ± 7% HRmax. In contrast, during the simulator riding to exhaustion (Trial 2) VO2 peak and HRpeak were 82 ± 10% and 87 ± 8% of the maximal values attained in the incremental cycle test, respectively.

CONCLUSION:

Determination of the physiological demands of simulated riding provides a clearer insight and understanding of the specific requirements of these athletes during training and competition. The novel results from this study suggest horse racing is a very demanding sport, requiring jockeys to perform close to their physiological limit to be successful. Further research is required to determine the specific physiological demands of horse racing during actual competition.

 Board #267  June 1  9:30 AM - 11:00 AM
Differences in Running Acceleration and Economy between Collegiate Runners and Cyclists Identified Using High-Resolution Accelerometers
Zachary J. Maino, Lucas J. Wall, Andrea D. Workman, Joshua P. Gordon, Stephen J. McGregor. Eastern Michigan University, Ypsilanti, MI. (Sponsor: Andrew Coggin, FACSM)

We previously reported differences in running economy between highly trained runners and triathletes using high-resolution accelerometer (HRA) and indirect calorimetry, which were partly attributed to greater training volume in the runners.
PURPOSE: To determine the differences in axial accelerations and running economy between collegiate runners (RUN) with high or low VO2max and cyclists (CYC) of comparable cardiovascular fitness during treadmill locomotion.

METHODS: Subjects gave informed consent to procedures approved by the EMU-CHHS Human Subjects Review Committee. 16 NCAA DI distance runners, divided by VO2max into HI (66±3.0 kg, 68±1.9 mL/kg/min) or LO (69±4.5 kg, 59±4.5 mL/kg/min), and 8 cyclists (CYC; 73±4.9 kg, 60±3.8 mL/kg/min) performed incremental VO2max trials starting at 8 kph and increasing 2 kph every 3 min until exhaustion while wearing HRA (Microstrain, VT: 617 Hz). Accelerations in g were recorded for vertical (VT), anterior/posterior (AP), medial/lateral (ML), and axial (AX) axes and filtered at 10-154 kph. Group comparisons were made for 10-154 kph. Axial root mean square (RMS), RMS relative to speed (EC), and ratio of RMS/RES (RA) were compared between groups. Expired gases were collected using an Oxycon Mobile (Viasys, CA). VO2 was used to determine O2 cost (O2C) and energy expenditure (EE). EE parameters and metabolic parameters were compared using MANCOVA using PASW 17.0 (SPSS; IL) α=0.05.

RESULTS: CYC VO2max was significantly lower than HI (p<0.05), but not different than LO. CYC acceleration parameters were significantly greater (p<0.05) for MAE, APAD, and TAD, and RESAD compared to both HI and LO. MLAD was also significantly greater for CYC vs. HI and LO (p<0.05), but TAD and APAD were both lower for CYC than HI and not significantly different from LO. O2C was lower in CYC vs. HI (177.5±19.5 vs. 184.3±21.0 mL/kg/km), but not different from LO. RER was higher in CYC vs. HI and LO (1.0±0.6 vs. 0.89±0.1 and 0.86±0.1, respectively); therefore, EE was not different between groups.

CONCLUSION: These data show that CYC accelerate more in all axes in absolute terms than HI and LO, however in CYC, APAD and TAD were similar to LO. Therefore, despite training, running economy (O2C) may be less dependent on absolute accelerations than the relationship between VT and AP, relative to RES.

Gravity-Assisted Downhill Mountain Biking: Physiological Demands and Health Benefits

Board #270 June 1 9:30 AM - 11:00 AM
Running Efficiency: Sprinters Vs. Distance Runners

Lindsey M. Kunkel, Maura L. Baumanstark, Katie L. Wargo, Colin B. Hanna. University of Central Missouri, Warrensburg, MO.

INTRODUCTION: In the world of running, one of the most important concepts is running economy, which is a measure of how efficiently a person uses oxygen while running at a given pace.

PURPOSE: The purpose of this research project was to compare two different types of collegiate level runners. Sprinters and distance runners were compared to determine which type of runner is more efficient in their running techniques. It was hypothesized that distance runners are more efficient.

METHODS: Eight distance runners and eight sprinters were assessed for lean mass using air displacement plethysmography. Subjects were assessed for VO2 consumption at a submaximal level, using a treadmill. All subjects ran at a 0.0 incline for 7 minutes at a 6.0 mph pace. The heart rate was measured and recorded with a heart rate monitor as well as weight (kg) and height (cm).

RESULTS: Distance runners had a mean oxygen consumption of 42.56 ± 1.8 mL/kg/BLM as compared to sprinters, with 43.22 ± 2.6 mL/kg/BLM. Distance runners had a mean LBM percentage of 81.16%, while sprinters had an average of 87.4%. A T-test was applied to tell if the means of the results were different enough to be beyond chance. The T-test result was 0.28, which indicated that the difference in the mean oxygen consumption was not significant enough to say that one group was more efficient.

CONCLUSION: Based on the data collected, the conclusion supports the hypothesis that distance runners are more efficient than sprinters when running 6 mph. Although the means of oxygen consumption data indicated that distance runners were more efficient, the difference was not significant. Therefore, each runner runs efficient enough for their type of race. Additionally the data indicates that sprinters have significantly higher lean body mass average percentage, however, their level of oxygen consumption was still higher at a submaximal level. Thus, according to the results, lean body mass percentage does not affect running economy. Key Words: running efficiency, lean body mass, oxygen consumption.

Supported by the University of Central Missouri
2999  Board #271  June 1  9:30 AM - 11:00 AM
Acute Metabolic And Mechanical Effects Of Different Sprint Workouts In High Level Sprinters
Pedro Jiménez-Reyes1, Victor Cuadrado-Penafiel2, Fernando Pareja-Blanco1, Manuel Alejandro Ortega-Becerra3, Juan Jose González-Badillo4, 1Catholic University of San Antonio, Murcia, Spain. 2University of Castilla La Mancha, La Mancha, Spain. 3Pablo de Olavide University, Seville, Spain. (No relationships reported)

Knowledge of acute effects of training load in sprint training sessions is essential for improving performance. The ultimate goal of training is to prepare athletes to perform at their best at important competitions. Therefore, it’s a need the training load’s individualization for sprint training.

PURPOSE: To analyze the acute metabolic and mechanical response to different sprint workouts (SW). SW with different number of repetitions (R) for each subject in short distance traveled (DT) and SW with same number of R in long DT.

METHODS: Eighteen high level sprinters (age 23.1 ± 4.4 yr, body mass 73.7 ± 4.6 kg, height 177.6 ± 5.9 cm; body fat 9.6 ± 2.9%) took part in this study. Six sessions separated by a week were performed. Three sessions for 40, 60 and 80m performed at highest possible speed up to lose 3% of speed with 4, 6 and 8 minutes rest between sets (same ratio work/recovery for different DT); thus, different R for the same DT [(x)RxDT]. Other three sessions performed over 150, 250 and 500m with the same R and DT for all subjects: 3xDT with 15 minutes rest between sets. Mechanical responses (i.e. height performance in countermovementjump (CMJ) and speed loss) and metabolic responses (i.e. blood lactate, uric acid and ammonia concentrations) were measured pre-exercise, during exercise each repetition performed and post-exercise.

RESULTS: CMJ height loss pre-post session were significant for all sprint workouts analyzed and highly correlated to metabolic responses (r = 0.86-0.98). The speed losses produced in the successive sprints presented a high relation between the distances and reduction in CMJ height. These losses were between 9.1% for 40m and 26.3% for 500m. The fatigue, measured as CMJ height loss, increases with DT, and, is strongly correlated to lactate (r = 0.93), uric acid (r = 0.86) and ammonia (r = 0.98).

CONCLUSIONS: The metabolic stress developed during the effort can be estimated by controlling CMJ because of the high correlation between CMJ and blood lactate, uric acid and ammonia concentrations. The high correlations found between mechanical (speed and CMJ height losses) and metabolic (lactate, uric acid and ammonia) measures of fatigue highlight the utility and validity of using CMJ to monitor training load in different sprint workouts and quantify objectively neuromuscular fatigue during sprint workouts.

3000  Board #272  June 1  9:30 AM - 11:00 AM
Physiological Correlates Of Cycling Efficiency, Economy And Performance In Elite Junior Cyclists
Elias Zacharogiannis, Vasilis Anastopoulos, Giorgos Paradisis, Nikos Dimitriadiis, Evagelos Rousopoulos, Athanasia Smimiotou. Athens University, Athens, Greece. (No relationships reported)

Among of the proposed determinants of cycling performance is cycling economy (CE) and work efficiency (WE). Enhanced CE is accompanied by a decrease in the percentage of VO2max required to sustain a given mechanical work. Improvements in WE can also theoretically maximize cycling performance as it is a measure of effective work and is expressed as a percentage of total energy expended that produces external work. Data in the literature are limited to elucidate the contribution of CE and WE in cycling endurance performance.

PURPOSE: The aim of this study was to investigate the correlation of WE and CE with physiological parameters. The contribution in 3 km indoor individual time trial of WE and CE was also studied.

METHODS: Subjects were eleven elite junior road cyclists (age 17.7 ± 0.5 years, body mass 66.8 ± 4.9 kg, body height 176.3 ± 7.4 cm, VO2max 69.7 ± 2.56 ml.kg-1.min-1). Physiological parameters were determined by continuous incremental testing. This protocol had steps of 2 min and increments of 30 W. Cyclists also performed two exhaustive trials in random order at 90%VO2max (tlim90) and 100%VO2max (tlim100) seven days apart. Five days after the last exhaustive trial cyclists performed an individual 3 km time trial on an indoor wooden track. CE was calculated as watt.L-1.min-1, while WE expressed as the ratio of work accomplished per minute (watt was converted to kcal.min-1) to energy expended per minute (in kcal.min-1).

RESULTS: Mean ± sd WE and CE were 20.11 ± 1.03% and 84.23 ± 4.28 watt.L-1.min-1. WE and CE did not correlate with VO2max, power at VO2max, tlim90, tlim100, maximal blood lactate concentration and the 3 km cycling performance (p > 0.05). WE was only related with ventilatory threshold (r = 0.62, p = 0.04). WE also presented a weak (r = -0.45, p = 0.12) relationship with 3km performance time. CE was only related with maximal pedalling revolutions (r = 0.65, p = 0.03).

CONCLUSIONS: Although WE and CE have been proposed to be the physiological criterion for efficient performance the data of the present study does not support their use for evaluation of cycling performance. Future research may elucidate better this by studying longer distances with a larger subject number.

3001  Board #273  June 1  9:00 AM - 11:00 AM
Interaction Among Vo2 Kinetics, Acid-base Status And Running Speed During On-track 800-m Running
Tomoharu Kitada, Hisashi Naito, YoshitoKonno, Shizu Katamoto. Juntendo University, Chiba, Japan. (No relationships reported)

During 400-m running, a fall in VO2 has been observed towards the end of the race. The decline in running speed as well as this fall in VO2 has been found to be correlated with acid-base status. The lactic acidosis therefore may contribute to the decline in running speed directly by perturbing contractile mechanisms, and also indirectly by impairing O2 supply. The interactions among VO2 kinetics, acid-base status and running speed during 800-m running however has not been studied to date. It is of interest whether decline in running speed during 800-m running would result from similar fatigue mechanisms to those of 400-m running.

PURPOSE: To investigate VO2 kinetics, acid-base status and running speed during on-track 800-m running.

METHODS: Seven male 800-m runners (age: 19.4 ± 1.7 y.o., season best: 120.4 ± 3.1 s) performed a maximal 800-m running for the best performance on track, following a warm-up. They also ran 400-m and 600-m on different days at the pace resembling that of 800-m running to collect blood samples at these distances. VO2 was measured by the K4b2 portable gas exchanges system. The average running speed was calculated for each 100-m using digital moving images (60 Hz). Breath-by-breath gas data were averaged within each 25-m. Blood samples (pH, HCO3- and Lactate) were taken from the earlobe after the warm-up and then 1 min after completing each trial to be analyzed.

RESULTS: The average 800-m performance time was 130.3 ± 4.5 s. The running speed peaked (24.5 ± 0.8 km.h-1) in the first 100-m then decreased gradually towards the end (20.9 ± 1.8 km.h-1). VO2 peaked (53.5 ± 3.3 ml.kg-1.min-1) about 425-m and remained similar until the end of the trial. For the acid-base status parameters, only the pH values at 400-m were negatively correlated with the decline in running speed in the last 200-m intervals. (r = -0.27, p < 0.05).

CONCLUSIONS: For Japanese collegiate 800-m athletes, VO2 remained elevated throughout the latter half of 800-m running, implying that the decline in running speed towards the end of the event could not be attributed to a fall in VO2. The ability to prevent a profound decrease of pH until 400-m may be the key to maintaining faster running speed near the end of the race. No grant for this study.

3002  Board #274  June 1  9:30 AM - 11:00 AM
Comparison of Sport Vision Between two Elite Athletes of Volleyball and Shooting
Yi-Jia Lin1, Cheng-Hsiu Lai2, Chia-Hua Kuo3, Shih-Wei Chou4, Alice Ma-yuen Wong5, 1Taipei Physical Education College, Taipei, Taiwan. 2Chang Gung Memorial Hospital, Tao-yuan, Taiwan. (No relationships reported)

Sports vision is fundamental for both volleyball (V) and shooting (S) disciplines but may be different between. Quantification of sport vision may help differentiate the components of sport vision required and also assess any training effects, if possible.

PURPOSE: For preliminary comparisons of sport vision between two disciplines of sports, i.e., volleyball and shooting.
METHODS: Two female elite athletes, one of volleyball and the other of shooting (Aged: V/S=22/29 years, BHI: V/S=178/161 cm, BWt: V/S=67/73 kg, career duration: V/S=9/12 years) were recruited to receive training which includes whole body stretching and strengthening exercise for one month. Visual performance was measured by a sport vision measurement software, including dynamic visual acuity (DVA), eye movement (EM), peripheral vision (PV), and momentary vision (MV). DVA was measured in four directions including left-to-right, right-to-left, up-to-down, and down-to-up. Measured variables were compared between two disciplines as well as before and after training.

RESULTS: For the comparison between two disciplines before training, better PV (V:24.9 vs. S:3.1 degrees) and MV (V:400 vs. S:600 pixels/frame) were found in volleyball. For the comparison of the post-test data, better EM (V:100 vs. S:200), PV (V:31.2 vs. S: 3.1 degrees) and MV (V:200 vs. S:600 pixels/frame) as well as DVA in right to left direction were found in volleyball. For training effect, all the items were improved in volleyball disciplines. However, effect of training was found only in DVA scores in shooting discipline.

CONCLUSION: Better PV and MV in volleyball suggested that peripheral vision and momentary vision were important to track ball between two groups of players. Better DVA in shooting suggested that dynamic visual acuity was essential to track targets in free dimension from fixed head position. Difference in sports-specific characteristics response to training was found mainly in PV. It can be explained that, for the shooting, focus ability was more important than PV within the range of shooting gun, therefore PV test conducted in shooting players was suggested to modify. Although peripheral vision was essential for the shooting performance; however, it may only be true when the evaluation was conducted in the distance larger than the length of the shooting gun.

3003 Board #275 June 1 9:30 AM - 11:00 AM Comparisons in Running Economy and Mechanics between Collegiate Pole Vaulters and Runners using High-Resolution Accelerometers Andrea D. Workman, Shean Conlon, Tim Muth, Anna Daoud, Aaron Stickel, Stephen J. McGregor. Eastern Michigan University, Ypsilanti, MI.

No relationships reported

Sprint and plyometric training have both been shown to improve running economy in distance runners. Pole vaulters are both sprint and plyometric trained athletes who do not perform endurance training. We previously used high resolution accelerometers (HRA) to demonstrate differences in kinematics that contribute to running economy. The purpose of this study was to compare running economy and mechanics between NCAA Division I Pole Vaulters (PV) and Cross Country Runners (XC) using HRA’s during an incremental treadmill test. We hypothesized that despite lower aerobic fitness, PV would be more economical runners than XC.

METHODS: 8 collegiate PV athletes, 5 males (19.6 ± 0.67 yr, 74.3 ± 3.7 kg, 54.2 ± 2.6 ml/kg/min) 3 females (19.25 ± 0.94 yr, 66.8 ± 0.7 kg, 42.6 ± 1.9 ml/kg/min) and 15 male collegiate XC athletes (22.1 ± 1.5 yr, 66.5 ± 5.7 kg, 71.1 ± 5.2 ml/kg/min) consented to procedures approved by EMU-CHHS Human Subjects Committee and performed an incremental running test (VO2max) consisting of 3 minutes stages, beginning at 8 kph and increasing 2 kph until exhaustion while wearing tri-axial HRA’s (Microstrain, VT). Group comparisons were made from 10 kph to 14 kph. Accelerations for vertical (VT), anterior/posterior (AP), medial/lateral (ML), axes were recorded and Euclidean resultants were computed (RES). Axial root mean square (RMS) relative to speed (EC), and ratio of RMS/RES (RA) were compared between PV and XC athletes to determine if differences in acceleration profiles could be identified between the two groups. Expired gasses were collected using an Oxycon Mobile (Viasys, CA). VO2 and RER were used to determine O2 cost (O2C) and energy expenditure (EE). MANOVAs were performed using SPSS 19.0 (IBM, NY) α=.05.

RESULTS: XC exhibited greater VT,RMS and AP,RMS than PV (p<.001) but ML,RMS and AP,RES were lower (p<.001). O2C was lower (p<.001) in PV (173.1 ± 13.7 vs 181.5±22.6, respectively) at every speed but RER was greater, therefore EE (p=.151) was not different among groups.

CONCLUSION: PV indeed exhibited better O2C than XC, but energy expenditure was not different between groups. Differences do exist in acceleration profiles between PV and XC, but these do not seem to contribute to reduced energy expenditure of running, as differences in O2C appear to relate to metabolic differences between PV and XC.

3004 Board #276 June 1 9:30 AM - 11:00 AM Field Testing vs. Physiological Testing in Novice Marathoners

Christopher J. Lundstrom, Stacy J. Ingraham, Ph.D., Gregory S. Rhodes. University of Minnesota, Minneapolis, MN.

No relationships reported

INTRODUCTION: Field testing, such as the use of time-trials (TT) and training races are utilized to assess and predict performance in endurance races. TTs have been studied as a method of predicting performance at rates of different distances. VO2MAX has not been considered one of the best physiological predictors of performance in endurance sports. Lactate threshold, running economy, and peak treadmill running velocity during a VO2max test (PTV) are also factors used in predicting running performance.

PURPOSE: To compare VO2MAX, PTV, and TT as predictors of marathon (26.2 mile) performance in novice marathoners.

METHODS: Forty-seven novice and minimally-experienced college-aged subjects (13 male, 34 female) aged 21.1 +/- 2.8 years, trained for and completed a marathon as part of a university course. Three TTs were performed: a 3200 meter, 3 months prior to the marathon; a 1/2-marathon, (13.1 miles), 2 months prior; and a second 3200M, 10 days before the marathon. Forty-seven subjects completed the first 3200M, and 41 subjects completed the additional TTs. The VO2MAX test was conducted on a treadmill one to three weeks prior to the marathon, using a graduated course. Three TTs were performed: a 3200 meter, 3 months prior to the marathon; a 1/2-marathon, (13.1 miles), 2 months prior; and a second 3200M, 10 days before the marathon. Forty-seven novice and minimally-experienced college-aged subjects (13 male, 34 female) aged 21.1 +/- 2.8 years, trained for and completed a marathon as part of a university course. Three TTs were performed: a 3200 meter, 3 months prior to the marathon; a 1/2-marathon, (13.1 miles), 2 months prior; and a second 3200M, 10 days before the marathon. Forty-seven subjects completed the first 3200M, and 41 subjects completed the additional TTs. The VO2MAX test was conducted on a treadmill one to three weeks prior to the marathon, using a graduated course.

RESULTS: Using Pearson’s correlations, VO2MAX, PTV, and three TTs were correlated with marathon finishing time (p<.01). While the correlation values were not significantly different, the half marathon and second 3200M TT had a higher correlational value specific to the marathon finish time (r = 0.91 and 0.89) than either the first 3200M TT (r = .85), VO2MAX (r = -0.78), or PTV (r = .81).

CONCLUSIONS: TTs of distances shorter than the marathon, VO2MAX and PTV correlate with marathon finish time. TTs closer to the date of the marathon had higher correlation values with marathon time than PTV or VO2MAX, though the differences were not statistically significant. Conducting testing at distances closer to the race distance or closer to the date of the race may strengthen the association. While this method does not provide the additional physiological data available through laboratory testing, it is less expensive and easier to conduct and shows a relationship to finish time.

3005 Board #277 June 1 9:30 AM - 11:00 AM Proposal Of A Specific Exercise Test For Taekwondo Athletes: Comparison To Traditional Cardiopulmonary Exercise Test Gabriel Espinosa, Jonas Lírio Gurgel, Flávia Porto, Allan Sales, Renata Castro, Renata Castro, Antonio Claudio Nobrega. Fluminense Federal University, Niterói, Brazil.

No relationships reported

PURPOSE: Compare the cardiorespiratory responses of a treadmill incremental exercise test (TREADtest) and a Taekwondo incremental exercise test (TKDtest).

METHODS: Seven (5 men and 2 women) Brazilian Taekwondo elite athletes (age: 21.29 ± 3.35yrs; weight: 77.20 ± 11.32kg; height: 1.75 ± 0.10m) were submitted to a two-day protocol consisting of a 3200 meter, 3 months prior to the marathon; a 1/2-marathon, (13.1 miles), 2 months prior; and a second 3200M, 10 days before the marathon. Forty-seven subjects completed the first 3200M, and 41 subjects completed the additional TTs. The VO2MAX test was conducted on a treadmill one to three weeks prior to the marathon, using a graduated course. Maximum velocity was determined based on ACSM equation. Initial velocity for all subjects was 60% of maximum predict velocity and increment was calculated for test duration of 10 minutes. Shapiro Wilks test were applied for confirmation of normality, a bi-caudal paired samples Student t test was applied to verify significance differences between the two tests (TREADtest and TKDtest).

The significance level was set at α=0.05.

RESULTS: For all analyzed variables there was no significant difference between the TREADtest and TKDtest (see table -1).

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Table 1 - Results from the comparison of the two exercise tests TREADTest x TKDTest.

<table>
<thead>
<tr>
<th>Sprint Distance</th>
<th>Pre Train Land</th>
<th>Pre Train Water</th>
<th>Post Train Land</th>
<th>Post Train Water</th>
</tr>
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<tbody>
<tr>
<td>50 yards</td>
<td>6.29(1.54)</td>
<td>4.55(1.58)</td>
<td>4.36(1.42)*</td>
<td>4.39(1.60)*</td>
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<tr>
<td>60 yards</td>
<td>7.94(1.22)</td>
<td>8.15(1.13)</td>
<td>7.72(0.86)*</td>
<td>8.07(1.14)*</td>
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<tr>
<td>100 yards</td>
<td>13.44(2.15)</td>
<td>13.83(2.41)</td>
<td>13.11(1.80)*</td>
<td>13.71(2.44)*</td>
</tr>
<tr>
<td>200 yards</td>
<td>22.15(4.36)</td>
<td>23.46(4.23)</td>
<td>21.19(3.59)*</td>
<td>22.29(4.83)*</td>
</tr>
</tbody>
</table>

CONCLUSION: The presented data did not show differences between the TREADTest and TKDTest for the tested sample. These results suggest that the new specific protocol developed is valid to assessment cardiorespiratory capacity of Taekwondo Do athletes.
RESULTS: Peak HIT VO₂ was unchanged over the training period (56.0±12.5 vs 51.6±7.7 ml·kg⁻¹·min⁻¹ for HIT1 vs HIT6 respectively) however peak Pavg was higher (p<0.05) for HIT6 (318.9±115.2 W) vs HIT1 (293.6±110.4 W). No significant differences were found between PRE and POST for SD at any speed during the treadmill rollerski intervals. SD values at 5.59 m·s⁻¹ were 5.24±1.89 and 5.43±1.78 m·stride⁻¹ for PRE and POST respectively.

CONCLUSIONS: Short term HIT training for double-poling improves peak average power in the specific training mode without a change in peak VO₂. The mode-specific training effect does not carry over to treadmill rollerski performance.

E-39  Free Communication/Poster - Sweating and Fluid Imbalance
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

3009  Board #281  June 1  11:00 AM - 12:30 PM
Effect of Hydration and Environment on Dynamic Postural Stability
Robert W. Kenefick, FACSM, Kurt J. Sollanek, Brett R. Ely, Samuel N. Cheuvront, FACSM, Michael N. Sawka, FACSM. U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Postural balance is critical to physical performance, completion of work tasks and a potential contributor to accidents. However, the influence of environmental temperature and hydration state has not been well studied.

PURPOSE: To determine the impact of hydration and a range of environmental temperatures on measures of dynamic balance.

METHODS: Following 5 days of training to reduce learning and within subject variation, 32 men (22 ± 4 yr) were divided into four matched cohorts (n=8), and tested (Biodex Balance System) in one of four Tₑ and RH environments: EUH (20°C, 40% RH); HYPO (20°C, 20% RH); EUH (+10°C, 40% RH); HYPO (+10°C, 20% RH). For each environment, subjects stood on an unstable platform and attempted to hold it in a level position. Balance measures consisted of % time in region A (%A), mean deflection (MD), and overall stability index (OSI).

RESULTS: Overall, core temperatures were stable across each environment. Skin temperature increased by ~4°C with each 10°C increase in Tₑ and thermal sensation was markedly different (p<0.05) in each environment, with no effect of HYPO. Intra-individual %CV calculated from training days 3-5 was 14.1% (±%, 24.6% (MD), and 22.5% (OSI)). In general, HYPO vs. EUH balance measures were not different (p>0.05) thus, EUH and HYPO trials were collapsed. A mixed model ANOVA revealed differences (p<0.05) between 10°C vs. other environments for %A, MD and OSI.

CONCLUSION: Hydration of -4% body mass does not alter dynamic postural stability. However exposure to cold does appear to negatively impact dynamic postural stability which may be related to low skin temperature and thermal sensation. Individuals who work, train or compete in the cold should be aware that dynamic postural stability may be compromised, possibly increasing risk for accidents or injury.

The opinions or assertions contained herein should not be construed as or reflecting the views of the Army or the DoD.

3010  Board #282  June 1  11:00 AM - 12:30 PM
A Comparison Of Hyperhydration Vs. Ad Libitum Fluid Intake Strategies On Markers Of Oxidative Stress
Angela R. Hillman¹, Mark C. Turner², Daniel J. Pearl³, Lee Taylor¹, Jason C. Siegler, FACSM.¹ University of Hull, Hull, United Kingdom. ²University of Bedfordshire, Bedford, United Kingdom. ³University of Western Sydney, Penrith, Australia.

Both in vitro and in vivo work has demonstrated that dehydration augments oxidative damage while euhydration can attenuate this trend. Similarly, in vitro work has demonstrated hyperhydration can attenuate oxidative damage. Glyceral is often employed as a hyperhydrating agent that is evenly distributed among the intra- and extracellular compartments, which would likely maintain cellular integrity providing protection against oxidative stress.

PURPOSE: The purpose of this experiment was to compare pre-exercise hyperhydration with glycerol (G) or water (W) to no hyperhydration (C) on markers of oxidative stress.

METHODS: Seven trained males (28 ± 8 yr, 178.4 ± 7.8 cm, and 73.2 ± 9.6 kg) were hyperhydrated by consuming either 1.2 g of glycerol·kg⁻¹·BM in 26 ml·kg⁻¹·BM or an equal volume of aspartame flavoured water. Drinks were evenly distributed every 30 min for a 120 min period followed by a 90 min time trial (TT) in a hyperthermic environment (35°C and 40% RH). Blood was drawn pre-ingestion (PRE), post-ingestion/pre-exercise (PI), post exercise (PE), and one hour post exercise (1HR) and analysed for whole blood total (TGSH) and oxidised (GSSG) glutathione, as well as plasma glycerol, protein carbonyl (PC), and lipid hydroperoxide (LOOH) concentrations.

RESULTS: Hyperhydration increased BM (0.6 ± 0.2 kg, p < 0.01) and plasma volume (6.1 ± 0.7%, p < 0.01) PI and increased total fluid retained PE (1.8 ± 0.1 L, p < 0.01). Plasma glyceral concentration increased PI and remained elevated at 1HR in G (peak: 4.5 mmol/L, p < 0.01). TGSH increased PI to PE in G and W (p < 0.01), while GSSG was lower PI and PE in G vs. C (p = 0.03). PC concentration increased PE during the C trial only (p = 0.04). Furthermore, PC concentration had a moderate negative relationship with hydration status PRE to PI (r² = -0.4, p = 0.04). There were no significant changes in LOOH (p < 0.05). Core, mean body, and skin temperatures as well as heart rate increased with exercise (p < 0.01 for all) but were not different between trials. Finally, there was no difference between trials for total distance covered (p > 0.05) or mean power output (p > 0.05).

CONCLUSION: Hyperhydration enhanced fluid balance and attenuated oxidative stress; however this did not translate to any thermoregulatory or performance enhancements during exercise.

3011  Board #283  June 1  11:00 AM - 12:30 PM
Hydropovery Impairs Strength And Alters Peripheral And Corticospinal Excitatory Output
Jo Bowtell¹, Gareth Avenell², Katya N. Mileva³. ¹Exeter University, Exeter, United Kingdom. ²London South Bank University, London, United Kingdom.

Muscle isometric (MVC) and isokinetic (IK) strength is impaired by hypohydration, due at least in part to reduced central drive. However, it is not clear whether this is due to hypohydration per se or accompanying hyperhydromia, and no neural excitability data are available.

PURPOSE: To investigate whether the hypohydration-induced decline in muscle strength is related to altered peripheral and corticospinal excitatory output.

METHODS: 7 male trained taekwondo players completed two trials (hyperhydrated, Hy; euhydrated, Eu) comprising 6x15 min cycling bouts at 85% HRmax at 40°C and 50% relative humidity, with core temperature (Tₑ) measured throughout. MVC and IK (90°·s⁻¹) strength and skin temperature (Tsk) were measured pre and post, and peripheral (femoral nerve) and transcranial magnetic stimulation were applied during MVC to quantify voluntary activation (VA) and evoked potential amplitude in vastus medialis (Mwave and motor evoked potential, MEP respectively). Data were analysed with 2way repeated measures ANOVA.

RESULTS: Body weight decreased by 2.7±0.1% in Hy, but there was no difference between conditions in pre and post Tₑ (pre: 37.3±0.1 vs post: 37.4±0.1, Eu; pre: 37.3±0.2 vs post: 37.6±0.1, Hy; °C) or Tsk (pre: 18.5±0.3 vs post: 18.6±0.1, Eu; pre: 18.7±0.2 vs post: 18.1±0.2, Hy; °C) in either condition. Both MVC (pre: 677±105.8 s vs post: 645±95.2, Eu: pre: 679±268.7 vs post: 576±657.5, Hy; Nm) and IK eccentric (pre: 646±384.0 vs post: 559±547.9, Eu: pre: 745±391.0 vs post: 505±447.4, Hy; Nm) strength decreased to a greater extent in Hy condition (x time interaction, P<0.05), but the decrease in VA was not significantly different between conditions (Hy: -8.9±3.7, Eu: -5.2±3.1 %). Mwave amplitude decreased significantly from pre (3.9±0.7, Hy; 4.1±0.5, Eu; mV) to post (3.1±0.3, Hy; -2.7±1.8, Eu; %, P<0.05). MEP amplitude was higher in Eu (1.5±0.2, post: 2.0±0.37, post) than Hy (1.3±0.18, pre: 1.39±0.32, post; mV; P=0.09).

788
CONCLUSIONS: The hypohydration-induced reduction in strength does not appear to be due to greater reductions in voluntary activation. Excitatory output was enhanced in the hypohydrated condition, presumably in an inadequate attempt to preserve function in the face of reduced contractility.

Supported by European Hydration Institute.

3012 Board #284 June 1 11:00 AM - 12:30 PM

Does Dehydration affect Peak Loading Rate during Landing in Adolescent Boys following Intermittent Exercise?

Jason C. Dorman,1 Szu-Ping Lee,2 Thayne A. Muncé,3 Paul A. Thompson,2 Ashley L. Miller,2 Christopher M. Powers, FACSM1, Michael F. Bergeron, FACSM1. 1Sanford USD Medical Center, Sioux Falls, SD. 2University of Southern California, Los Angeles, CA. (No relationships reported)

Injury risk reduction in youth sports is an ongoing priority. A potential contributing factor for a greater risk of certain musculoskeletal injuries during prolonged exercise is an increase in peak loading rate (PLR). Elevated loading rates have been linked to several lower extremity injuries, and fatigue is one factor common in sports that may increase these rates. We hypothesized that the combined effect of fatigue and dehydration would compound the problem.

PURPOSE: To investigate the influence of dehydration (+2% body weight deficit) on measures of PLR during a one-hop jump test in young athletes before and after an intermittent, moderate-intensity bout of exercise.

METHODS: Twenty-five physically active adolescent boys (16.6 ± 0.9 yr) were grouped into one of three exercise conditions: Dehydration-hot (DE-HOT: 35°C, 50% relative humidity (rh), with no fluid replacement), hydration-hot (HY-HOT: 35°C, 50% rh with fluid replacement) or hydration-mild (HY-MILD: 22.2°C, 50% rh with fluid replacement). Exercise trials consisted of one 60-min bout of intermittent exercise (alternating treadmill running @ 60% VO2max & cycle ergometry @ 40% VO2max). Immediately before (PRE) and after (POST) each exercise bout, PLR was assessed by the performance of a unilateral one-hop jump test on a force platform.

RESULTS: Peak measures of core body temperature, heart rate, rating of perceived exertion, and thermal stress rating were significantly higher in the DE-HOT (39.1±0.4°C, 187.4±12.1 bpm, 16.0±2.0, 11.0±0.6) and HY-HOT (38.9±0.5°C, 182.3±11.8 bpm, 16.1±3.0, 11.6±0.8) groups vs. the HY-MILD (38.1±0.3°C, 161.0±14.6 bpm, 11.6±1.3, 8.4±0.9) group (p<0.01). Mean PLR progressively increased PRE vs. POST in each exercise condition bout, as seen by the PRE vs. POST differences (DE-HOT 1243±1758, HY-HOT 792±2304, HY-MILD 403±1321 body weight/sec), though not statistically significant.

CONCLUSIONS: One hour of moderate-intensity, intermittent exercise, similar to that commonly experienced in youth sports, did not result in significant changes in PLR. Contrary to our hypothesis, inducing dehydration did not result in a consistent decrease in PLR. Therefore, greater levels of dehydration may be required to see an increase in injury risk during landing.

3013 Board #285 June 1 11:00 AM - 12:30 PM

Deep Ocean-Based Desalted Mineral Water Attenuate Dehydration Exercise-Induced Oxidative Stress and Inflammation in Healthy Young Men

KUNG-KUN YANG1, Chien-Wen Hou1, Feng-Chih Hsu2, Sheng-Chih Huang3, Mullikarjuna Korivi4. 1Taipei Physical Education College, Taipei, Taiwan. 2National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. (Sponsor: Kuo Chia-Hua, FACSM) (No relationships reported)

PURPOSE: Dehydration for long time in the body cause oxidative stress and influence other biochemical parameters. Exercise under high temperature conditions cause dehydration, which is probably due to the loss of minerals from the body. In the present study, we investigated the effect of deep ocean-based mineral water (DOMW) supplementation on dehydration exercise-induced oxidative mineral water levels in young men.

METHODS: Twelve-young healthy male college students were recruited for this double-blind crossover study. Dehydration was achieved by performing the treadmill running at 40% VO2max under 30°C in a closed room, leading to 3% body weight loss. The subjects were orally supplemented with deep ocean-based desalted mineral water (DOMW, N=6) or pure water (placebo, N=6) in a volume equivalent to 1.5 fold of their body weight loss, and consumed in 150-min. Malondialdehyde (MDA), interleukin (IL-6), erythropoietin (EPO), testosterone, myoglobin and lactate dehydrogenase (LDH) levels were measured in the blood before exercise, 4-h and 24-h after exercise.

RESULTS: Dehydration exercise-induced lipid peroxidation was evidenced by increase of MDA levels along with increased IL-6 concentration in both trail. However, MDA and IL-6 levels were significantly suppressed in DOMW received trail during recovery compared to placebo trail. Estimated EPO was not significantly altered in placebo trial, but increased (~130%, P=0.06) in the DOMW trial. Rise in myoglobin (muscle damage marker) and drop in testosterone, which normally observed after exercise, were significantly attenuated in the DOMW trial.

CONCLUSIONS: From our findings, it is concluded that deep ocean-based desalted mineral water is able to attenuate the oxidative damage and suppress the inflammation caused by dehydration exercise.

3014 Board #286 June 1 11:00 AM - 12:30 PM

Beverage Sodium Concentration and Total Ionic Load Increase Post-Exercise Fluid Retention


Replacement of Na is important for post-exercise rehydration. However, the potential additive effect of other electrolytes, such as K, Cl, Mg, and Ca in promoting rehydration is not well understood.

PURPOSE: To compare the impact of beverage [Na] and total ionic load (combined mM/L from Na, K, Cl, Mg, and Ca) on rehydration in athletes.

METHODS: After a 10-h (overnight) fast, 18 men (25 ± 2 y, 72 ± 2 kg) exercised (70-75% HR max) for 90 min in a warm room (27°C, 57% rh) without drinking. After exercise, subjects sat at rest for a 4-h rehydration period. From min 30 to 80 of rehydration, subjects drank 1 of 5 beverages in a volume equivalent to 100% of fluid losses (sweat and urine) incurred during exercise.

RESULTS: Subjects lost 2.3 ± 0.5% of body mass during exercise and consumed 1656 ± 382 mL of beverage during rehydration (consistent across all trials, P > 0.05). Malondialdehyde (MDA), interleukin (IL-6), erythropoietin (EPO), testosterone, myoglobin and lactate dehydrogenase (LDH) levels were measured in the blood before exercise, 4-h and 24-h after exercise.

RESULTS: Subjects lost 2.3 ± 0.5% of body mass during exercise and consumed 1656 ± 382 mL of beverage during rehydration (consistent across all trials, P > 0.05). In general, fluid retention increased as beverage [Na] and total ionic load increased (51.3 ± 15.8%, 57.4 ± 16.8%, 63.2 ± 15.3%, 65.3 ± 15.8%, and 69.2 ± 14.6% for PLA, LL, LH, HL, and HH, respectively). Subjects voided their bladder and were weighed at min 90, 120, 180, and 240 to determine percent fluid retention throughout the 4-h rehydration period. Data are reported as means ± sdev.

CONCLUSIONS: In agreement with previous studies, increasing beverage [Na] increased fluid retention; however, total ionic load also improved fluid retention, especially when beverage [Na] was relatively low.

3015 Board #287 June 1 11:00 AM - 12:30 PM


Chien-Wen Hou1, Yi-Ming Yeh2, Feng-Chih Hsu2, Mullikarjuna Korivi1. 1Taipei Physical Education College, Taipei, Taiwan. 2Hsin Sheng College of Medical Care and Management, Taoyuan, Taiwan. (Sponsor: Kuo Chia-Hua, FACSM) (No relationships reported)

PURPOSE: Exercise under high temperature conditions cause dehydration that causes loss lot of minerals, which simultaneously influence the individual performance. The present study was purposed to investigate the impact of deep ocean-based desalted mineral water (DOMW) on athlete’s performance after performing the dehydration exercise regimen.

789
METHODOLOGY: In this double-blind cross-over study, we recruited twelve healthy young men. All the subjects were performed prolonged treadmill running at 40% VO2max under 30°C leading to 3% body weight loss. Then subjects were orally supplemented with deep-ocean-based desalted mineral water (DOMW, N=6) or pure water (placebo, N=6) in the volume equivalent to 1.5 fold of their body weight loss, and consumed in 150-min. One-week after washout crossover trial was performed. Leg explosive power (instantaneous force change measured by force plate), maximal aerobic capacity (VO2max) and changes in heart rate variability (HRV) were measured at 4-h and 24-h during post-exercise recovery.

RESULTS: We found that exercise challenge caused a significant drop in explosive power at 4-h of recovery. However, DOMW supplementation showed higher recovery rate in explosive power above the placebo trial. Furthermore, only in DOMW trial, VO2max was significantly improved with concurrent increased heart rate variability (HRV) during recovery.

CONCLUSIONS: The result of the present study provides some supportive evidences that deep ocean-based desalted mineral water can accelerate recovery in physical performance after prolonged exercise challenge under high temperature condition.

3016 Board #288 June 1 11:00 AM - 12:30 PM
Rehydration and Cognitive Performance after Moderate Endurance Exercise in a Hot and Humid Environment in Women
Yajun Chen, Stephen H.S. Wong, FACSM, Fenghua Sun. The Chinese University of Hong Kong, Hong Kong, Hong Kong. (No relationships reported)

PURPOSE: this study was to observe the effectiveness in rehydrating women and the cognitive performance after a 60 min moderate endurance exercise in a hot and humid environment of three different beverages.

METHODS: Ten active eumenorheic women (n = 10, mean ± S.E.M; 22.6 ± 0.8 years, 56.5 ± 6.1 kg; 37.9 ± 4.6 mL·kg·min⁻¹ and 185 ± 3 beats·min⁻¹ ) ran for 60 min on three occasions on a level treadmill at 60% VO2max. Each trial was performed in a hot and humid environment (29.2 ± 0.9 °C, 71% ± 5% relative humidity) and was separated by at least seven days. During 4 hr REC, the subjects consumed either a volume of a carbohydrate electrolyte beverage (CE), lemon tea (LT), or distilled water (DW) equal to 150% of the body weight lost during the previous run. The fluid was consumed in 6 equal volumes at 30, 60, 90, 120, 150, and 180 min of REC. A battery of CogState tests in Chinese Version was selected in sequence: four-choice reaction time, visual vigilance, match-to-sample, repeated acquisition, and grammatical reasoning, to provide information on a variety of cognitive parameters on arrival, immediately after exercise, and at the end of 4 hr recovery period.

RESULTS: By the end of the REC, of the ~1.4% BW fluid losses, 55.6 ± 14.0%, were replaced when the CE was ingested during the 4 hr REC. This is higher compared with 45.6 ± 15.7% when the LT was drunk (p < 0.05), and 40.9 ± 9.3% when DW was consumed (p < 0.05). When compared with DW, the CE drink improved (p < 0.05) the speed performance of Detection in the end of 4 hr REC (2.55 ± 0.10 vs. 2.50 ± 0.15 vs. 2.47 ± 0.09). The carbohydrate drink, CE and lemon tea, are both benefiting to the accuracy performance of working memory compared to DW (p < 0.05) (CE vs. LT vs. DW: 1.26 ± 0.08 vs. 1.16 ± 0.13 vs. 1.08 ± 0.07).

CONCLUSION: During a 4 hr REC following exercise in a hot environment, a CE solution is a more effective rehydration beverage than other drinks typically consumed in Hong Kong, such as LT and DW. In addition, when compared to DW, the carbohydrate drink, especially the CE, also have the potential benefits for the Working memory, Detection, and Learning in a short-term REC following a moderate exercise in hot environment.

3017 Board #289 June 1 11:00 AM - 12:30 PM
Mild Dehydration Impairs Exercise and Cognitive Performance During a Cycle-Based Simulated Ice Hockey Game
Matthew S. Palmer, Rachel L. Driscoll. University of Guelph, Guelph, ON, Canada. (Sponsor: Lawrence L Spriet, FACSM) (No relationships reported)

Dehydrating by ~2% body mass (BM) during moderate intensity exercise and stop and go sports has been shown to decrease physical performance, brain blood flow and cognitive function. On average, ice hockey players lose 1.3% BM during a game with 1 in 3 players losing between 1.8 - 4.3% BM, but few studies have examined the effects of mild dehydration on hockey performance.

PURPOSE: To determine if mild dehydration in hockey players (n = 9, 1.80 ± 0.01 m, 77.0 ± 2.9 kg, 21 ± 0 years, 56.8 ± 1.9 mL·kg·bm⁻¹) affects exercise performance, perceived exertion (RPE), cognitive performance (modified Stroop test), and reaction time in period 3 (P3) of a cycle-based protocol to simulate an ice hockey game, as compared to staying hydrated with a carbohydrate-electrolyte solution (CES).

METHODS: Subjects performed a cycle-based intermittent sprint protocol that was designed to simulate an ice hockey game on two occasions and either restricted their fluid intake prior to exercise and did not ingest fluid (DEH), or drank 500 mL of water 1-2 hours prior to exercise and fully replaced sweat losses with a CES (HYD).

RESULTS: Subjects lost a total of 1.7 ± 0.2% BM following P2 and 2.5 ± 0.2% BM after P3. RPE was higher in P3 for the DEH group (18.1 ± 0.4 vs. 17.2 ± 0.7, p < 0.05). Performance of a modified Stroop test following the protocol was lower in DEH (Score: 147 ± 54 vs. 216 ± 74, p < 0.05). Reaction time assessed after the protocol however, was improved in DEH (212 ± 9 vs. 262 ± 32 ms, p < 0.05). Sprint performance decreased over time in both groups but was not different between groups, and ∆Tc increased sharply in PI in DEH (1.0 ± 0.1 vs. 0.6 ± 0.0°C, p < 0.05). Mean sprint HR was higher in P1 (174 ± 3 vs. 171 ± 3 bpm, p < 0.05) and P2 (178 ± 2 vs. 176 ± 2 bpm, p < 0.05) in DEH, but similar in P3 (176 ± 2 vs 174 ± 3 bpm).

CONCLUSIONS: Mild dehydration had a negative impact on perceived exertion and exercise performance period 3 of a cycle-based simulated hockey game. Performance of a modified Stroop test was also impaired after the game. Hockey players benefited from improved cognitive and physical performance later in a simulated hockey game, as compared to staying hydrated with a carbohydrate-electrolyte solution (CES).

3018 Board #290 June 1 11:00 AM - 12:30 PM
Effects of Hyperthermia and Dehydration on Physiological and Perceptual Measurements During Exercise in Two Environments
Julie K. DeMartini, Douglas J. Casa, FACSM, Robert A. Huggins, Megan VanSumener, Rachel Karslo, Rebecca L. Steams, Lindsay J. DiStefano, Lawrence E. Armstrong, FACSM, Carl M. Maresh, FACSM. University of Connecticut, Storrs, CT. (No relationships reported)

Limited research has evaluated combined effects of hyperthermia and dehydration on body temperature, heart rate, and perception during exercise while carrying a military rucksack.

PURPOSE: Evaluate separate and combined effects of hyperthermia and dehydration (%BML) on rectal temperature (Tre), heart rate (HR), and rating of perceived exertion (RPE) during exercise while carrying a 20.5 kg load.

METHODS: Twelve males (age = 20 ± 2 y, height = 182 ± 8 cm, body mass = 74.0 ± 8.2 kg, body fat = 9 ± 3%, VO2max = 57.0 ± 6.0 mL·kg⁻¹·min⁻¹) completed four randomized, 90-min treadmill bouts (1.34-1.78m·s⁻¹; 5% grade) in a climate controlled chamber under two hydration states and two environmental conditions: euhydrated temperate (EUT), dehydrated temperate (DEH). To maintain hypohydration, 55.6 ± 14.0% of body mass losses. Supported by GSSI and NSERC Canada.

RESULTS: By the end of 4 hr REC (2.55 ± 0.10 vs. 2.50 ± 0.13 vs. 2.47 ± 0.09). This suggests a greater risk for exertional heat stroke when individuals are both dehydrated and hyperthermic while carrying a load, as is the case with military personnel.
Dehydration (DHY) increases the rise of internal body temperature (T) compared to a euhydrated state during exercise in the heat. Numerous original research studies have quantified the effect of DHY on T; however a wide range has been reported (0.01-0.43°C·1%BML) difference.

**PURPOSE:** To systematically review the current literature to determine ΔT per 1% body mass loss (%BML) difference.

**METHODS:** PubMed, SPORTDiscus, Web of Science, Rehabilitation & Physical Medicine, CINAHL and Cochrane Reviews were searched from inception to March 2011 with limitations on human subjects and English. Key words included: dehydration, dehydrated, hypohydration, hypohydration, hyperthermia, hyperthermic, core temperature, and core body temperature. Original research articles which met these criteria were included: 1) reported mean and SD of valid T and %BML difference 2) hyperthermia ≥ 38.9°C in one trial condition, 3) exercise mode was similar between conditions other than hydration status. Of the 1192 articles retrieved, 281 examined the effects of DHY on T during exercise. Twenty original research studies met the inclusion criteria and were scored using the Physiotherapy Evidence Database (PEDro) Scale (7.0 ± 0.6). Means and SD for trial conditions were compiled for final 1°C and %BML difference. Meta-analysis was performed to determine pooled and weighted mean differences (MD) between the greater and lesser DHY trials for °C and %BML difference.

**RESULTS:** Final weighted MD for °C were (0.54°C, 95% CI 0.51 to 0.54) and %BML difference (2.45%, 95% CI 2.42 to 2.48). For every 1% BML difference, T increased 0.22°C during exercise in the heat.

**CONCLUSION:** This meta-analysis precisely defines the rise in T for exercising individuals per 1% BML difference. Clinically, this information confirms that the rise in T is increased with greater body mass loss. Furthermore, sports medicine personnel and researchers can better determine the rise of T in an individual exercising in the heat based on their %BML difference and prevent heat illness.

**3020 Board #292 June 1 11:00 AM - 12:30 PM**

**Validation of the OMNI Perceived Sweating Scale during Treadmill Walking while Wearing Thermal Protective Clothing**

Fredric L. Goss, FACSM, Robert J. Robertson, FACSM, Michael Gallagher, Jr., Luke Haile, Julia Morley, Joe Suyama, David Hostler. *Univ. of Pittsburgh, Pittsburgh, PA.*

**METHODS:** Concurrent and construct validation of the OMNI Sweating Scale was examined using adult male (n = 116) and female (n = 58) subjects. This category scale contains verbal and pictorial descriptors positioned along a narrow (1-10) numerical range.

**RESULTS:** Subjects were 27.9 ± 4.6 years old, weighed 73.5 ± 15.5 kg, were 174.5 ± 9.4 cm tall and had a maximal oxygen uptake of 50.3 ± 8.3 ml kg⁻¹ min⁻¹. Subjects ingested a thermistor capsule for the measurement of core temperature approximately 8 hours before the experimental trial. Weighted mean skin temperature was calculated using the following formula: Tsk = chest (0.25) + back (0.25) + thigh (0.30) + arm (0.20). Concurrent validity was established by correlating OMNI sweating scale ratings (OMNI-SW) with core (Tc) and weighted mean skin (Tsk) temperatures obtained during treadmill walking while wearing firefighter thermal protective clothing. Construct validity was established by correlating OMNI-SW with a construct specific 10 cm visual analogue scale (VAS).

**RESULTS:** Tc ranged from 37.1 ± 0.1°C to 38.9 ± 0.1°C and Tsk ranged from 33.8 ± 0.1°C to 38.7 ± 0.1°C. OMNI-SW ranged from 1-10 and distributed as a positive linear function of Tc (r = 0.75, p < 0.01) and Tsk (r = 0.81, p < 0.01). OMNI-SW distributed as a positive linear function of the VAS responses which ranged from 0-10 cm (r = 0.97, p < 0.01).

**CONCLUSIONS:** Concurrent and construct validity were established for the OMNI Sweating Scale in healthy adults performing treadmill walking while wearing firefighter thermal protective clothing.

**3021 Board #293 June 1 11:00 AM - 12:30 PM**

**Effect Of The Vasopressin2 Receptor On Sweat Composition, Fluid Balance And Performance**

Tamara D. Hew-Butler, FACSM¹, Jed Hummel¹, Brian Rider², Elizabeth Jones¹, Jeff Cross¹, Qin Xu², Nikhil Sharma², Joseph G. Verbalski², *Oakland University, Rochester, MI; Georgetown University Medical Center, Washington DC, DC.*

Previous data revealed statistically significant linear relationships between sweat, urine and blood sodium concentration ([Na⁺]) as well as arginine vasopressin ([AVP]) during steady-state running.

**PURPOSE:** To determine if sweat sodium concentration is regulated by [AVP] through activation of the Vasopressin2 (V2) receptor.

**METHODS:** 10 subjects participated in 3 double-blind randomized trials ingesting a: placebo, V2 agonist or V2 antagonist. Each treadmill trial consisted of 60 minutes running at 60% peak speed (Steady-State) followed by an incremental test to exhaustion (Performance). Blood, urine and saliva samples were collected at baseline and following both Steady-State and Performance segments. Sweat samples were obtained after the Steady-State and Performance segments from side-by-side shoulder patches, followed by a whole body washdown. Water was allowed ad libitum.

**RESULTS:** Significant decreases (p<0.05) in urine [Na⁺] noted with the V2 antagonist (18; 16; 31 mmol/L) versus the placebo (106; 82; 57 mmol/L) and V2 agonist (132; 89; 65 mmol/L) (Baseline mean; after Steady-State mean; after Performance trial mean, respectively). Significant increases (p<0.05) in plasma [Na⁺] noted from baseline vs. after Performance in the: placebo (143 vs. 145 mmol/L), V2 agonist (143 vs. 146 mmol/L) and V2 antagonist (143 vs. 148 mmol/L) trials and between the placebo vs. V2 antagonist after Performance. Similar increases in endogenous [AVP] from baseline to performance noted with the V2 agonist (0.4 vs. 2pg/mL) and V2 antagonist (0.2 vs. 4pg/mL) trials and between placebo vs. V2 antagonist after Performance. Significant increases (p<0.05) in saliva [Na⁺] noted from baseline vs. after Performance in the: V2 agonist (18 vs. 33 mmol/L) and V2 antagonist (18 vs. 42 mmol/L) trials. No significant difference in sweat [Na⁺] seen between the placebo (80; 14mmol/L), V2 agonist (77; 13mmol/L) or V2 antagonist (82; 12mmol/L) after Performance sweat patch; whole body washdown trials. No meaningful difference in performance between the placebo (58sec), V2agonist (61sec) and V2 antagonist (617sec) trials.

**CONCLUSION:** Sweat [Na⁺] is not regulated by the V2 receptor. Increased plasma [Na⁺] and [AVP] with the V2 antagonist had no detrimental effect on performance, with a trend towards augmented performance.

**3022 Board #294 June 1 11:00 AM - 12:30 PM**

**Determination of Sweat Na+ Concentration in Elite Athletes Training in a Hot and Humid Environment**

Raúl A. Rosario, Jessica A. Frontanés, Farah A. Ramirez-Marrero, FACSM, Oswaldo Hernández, Walter R. Frontera, FACSM, Anita M. Rivera-Brown, FACSM. *Center for Sports Health and Exercise Sciences, University of Puerto Rico School of Medicine, San Juan, Puerto Rico.*

Reductions in serum sodium concentration and exercise-associated skeletal muscle cramps have been related to high sodium losses during exercise in the heat.

**PURPOSE:** To determine factors associated with sweat sodium concentration in elite heat acclimatized athletes training in a hot and humid environment.

**METHODS:** Elite athletes (N=109; males=73 females=36; mean ages=25.2 ± 4.9 yr) were tested during training sessions (mean duration=82.9 ± 22.5 min) in running, cycling, beach volleyball, soccer, tennis, and fencing in a hot and humid climate (WBIT=30.1 ± 1.8°C). Exercise intensity was estimated using an accelerometer worn by the athletes during the entire session. Acute changes in body mass were used to estimate sweat rate. A sweat sample was collected with an absorbent patch to measure sweat [Na⁺]. Saliva samples were obtained for genetic analysis in athletes with high sweat [Na⁺].

**RESULTS:** The average training time in a hot and humid climate in the past month (3,056.7 ± 2,477.5 min) indicated that the athletes were heat acclimatized. The mean sweat [Na⁺] was 67.5 ± 22.2 mmol/L. Gender, environmental heat stress, and training time in the heat in the past month were not significantly correlated with sweat [Na⁺]. Stepwise multiple regression revealed that

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sweat rate (1.3 ± 0.5 L/h) and exercise intensity (3.976 ± 2.466 activity counts/min) accounted for approximately 16% of the sweat [Na+] (R²=0.16, P=0.001). Sweat [Na+] and total sweat Na⁺ loss was similar in athletes with a history of muscle cramps (68.5 ± 23.1 mmol/L and 2,191.5 ± 1,131.8 mg) compared to those reporting no cramping (69.9 ± 22.2 mmol/L and 2,176.4 ± 1,255.3 mg), P > 0.05. Twenty nine athletes with a sweat [Na⁺] > 70 mmol/L and sweat [Cl⁻] > 60 mmol/L provided saliva samples for genetic analysis. One athlete was identified as having heterozygous presence of the AF508 mutation in the CFTR gene and had a history of whole body muscle cramps.

CONCLUSIONS: In heat acclimatized elite athletes training in a hot and humid environment, sweat sodium concentration is related to exercise intensity and sweat rate but not to gender, environmental heat stress, or heat exposure time in the previous month.

3023 Board #295 June 1 11:00 AM - 12:30 PM Preventing Mild Dehydration with a Carbohydrate Electrolyte Solution Improves Performance during an Ice Hockey Scrimmage

Mark E. Linseman, Matthew S. Palmer, Heather M. Logan-Sprenger, Lawrence L. Sprriet, FACSM. University of Guelph, Guelph, ON, Canada. (M.E. Linseman: Salary; GSSI paid my graduate student stipend, but did not have a say in how the study was conducted.)

Mild dehydration (1.5-2%) is associated with increased core temperature (Tc), heart rate (HR) and mental fatigue (MF), and decreased performance during “stop-and-go” sports such as basketball and soccer. Similar studies in ice hockey players are scarce, and many ice hockey players lose more than 1.5% body mass (BM) through sweating during games.

PURPOSE: To investigate the effects of remaining hydrated with a carbohydrate electrolyte solution (CES) vs. dehydrating by 1.5-2% BM on Tc, HR, on-ice performance, and MF during ice hockey.

METHODS: High-level male hockey players (n = 14; 21.3±0.2 yrs, 80.1±2.5 kg, 182±1.2 cm) participated in a randomized crossover study. Players performed a set of three on-ice performance drills before and after a 70-min on-ice hockey scrimmage. Players ingested no fluid to progressively dehydrate by 1.5-2% BM (NF), or ingested CES to maintain BM (CES).

RESULTS: Peak Tc was lower in CES than in NF (38.69±0.10 vs. 38.92±0.11 °C, p<0.05). Tc peaked at ~49 min in CES and ~44 min in NF, and was lower throughout the scrimmage in CES. In-game HR was not different between trials. In the last 20 min of play, NF players complained fewer turnovers/min with the puck (1.6±0.3 vs. 3.1±0.7, p=0.05) and completed a higher percentage of attempted passes (78±5 vs. 51±8%, p<0.05). There were no between-trial differences in shooting or slalom drill performance. MF, assessed by two post-trial questionnaires, was lower in CES. Hockey Fatigue Questionnaire total score (29.9±2.8 vs. 37.1±1.6, p=0.05) and Profile of Mood States fatigue subsection score (15.1±1.3 vs. 19.4±1.0, p<0.05) were lower in CES. Since responses to mild dehydration were highly variable, individual data were also analyzed. Players demonstrating improved skating performance in CES tended to have lower Tc and MF in CES, and a BM that was higher than the mean.

CONCLUSION: Maintaining BM with a CES resulted in decreased Tc, improved skating and puck handling performance, and decreased mental fatigue, compared to dehydrating by 1.5-2% BM during an on-ice hockey scrimmage. Supported by GSSI and NSERC Canada.

3024 Board #296 June 1 11:00 AM - 12:30 PM Effective Microorganism-x Attenuates The Hit-induced Increases In Plasma Superoxide Dismutase Within A Hot Humid Environment

Lee Taylor¹, Ben J. Lee², Adrian W. Midgley¹, Peter Watt¹, Lars R. McNaughton, FACSM³, Paul C. Castle¹. ¹The University of Bedfordshire, Bedford - Bedfordshire, United Kingdom. ²Coventry University, Coventry, United Kingdom. ³University of Hull, Hull, United Kingdom. ⁴University of Brighton, Eastbourne, United Kingdom.

RP 3-1

PURPOSE: To investigate the effects of remaining hydrated with a carbohydrate electrolyte solution (CES) vs. dehydrating by 1.5-2% BM on Tc, HR, on-ice performance, and MF during ice hockey.

METHODS: High-level male hockey players (n = 14; 21.3±0.2 yrs, 80.1±2.5 kg, 182±1.2 cm) participated in a randomized crossover study. Players performed a set of three on-ice performance drills before and after a 70-min on-ice hockey scrimmage. Players ingested no fluid to progressively dehydrate by 1.5-2% BM (NF), or ingested CES to maintain BM (CES).

RESULTS: Peak Tc was lower in CES than in NF (38.69±0.10 vs. 38.92±0.11 °C, p<0.05). Tc peaked at ~49 min in CES and ~44 min in NF, and was lower throughout the scrimmage in CES. In-game HR was not different between trials. In the last 20 min of play, NF players complained fewer turnovers/min with the puck (1.6±0.3 vs. 3.1±0.7, p=0.05) and completed a higher percentage of attempted passes (78±5 vs. 51±8%, p<0.05). There were no between-trial differences in shooting or slalom drill performance. MF, assessed by two post-trial questionnaires, was lower in CES. Hockey Fatigue Questionnaire total score (29.9±2.8 vs. 37.1±1.6, p=0.05) and Profile of Mood States fatigue subsection score (15.1±1.3 vs. 19.4±1.0, p<0.05) were lower in CES. Since responses to mild dehydration were highly variable, individual data were also analyzed. Players demonstrating improved skating performance in CES tended to have lower Tc and MF in CES, and a BM that was higher than the mean.

CONCLUSION: Maintaining BM with a CES resulted in decreased Tc, improved skating and puck handling performance, and decreased mental fatigue, compared to dehydrating by 1.5-2% BM during an on-ice hockey scrimmage. Supported by GSSI and NSERC Canada.

3025 Board #297 June 1 11:00 AM - 12:30 PM The Effect Of Selected Foods On Urinary pH

Jo M. Welch, Jason C. Davis. Dalhousie University, Halifax, NS, Canada.

PURPOSE: To test the hypothesis that certain foods consumed in one snack can alter urinary pH similarly to sodium bicarbonate.

METHODS: Nine healthy subjects (5 men), aged 19-26, were assigned to one of three treatment groups and proceeded to subsequent treatments based a Latin square design. Each treatment was completed in temperate conditions (HIT-survive) and in heat stress conditions (HIT-survive). Two visits were completed in temperate conditions (HIT-sprint (20.4±1.7°C; 41±4.2% RH), and in hot and humid conditions (HIT-sprint (34.7±2°C; 51±7±4.5% RH), with EMX supplementation (HIT-EMX) or without (placebo) (HIT-CTRL)). Typical physiological measures were recorded throughout with blood lactate and glucose assessed quarterly. Venous whole blood samples were obtained at rest pre and immediately post completion of HIT for assessment of plasma eHSP72 and superoxide dismutase (SOD) using commercially available ELISAs.

RESULTS: Plasma eHSP72 increased significantly pre- to post HIT (F = 62.1, p < 0.001), with eHSP72 in HITCTRL increased by 0.8 ng·mL⁻¹ (95% CI = 0.3 to 1.2 ng·mL⁻¹, p = 0.005), compared to 1.5 ng·mL⁻¹ in HITEMX (95% CI = 1.1 to 1.9 ng·mL⁻¹, p < 0.001). Plasma SOD activity significantly increased pre- to post HIT (F = 70.1, p < 0.001), with SOD in HITEMX significantly increasing 0.10 U·mL⁻¹ (95% CI = 0.047 to 0.16 units, p = 0.001), compared to a 0.22 U·mL⁻¹ increase in the HITCTRL (95% CI = 0.16 to 0.38 U·mL⁻¹, p < 0.001). SOD activity was 0.10 U·mL⁻¹ significantly higher in HITEMX compared to the HITCTRL (95% CI = 0.045 to 0.16 U·mL⁻¹, p = 0.001).

CONCLUSION: EMX supplementation may convey some protection to the HIT induced disturbances to redox balance within a hot and humid environment.

3026 Board #298 June 1 11:00 AM - 12:30 PM Time To Plasma Sodium Accumulation Of Three Different Beverages Of Varying Sodium Concentration At Rest

Rachel Sharpe¹, Dawn M. Minton¹, Toni M. Torres-McGehee¹, Thomas P. Dompier³, J Mark Davis, FACSM. ¹University of South Carolina, Columbia, SC. ²DatalysCenter, Indianapolis, IN.

PURPOSE: To test the hypothesis that certain foods consumed in one snack can alter urinary pH similarly to sodium bicarbonate.

METHODS: Nine healthy subjects (5 men), aged 19-26, were assigned to one of three treatment groups and proceeded to subsequent treatments based a Latin square design. Each treatment consisted of a small meal which was anticipated to elicit an acidic, basic, or neutral response. Subjects consumed the same standardized diets during each day prior to the mid-afternoon experimental snacks. Urine samples were analyzed for pH and hydration before and also 2 hours after consumption of each snack. Subjects completed all three diets with a minimum of one washout day between treatments. The difference between pre-meal and post-meal urine pH was analyzed using repeated measures ANOVA.

RESULTS: Urine pH decreased by an average of 0.281 after an acidic snack and changes in urine pH for neutral and basic snacks dropped by 0.006 and 0.034 respectively. Pairwise comparisons showed a trend towards significance between the acidic and neutral snacks (p=0.07) and between the acidic and basic snacks (p=0.06) but no difference between the neutral and basic snacks. Urinary pH was not correlated with hydration status.

CONCLUSION: Both the basic and neutral snacks resulted in a higher urinary pH than did the acidic snack. Attention to pre-competition diet could play a role in delaying metabolic acidosis in athletes in some sports.
PURPOSE: To examine changes in [PNa+] and urine [Na+] ([UNa+]) in euhydrated and Na+ depleted individuals ([PNa+] < 137.5 mmol/L) over a period of 3 hrs of rest following ingestion of 3 different beverages of varying [Na+].

METHODS: A randomized crossover design examined the effects of water (W), carbohydrate electrolyte beverage (CEB), and enhanced CEB (E-CEB) on [PNa+] and [UNa+]. Participants were given 500 mL of assigned beverage and electrolyte measures were taken over 3 hrs of rest. CEB was commercially available and the E-CEB was a packet, added to the CEB, containing additional electrolytes. [PNa+] and [UNa+] were analyzed using ion selective electrodes (Na+/K+/Easylyte, Medica Corporation, Bedford, MA).

RESULTS: Participants were 9 (3 male and 6 female; mean age = 22.1 yr, weight = 66.5 kg, height = 167.2 cm) moderately active individuals from the surrounding area. Mean [Na+] for W = 0 g/L, CEB = 5.1 g/L, and E-CEB = 12.5 g/L. Repeated measures ANOVA was used to calculate [PNa+] and [UNa+] changes over 3 hours (180 min). We found a significant increase in overall [PNa+] from 0 to 150 min (134.9 mmol/L to 136.4 mmol/L, p = 0.045) and 0 to 180 min (134.9 mmol/L to 137.1 mmol/L, p = 0.003). There was a significant increase in overall [UNa+] from 0 to 180 min (6.5 mmol/L to 14.2 mmol/L, p = 0.002). No significant difference were found between the 3 beverage groups for [PNa+] and [UNa+] across time. Although not statistically significant, only the E-CEB increased [PNa+] above our cutoff for Na+ depletion (mean [PNa+] at 180 min = 137.7 mmol/L).

CONCLUSION: While participants’ overall [PNa+] increased over time, the CEB and E-CEB were not significantly different from W. The CEB or E-CEB did not significantly increase [PNa+] in our Na+ depleted participants during rest. While hydration protocols should be individualized, the time and amount of Na+ suggested by the recommendations should be further examined and adjusted accordingly to ensure individuals are sodium balanced prior to physical activity.

3027 Board #299 June 1 11:00 AM - 12:30 PM
Urinary Parameters Are Relevant Hydration Markers In Real Life Conditions
Alexis Klein1, Romain Barnourn2, Sebastien Vergne1, Deborah Metzger1, Nicolas Girard3, Agnes Demaziere3, Isabelle Guelinckx1, Nathalie Pross4, Erica Perrier4.
1Danone Research, Palaiseau, France. 2Forenap, Rouffach, France. 3USARIEM, Natick, MA. 4USDA, Grand Forks, ND.

PURPOSE: Despite its importance for health, knowledge on what optimal hydration status is and how it could be evaluated is conflicting. Previous works indicate that 24-h urine parameters can differentiate fluid intake habits, and that they may be valid hydration markers under real life conditions. However to confirm this, assessment of their adjustment to mild changes in fluid intakes is needed.

The purpose of this study was: first to determine if urinary parameters of hydration change rapidly in response to modifications of fluid intake; and second to assess whether shorter urine collection periods are adequate to accurately reflect hydration status.

METHODS: Forty-eight participants (age: 24.7 ± 3.1 yrs, BMI: 22.4 ± 1.6 kg/m2) were classified as Low (n=29) or High drinkers (n=19), and completed a 6-day inpatient parallel group trial. During the first 2 days (baseline), participants followed a fluid regimen quantitatively comparable to their self-reported intake habits (1.0L/d for Low drinkers and 2.5 L/d for High drinkers). In the second 3 day phase, fluid intakes between groups were reversed. Urine was collected in three to five-hour intervals during waking hours.

RESULTS: Statistical comparisons showed that the 24h urinary osmolality (Uosm), Specific Gravity (USG), and color were significantly higher in the Low as compared to High drinker group for Ca, Cu, Fe, Mg, and Zn. This was also the case for shorter collections. Moreover, these parameters were significantly altered by fluid intake modification in both groups (p<0.001), with the alterations being statistically significant on the first day of the intervention. No differences were observed for blood osmolality (Bosm) whatever the group or the period.

CONCLUSIONS: The study confirms that parameters such as 24h urinary volume, color, Uosm, USG, but not Bosm accurately detect mild changes in hydration status. Moreover, findings support use of shorter urine collection periods to this aim. Urinary parameters appear as most sensitive markers to differentiate low and high drinkers, and to detect changes in hydration status caused by modifications of fluid intake mimicking the ones that can be encountered in real life conditions.

This study has been granted by Danone Research

3028 Board #300 June 1 11:00 AM - 12:30 PM
Effect of Skin Surface Contamination on Sweat Mineral Concentration During Heat Acclimation.
Matthew R. Ely1, Robert W. Keneffick, FACSM1, Samuel N. Cheuvront, FACSM2, Troy D. Chinevere1, Craig P. Lacher1, Henry C. Lukaski, FACSM2, Scott J. Montain, FACSM3, 1USARIEM, Natick, MA. 2USDA, Grand Forks, ND.

(No relationships reported)

Heat acclimation reportedly conserves sweat in real consumption. It was recently reported that removing surface contamination through comprehensive cleaning of the skin surface negated sweat micro-mineral reductions during prolonged sweating. It is unknown if the sweat mineral conservation reported with heat acclimation may also be an artifact of surface contamination.

PURPOSE: To measure sweat mineral concentrations during heat acclimation and determine if surface contamination plays a role in the reported decrements of sweat minerals.

METHODS: Sweat mineral concentrations were measured in ten male volunteers from arm bag and scapular pouches on day 1, 5, and 10 of a heat acclimation protocol. To assess the potential contribution of skin contamination the initial mineral residue on the skin on the arm/hand was assessed with a 10-mL distilled water rinse. The arm was then meticulously cleaned to minimize surface contamination and sweat samples were obtained 20-25 minutes after the initiation of exercise using an arm bag. Additionally, sweat was simultaneously and serially sampled (two times each day) from a cleaned (WASH) and un-clean (No-WASH) site on the scapular surface via pouch technique. All rinse and exercise sweat samples were analyzed by spectrometry for Ca, Cu, Fe, Mg, and Zn.

RESULTS: No heat acclimation effect on sweat micro-minerals was observed. Sweat mineral concentrations from the WASH site were relatively low and did not change between Day 1, 5, or 10 within each day of heat acclimation (Ca: 0.29 ± 0.14 mmol/L, C: 0.58 ± 0.81 µmol/L, Fe: 0.12 ± 0.22 µmol/L, Mg: 0.04 ± 0.04 mmol/L, Zn: 1.45 ± 1.33 µmol/L). The initial mineral concentration from the No-WASH site did not change from Day 1, 5, or 10 but were significantly greater than concentrations from WASH and declined 45-57% from initial to subsequent samples within each day becoming similar to the WASH site. The arm/hand surface rinse micro-mineral concentrations were higher than the sweat samples from the cleaned skin.

CONCLUSION: When the skin surface is not cleaned mineral residue inflates initial sweat mineral concentrations. Heat acclimation does not confer a reduction in sweat Ca, Cu, Fe, Mg, or Zn concentrations.

E-40 Free Communication/Poster - Weight Loss Interventions
JUNE 1, 2012 7:30 AM - 12:30 PM
ROOM: Exhibit Hall

3029 Board #301 June 1 9:30 AM - 11:00 AM
Absenteeism In A Metropolitan Law Enforcement Agency Weight Loss Competition
Allen R. Mullins1, Robert W. Boyce, FACSM1, Tyler K. Willett1, Glenn R. Jones2, Edward L. Boone3, 1University of North Carolina Wilmington, Wilmington, NC. 24540, NC. 3Work Physiology Associates Inc, Charlotte, NC. 4Virginia Commonwealth University, Richmond, VA 23284, NC. (Sponsor: Robert W Boyce, FACSM)

(No relationships reported)

Evaluation of absentee patterns provides valuable insight into effective health promotion programs. Little has been published regarding absenteeism in weight loss competitions in law enforcement agencies.

PURPOSE: To report absenteeism outcomes of a police weight loss competition and compare participants who completed the program with irregular attendees.

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METHODS: A police department held a twelve week weight loss competition involving five person teams composed of civilians and sworn officers. Weight-losses were held at the beginning and bi-weekly. Teams recording the most weight loss won. ANOVA procedures were used to compare starting body mass of those who completed all weigh-ins (Reg) with three irregularly attending groups: Those missing the final weigh-in (Irreg1), those missing two or more weigh-ins (Irreg2), and those weighing-in at week 2 & missing all other weigh-ins (Irreg3). The proportion of those absent, expressed as a percent, was used to evaluate trends: Police vs. civilians, gender comparisons, and obese vs. non-obese.

RESULTS: 381 participants began the competition: 260 sworn officers and 121 civilians; 137 females and 244 males. All participants attended the first weigh-in & 14% failed to complete the final weigh-in. Reg were significantly (p ≤ 0.01) lighter, 99.9 ± 22.6 kg at the start of the program than groups Irreg2, 110.6 ± 26.1 kg and Irreg3, 124.8 ± 30.9 kg. Comparing the Reg group with the Irreg1 group, the Reg group had significantly (p ≤ 0.05) greater weight loss in body mass at week 2 and between weeks 2 and 4; 1.8 ± 1.8 kg vs. 1.2 ± 1.4 kg and 1.0 ± 1.5 kg vs. 0.1 ± 1.4 kg, respectively. The Reg group also had significantly (p ≤ 0.001) greater weight loss than the Irreg2 group between weeks 2 and 4; 1.0 ± 1.5 kg vs. -0.3 ± 1.4 kg, respectively. Civilians had a higher percentage of absences than police, 19% vs. 12%. Also, obese police had more absenteeism than non-obese police, 14% vs. 8% at program completion.

CONCLUSION: The police weight loss competition was effective with 86% of participants completing the program. Higher absenteeism by civilians and the more obese indicate that creative promotions directed at these groups may further encourage future program participation. Also, higher body mass and lower weight loss reported in irregular attendees supports the premise that full participation is associated with success.
Over the last two decades there have been significant increases in the rate of overweight and obesity in the US. Weight loss as low as 5% has been shown to reduce or eliminate disorders associated with obesity. Improving individual self-efficacy via increasing knowledge, skill and improving attitude has been shown to be a strong predictor of weight-control behavior.

**PURPOSE:** To implement a workplace weight loss program for overweight and obese employees that focused on improvement of weight loss self-efficacy (WLSE), exercise self-efficacy (ESE), and movement through the stages of change (SOC) while promoting healthy eating behaviors, and to compare its effectiveness between those who lost at least 5% of their weight and those who did not.

**Design:** Ninety-nine overweight and obese employees (BMI>25) from a healthcare organization participated in this 28-week workplace weight loss program. Mean body weight and BMI was 205±4 (Ib) and 34.82±7, respectively. Average age was 46±11 and 90% were female. All participants received consultation with a dietitian/health educator emphasizing self-efficacy, knowledge, attitude and skill development on weight management, exercise and healthy eating practices. Weight, WLSE, ESE, HES, and movement through SOC were measured pre-post intervention and compared between those who lost at least 5% of their body weight and those who did not.

**RESULTS:** Overall, significant weight loss was observed pre-post intervention (p<0.05). Significant improvements in WLSE, ESE, SOC, and HES were observed in those who lost at least 5% of their body weight (p<0.05). Waist circumference, self-reported general health, and energy level were also improved among those who lost 5% of body weight (p<0.05).

**CONCLUSIONS:** This study incorporates constructs of behavioral theory of self-efficacy into a weight loss program. The two self-efficacy measures correlate significantly with weight loss. Results found direct relationship between losing weight and improvements in WLSE, ESE, eating habits and SOC. Using behavioral techniques to improve self-efficacy can be effective to promote weight loss in overweight and obese people and can produce better outcomes.

Supported by CDC Grant TS-1444
INTRODUCTION: Air displacement plethysmography (ADP) body composition systems utilize an exact pre-test protocol that must be followed for each trial. This protocol includes no eating, drinking, or exercising at least 2 hours prior to testing. Previous research has shown that body temperature changes influence the results when using ADP as a measurement; however exercise was not the method used to increase body temperature.

PURPOSE: To determine the effect of post-exercise body temperature changes on body composition results using ADP.

METHODS: Forty-two young adults (18-30 yrs) participated in the study (24 females, 18 males). Resting heart rate was measured to calculate exercise intensity. After exercise intensity was calculated, an ADP test done according to instructions outlined by the manufacturer. Upon completion of the ADP test, the subject exercised on a treadmill at moderate intensity (~65% Heart Rate Reserve) for 30 minutes to increase body temperature. Another ADP trial followed the physical activity. A chamber temperature (CT) was also measured during each of the trials using a thermistor to assess temperature changes. Fat mass (FM), Fat Free mass (FFM), percent body fat (%BF), and (CT) were compared pre and post-exercise.

RESULTS: Paired sample T-tests revealed significant differences (p<0.05) between pre-exercise %BF and post-exercise %BF (21.3±9.8% vs 19.6±10.2%), pre-exercise chamber temperature and post-exercise chamber temperature (72.9±2.1°F vs 73.5±2.0°F), and pre-exercise FM vs post-exercise FM (32.9±17.3 lbs vs 30.5±17.7 lbs). FFM showed no significant difference.

DISCUSSION: This investigation demonstrates the importance of following the manufacturer’s recommended pre-test protocol as the accuracy of the ADP testing may be compromised, resulting in lower FM and %BF estimations.

INTRODUCTION: Air displacement plethysmography (ADP) body composition systems can use either measured or predicted lung volumes (LV) in their measurement. The difference in the predicted value and the repeatability of the measured value in each trial is an important factor in the accuracy of the test result. Tests that are done over a period of time can be significantly influenced by these measurements.

PURPOSE: To compare the variability and accuracy of ADP tests using predicted and measured LV over time.

METHODS: Twenty-four adults (18-30 yrs) participated in the study. Each subject underwent 3 ADP tests over a period of three weeks, with one week between tests. At each testing session, subjects were tested using a predicted LV protocol and a measured LV protocol. Testing order was randomized. LV and percent body fat (%BF) were compared between testing modes and between assessment times.

RESULTS: A two-way within-subjects ANOVA was conducted to examine the effect of the mode of lung volume assessment (measured or predicted) and time (day 1, 2, 3) on lung volume and the effect of the mode of body fat assessment (measured or predicted) and time on body fat. LV did not differ significantly (p>0.05) on the two modes of assessment (measured or predicted). Time also was not significant (p=0.05), therefore LV did not differ on the days it was assessed. Subjects responded in the same manner in both modes of assessment regardless of the time assessed. Mode is not significant (p=0.05), therefore %BF did not differ on the two modes of assessment. Time is also not significant (p=0.05), therefore %BF did not differ on the days it was assessed. Subjects responded in the same manner in both modes of assessment (measured and predicted) regardless of the time assessed.

DISCUSSION: This investigation demonstrates that the method used to determine LV during ADP testing does not significantly affect the final body composition result. Also, the results from tests performed over an extended period of time are not affected by LV measurement method.

INTRODUCTION: Comparison of Air-Displacement Plethysmography Results Using Predicted and Measured Lung Volumes Over Time.

PURPOSE: The purpose of this study was to determine the accuracy of an air displacement plethysmography (ADP) body composition measure in estimating resting metabolic rate (RMR). The specific aim was to quantitatively compare the estimated metabolic rate from air displacement plethysmography to the actual metabolic rate measured using indirect calorimetry via a standard metabolic cart.

METHODS: Fifty-eight apparently healthy (18-45 yrs) male (n=20) and female (n=38) subjects participated in the trial. All subjects were instructed to adhere to the following pretest instructions: 1) Fast 12 hours prior to the test 2) Avoid strenuous exercise 24 hours prior to the test 3) Wear tight fitting clothing (i.e. lycra or spandex material) and 4) refrain from nicotine and alcohol for 24 hours prior to testing. Each subject was required to lie down in a quiet room for a total of 30 minutes during the indirect calorimetry obtainment of resting metabolic rate (RMR) via the metabolic cart (MC) method. The first 15 minutes of the RMR data was discarded and the average VO2 of the following 15 minutes was used as the subjects RMR. Upon completion of the MC RMR, subjects moved directly to ADP testing following the manufacturers standardized protocol whereby an estimated RMR was obtained.

RESULTS: RMR measurements from the MC (1868.6±487.1 kcals) and estimates from the ADP (1428.2±306.7 kcals) were statistically significant (p<0.05).

CONCLUSIONS: Significant differences in RMR measurements were found between indirect calorimetry and the estimated value obtained from the ADP measure. This could cause confusion and be prohibitive in proper nutritional recommendations for people wanting to alter body composition.
**3039 Board #4 June 1 2:00 PM - 3:30 PM**  
**Ability of New Upright Biopendence Analyzer to Estimate Fat-Free Mass in Adults**  
*University of New Mexico, Albuquerque, NM.*  
(No relationships reported)

A major goal of applied body composition assessment is the development of valid methods to accurately estimate fat-free mass (FFM).

**PURPOSE:** To evaluate the accuracy of a new upright analyzer (InBody 520) to estimate FFM in comparison to underwater weighing (UWW).

**METHODS:** Fifty men (29.3±13.4 yrs, 181.4±8.5 cm, 95.8±28.4 kg, 27.7±4.7 kg/m²) and fifty women (22.2±4.2 yrs, 165.8±4.7 cm, 68.0±11.9 kg, 24.6±3.7 kg/m²) volunteered to have FFM assessed using the InBody 520 and UWW. Standard pre-test guidelines for body composition assessment were followed and residual volume was measured using oxygen dilution. The constant error (CE), standard error of the estimate (SEE), and total error (TE) were determined to evaluate the accuracy of the InBody 520 when compared to UWW for men and women. Bland-Altman plots were compiled to further investigate methodologic bias between the reference and InBody 520 between men and women.

**RESULTS:** There was a significant difference (p<0.05) in FFM between UWW and the InBody 520 for men (UWW:75.52±18.17kg, InBody: 72.37±16.67kg) and women (UWW:46.16±5.76, InBody: 45.35±5.08kg). There was large individual variance in FFM between UWW and the InBody 520 for both men and women. The CE, SEE, and TE were lower in the women (0.81, 2.30, 2.30, respectively) than in the men (3.15, 4.88, 4.78, respectively). Bland-Altman plots indicated FFM was not estimated within 2SD for 6 men and 3 women.

**CONCLUSIONS:** The results of this study showed that when compared to UWW the InBody 520 underestimated FFM in both men and women. The InBody 520 was more accurate in estimating FFM in the women than in the men.

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**3040 Board #5 June 1 2:00 PM - 3:30 PM**  
**Validity of Bioelectrical Impedance Analysis Instruments for the Measurement of Body Composition in Collegiate Gymnasts**  
Jeremy T. Barnes¹, Jason D. Waggoner², Jeremy P. Loennecke, Ronald D. Williams, Jr.³, Yugandhar Arja³, Graeme W. Kirby¹, Thomas J. Pujol, FACSM¹.  
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(No relationships reported)

**PURPOSE:** The body composition of gymnasts is frequently assessed. Many different methods are used including underwater weighing, bioelectrical impedance analysis (BIA) and skinfolds (SKF). The purpose of this study was to determine the validity and of various BIA machines and SKF for estimating percent body fat (%fat) in female collegiate gymnasts.

**METHODS:** Body composition was assessed via Tanita BF-350, Tanita BF-522, Omron HBF-510W, Omron HBF-306C, SKF and estimates of %fat were compared to dual-energy X-ray absorptiometry (DXA), which served as the criterion estimate. Ten female Division I collegiate gymnasts were studied (age 19.1 (1.3) yrs, height 1.66 (0.06) m, weight 60.73 (6.44) kg, and BMI 21.98 (1.22) kg/m²).

**RESULTS:** The validity of the %fat estimates (BF-350, BF-522, HBF-510W, HBF-306C, and SKF) was based on the evaluation of each method versus the criterion value from the DXA by calculating the mean, SD, coefficient of determination (r²), and standard error of estimate (SEE) from linear regression analysis. To assess the average deviation of individual scores from the line of identity, total error (TE) was calculated for each field method. Paired t-tests determined pair-wise differences between measurements using a Bonferroni corrected alpha level of 0.01. The mean %fat results were as follows: the Tanita BF-350 = 21.60 (3.35), the Tanita BF-522 = 21.74 (3.51), the Omron HBF-510W = 26.14 (2.96), the Omron HBF-306C = 18.36 (2.07), SKF = 19.50 (3.16), and the DXA = 21.06 (3.39). Mean differences were observed with HBF-510W (p<0.002) and HBF-306C (p<0.001) when compared to DXA. The r² values ranged from 0.709 (BF-350) to 0.713 (HBF-306C); SEE values ranged from 1.92%fat (HBF-306C) to 3.44%fat (BF-350); and total error (TE) values ranged from 3.19%fat (SKF) to 5.62%fat (HBF-510W).

**CONCLUSIONS:** For non-collegiate gymnasts, the Tanita BF-350, Tanita BF-522, and SKF provide the best estimates of %BF based on their acceptable TE values (<4%fat). These methods provide a valid assessment of body composition in non-laboratory settings. However, neither the Omron HBF-510W nor the Omron HBF-306 can be recommended for estimating %fat based on this preliminary analysis.

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**3041 Board #6 June 1 2:00 PM - 3:30 PM**  
**A New BIA Equation Estimating the Body Composition of Young Non-Hispanic Black Women**  
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(No relationships reported)

Obesity has dramatically increased in the past decade and is a major health concern. Several minority populations have reported greater incidence of overweight and obesity, including non-Hispanic black (NHB) women where a reported 78.0% aged 20-39 yrs are classified as overweight (OW; BMI > 25.0 < 29.9 kg/m²) or obese (OB; BMI > 30 kg/m²). To accurately assess the effectiveness of new strategies to prevent or combat obesity, valid, reliable, and sensitive methods of evaluating baseline and post-treatment measures of body composition are essential. One of the difficulties of conducting obesity research is identifying a safe, non-invasive, economical (cost and time), valid method of assessing body composition that can be used in the laboratory, clinic or field setting and is well-tolerated by subjects. Bioelectric impedance analysis (BIA) fulfills many of the requirements to be considered an optimal body composition method; however the lack of population specific equations with representative numbers of healthy weight (HW), OW and OB obese subjects can be problematic.

**PURPOSE:** To develop and cross-validate a new BIA body composition equation for young NHB women.

**METHODS:** Subjects included 89 (42 HW, 25 OW, 22 OB) young NHB women ages 18-30 yr. Using a single frequency (50 kHz) tetra-polar BIA unit and total body DXA scans as the criterion method, a BIA regression equation was developed and then cross-validated using the “leave- one-out” method.

**RESULTS:** The new equation was DXA FFM = -21.0 + 0.136(Wt) + 0.448(Ht) - 0.0296(Imp) where DXA FFM = DXA fat-free mass (kg); Wt = body weight (kg); Ht = standing height (cm); Imp = impedance (ohms). There was no significant mean difference between the DXA FFM (45.8±6.7 kg) and the new BIA equation FFM (45.9±6.2 kg). Using this equation 85.9% of the variance in DXA FFM was explained by the model. Cross-validation results demonstrated a small amount of statistical shrinkage by explaining 84.5% of the variance in DXA FFM. The 95% confidence interval for the predicted value of DXA FFM is y = ±5.054 kg.

**CONCLUSION:** The new BIA equation will help to provide a more accurate method to estimate the body composition of young NHB women in a variety of field, clinical and research settings. The use of this equation may help to identify effective intervention strategies to prevent or combat obesity in this population.

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**3042 Board #7 June 1 2:00 PM - 3:30 PM**  
**Time Course Of Postural Fluid Shifts In A Sample Of Healthy Adults: Preliminary Data Findings**  
Ann L. Gibson, Jason R. Beam, Michelle G. Kulovitz, Micah N. Zahl, Christine M. Merriem.  
*UNM, Albuquerque, NM.*  
(No relationships reported)

Standard body composition guidelines indicate participants should be supine for at least 10 minutes before assessment via bioelectrical impedance analysis (BIA). Little research has been found substantiating this guideline or addressing standing posture prior to assessment with new vertical BIA devices. Extracellular water (ECW) and intracellular water (ICW) from multifrequency BIA (MF-BIA) are used to measure total body water (TBW) and estimate fat-free mass (FFM) and body cell mass.

**PURPOSE:** This study investigated the time required for ECW and ICW to stabilize in standing and supine positions.

**METHODS:** Forty-five healthy volunteers (36 ± 16 yrs, 169.6 ± 9.1 cm, 68.2 ± 10.2 kg) followed standard pretest guidelines for body composition assessment. ECW and ICW were measured via MF-BIA (Xitron Hydra 4200) every 5 minutes for 30 minutes per position. The starting position was counterbalanced. A 2-min seated period preceded assumption of each posture. FFM was...
calculated in accordance with the MFBIA analyzer manual (FFM = 1.106*ECW = 1.521*ICW). A 2 (posture) x 6 (time) repeated measures ANOVA was conducted to investigate possible differences in postural fluid shifts over time. Significant main effects were further evaluated using paired samples t-tests.

RESULTS: There were significant within-group main effects over time for supine ECW, ICW, TBW, FFM, and standing ECW (p < .05). There was no significant main effect for posture. Pairwise comparisons revealed significant differences between each 5-min increment (5 - 10, 10 - 15, 15 - 20, 20 - 25, 25 - 30 min) for supine ECW and ICW; supine FFM differed between 10 and 15 min (p < .01). Standing ECW pairwise differences were found for the first three 5-min increments (p < .01).

CONCLUSIONS: The results of this study indicate that waiting 5 min is sufficient for the stabilization of calculated TBW and FFM for both supine and standing positions. However, if MFBIA is used for measuring ECW and ICW, more time is needed for stabilization in the standing and supine positions.

3043  Board #8  June 1  2:00 PM - 3:30 PM
Techniques for Undertaking DXA Whole Body Scans in Tall and/or Broad People
Alisa Nana1, Gary R. Slater2, Will G. Hopkins, FACSM3, Louise M. Burke, FACSM4. 1Australian Institute of Sport, Bruce, Australia. 2University of Sunshine Coast, Maroochydore, Australia. 3Auckland University of Technology, Auckland, New Zealand.

PURPOSE: Dual energy x-ray absorptiometry (DXA) is becoming a popular tool to measure body composition in athletes, owing to its ease of operation and comprehensive analysis. However, many athletes are taller and/or broader than the active scanning area of the DXA bed. The aim of this study was to investigate the reliability of DXA measures of whole body composition summed from two or three partial scans.

METHODS: Physically active young adults (15 females, 15 males) underwent one whole body and 4 partial DXA scans in a single testing session under standardized conditions. The partial scanning areas were head, whole body from neck region down, right side and left side of the body. Body composition estimates from whole body were compared with the addition of partial scans simulating different techniques to accommodate tall, broad, or tall and broad subjects. Magnitude of changes in the mean of DXA estimates were assessed by standardization.

RESULTS: For tall, and tall and broad subjects, body composition estimates from summed partial scans that included the head scan were substantially different to body composition estimates from the whole body scan. Summing with the head scan over-estimated ~2 kg of lean and ~1 kg of fat mass. For broad subjects, the addition of right and left body scans produced no substantial difference in body composition estimates compared to whole body scan.

CONCLUSIONS: Strategies can be undertaken with DXA technology to accommodate subjects who are broader than the scanning bed, however, whole body composition estimates in tall, or tall and broad subjects include error. Further work is needed to develop other standardized protocols to estimate body composition in tall and very tall athletes. This investigation was supported by funding from the Physique and Fuel Centre program of the Australian Institute of Sport (AIS) and RMIT University, and the AIS Sports Nutrition Discipline.

3044  Board #9  June 1  2:00 PM - 3:30 PM
Differences in DXA Anthropometric Measurements between Female Collegiate Soccer Players and Gymnasts
Jason D. Waggener1, Graeme W. Kerby2, Zane G. Alcantara3, Jeremy P. Loenneke4, Jeremy T. Barnes1, Thomas J. Pujol, FACSM5. 1Southeast Missouri State University, Cape Girardeau, MO. 2University of Oklahoma, Norman, OK.

PURPOSE: To compare the differences in anthropometric measurements between female Division I collegiate soccer players and gymnasts utilizing Dual-Energy X-ray Absorptiometry (DXA).

METHODS: Eleven (20+1y) normal weight (BMI: 22.7 ±1.2 kg-m-2) female collegiate soccer players and eleven (20+1y) normal weight (BMI: 22.6±1.1 kg-m-2) gymnasts were tested using DXA (GE Prodigy Series X Model 8743). Data points analyzed were weight (kg), height (m), bone mineral density (g/cm2), body fat percentage and fat free mass (kg). An independent samples t-test was used to test for statistical significance between groups. All analyses were performed using SPSS v19.0 statistical software package. Values are presented as (mean±SEM). Statistical significance was set at p<0.05.

RESULTS: The soccer players were significantly taller than the gymnasts (p=0.04). No statistical significance was noted for any other variable across the two groups. The mean values were as follows: BMI [1.27 ± 1.27g/cm² (p=0.94)], Weight [62.4 ± 59.5kg (p=0.33)], Height [1.68 ± 1.63m (p=0.04)], body fat [26.7 ± 23% (p=0.11)], and fat free mass [46.4 ± 46.5kg (p=0.95)] (all data listed as soccer vs. gymnast).

CONCLUSIONS: Other than height differences, no other anthropometric measurements showed any significant difference when comparing female collegiate soccer players to female collegiate gymnasts. Past research has indicated the likelihood of gymnasts exhibiting low BMD and low body fat percentages; however the group of gymnasts utilized in this study exhibited healthy BMD and body compositions.

3045  Board #10  June 1  2:00 PM - 3:30 PM
Comparison of Body Composition Measurement Techniques in College Wrestlers
Jerry Mayhew1, Jana L. Arubas1, Timothy M. Schweger1, Thomas Redman1, David Schutter1, Jody L. Classy2. 1Southeast Missouri State University, Cape Girardeau, MO. 2University of Kentucky, Lexington, KY.

PURPOSE: To compare selected methods of determining body fat in college wrestlers.

METHODS: NCAA Division II wrestlers (n = 23; M ± SD: age = 19.6 ± 0.8 y, weight = 78.2 ± 13.7 kg, BMI = 25.6 ± 3.8 kg/m²) were evaluated using 4 body composition measurement techniques: DXA, hand-to-hand BIA, leg-to-leg BIA, and skinfolds. Both BIA techniques used an athletic setting and measured at a single frequency (50 kHz). Skinfolds (SKF) were measured at 9 sites and used to predict %fat using 4 athletic-specific prediction equations [Lohman (1981), Tipton-Opplinger (1984), and two Jackson-Pollock equations (1978)].

RESULTS: Repeated-measures ANOVA with Bonferroni post hoc testing revealed significant differences among the techniques. DXA %fat was significantly greater (17.1 ± 5.3%) than all other techniques. The Jackson-Pollock 7SKF equation %fat (9.4 ± 3.4%) was not significantly different from the hand-to-hand BIA %fat (11.3 ± 4.9%). Hand-to-hand BIA %fat was not significantly different from the Lohman equation %fat (12.5 ± 3.8%). The Lohman equation %fat was not significantly different from the leg-to-leg BIA %fat (13.3 ± 5.8%). The Jackson-Pollock 3SKF equation %fat (8.4 ± 2.7%) and the Tipton-Opplinger equation %fat (7.7 ± 2.5%) were significantly lower than all other methods but not significantly different from each other. All techniques were highly correlated with DXA %fat (r = 0.93 to 0.95), except for leg-to-leg BIA %fat (r = 0.57) and hand-to-hand BIA %fat (r = 0.61). Minimum wrestling weight calculated using the Lohman equation (71.6 ± 10.1 kg) would have been 5.8% greater than when calculated from DXA (67.7 ± 9.2 kg).

CONCLUSIONS: Measurement of %fat in college wrestlers from DXA would yield %fat values that were 3.8% to 9.4% higher than with other prediction techniques. This would result in an average of 4.8% greater body weight loss allowance than when using the Lohman equation.
Body Mass Index (BMI) is a measure of the relationship between height and weight and correlates with body fat percentage in the young and middle age adults. However, older adults experience changes in body composition that alter the relationship between BMI and body fat percentage. Excess body fat and obesity are often associated with a myriad of health problems that lead to considerable morbidity, impaired quality of life, and premature death.

PURPOSE: To determine a suitable, non-invasive, inexpensive method of determining body composition in older adults.

METHODS: Thirty-seven older adults were recruited from senior centers and senior focused programs (15M/22F, 65.9±7.42 yr, 167.30±7.55cm, 76.04±15.57 kg). Total body fat % (BF%) was measured by dual-energy x-ray absorptiometry (Lunar IDX). The standard Body Mass Index (BMI) calculation was used, as well as the Deurenberg et. al.(1991) equation for BF%. One paired T-test was performed (DXA BF% vs. Deurenberg BF%). Correlational analysis was performed on all variables.

RESULTS: No significant differences (α = .05) were found between DXA BF% and Deurenberg BF%. Correlational results are listed below:

<table>
<thead>
<tr>
<th>Deurenberg BF%</th>
<th>BMI</th>
<th>W/H Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>DXA BF%</td>
<td>&gt; .801*</td>
<td>&gt; .395</td>
</tr>
</tbody>
</table>

*significant at p<.01

CONCLUSIONS: BF% calculated by the Deurenberg et. al.(1991) equation seems to be a better field measure of body composition than BMI or W/H ratio in community dwelling older adults.

Validation Of The Bodymetrix Ultrasound System For Percent Body Fat

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The Body Metrix (BM) system (IntelaMetrix, CA) is an affordable computer based ultrasound system that provides rapid body composition assessment. We present preliminary data comparing percent body fat (%BF) as measured using the BM system and a DEXA as a reference measurement.

PURPOSE: To establish the validity of the BM computer based ultrasound system for the quantification of %BF.

METHODS: %BF was calculated on 10 university aged participants (5 females, 5 males) using the BM system with the Jackson and Pollock 7 sites equation (1978). A DEXA was also used as a reference to measure %BF on the same subjects. The Bland and Altman (1986) statistical procedure was used to determine de validity of the BM %BF.
RESULTS: The level of agreement between both devices was equal to -0.6% BF. As well, no significant correlation was found between the score difference from both devices and the score average of both devices (r = 0.17, p=0.641). The regression analysis between the BM system and the DEXA showed a significant correlation (r=0.71, p=0.023) with a SEE of ±3.93 %BF.

CONCLUSIONS: Both devices can be used interchangeably within the range of 10 to 30% BF. The data obtained on a limited number of subjects (n=10) show good agreement and the BM system underestimates by 0.6% on average when compared to the DEXA.

### 3050 Board #15 June 1 2:00 PM - 3:30 PM

**Validity Of Futrex-6100 X/L For Estimating Body Composition In Elite Male Rowers.**

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2University of North Carolina-Chapel Hill, Chapel Hill, NC. 3Oklahoma State University, Stillwater, OK.

(No relationships reported)

For athletes competing in weight categories, accurate measurements of body composition are important to optimize performance, and to evaluate the effectiveness of training and nutritional regimes on fat and fat-free mass during periods of weight reduction.

**PURPOSE:** The purpose of this study was to examine the validity of near-infrared interantance (NIR) estimates of percent body fat (% fat) and fat-free mass (FFM) using the Futrex 6100 X/L in elite male rowers.

**METHODS:** Twenty Olympic-caliber male oarsmen (mean age ± SD= 24.6±2 years) volunteered to serve as subjects. Body composition measurements were obtained from NIR and hydrostatic weighing (HW). The statistical analyses included constant error (CE), standard error of estimate (SEE), correlation coefficients (r), and total error (TE).

**RESULTS:** NIR estimates of % fat were not significantly correlated to those values from HW (r=-0.03, p=0.924) with a SEE of 3.2%. The Futrex 6100 X/L produced a non-significant CE (-0.54, p=0.004); however, the TE value exceeded Lohman’s recommendation of ≤4.0% (TE=4.5%). NIR estimates of FFM were significantly correlated to those values from HW (r=0.962, p<0.001), with a SEE of 2.2 kilograms (kg). CE was non-significant (CE=0.83, p=0.354) and total error was “fairly good” according to Lohman (TE=3.9kgs).

**CONCLUSION:** The findings from the present study indicated that the Futrex-6100 X/L resulted in TE values that were too large to be of practical value for % fat, but acceptable for FFM estimates. Research suggests that FFM is a significant predictor of rowing success, therefore, the Futrex 6100 X/L may provide a quick and portable alternative to HW for estimating FFM in elite male rowers.

### 3051 Board #16 June 1 2:00 PM - 3:30 PM

**Yearly Changes in the Body Composition and Body Build of Young Female Swimmers**

Robert W. Lewis Jr, Daniel A. Traylor, Haley C. Bergstrom, Terry J. Housh, FACSM, Glen O. Johnson, FACSM, Richard J. Schmidt, Dona J. Housh, FACSM. University of Nebraska, Lincoln, Lincoln, NE.

(No relationships reported)

Few studies have examined age-related changes in the body composition and body build of young swimmers.

**PURPOSE:** The purpose of this study was to determine the yearly rates of changes in the body composition and body build characteristics of young female swimmers.

**METHODS:** Seventy-one female swimmers (age ± SD: 11.7 ± 2.6 yr; range: 7.1-16.9 yr) served as subjects. Body composition characteristics (% fat and fat-free weight (FFW)) were determined from underwater weighing using the age-specific conversion constants of Lohman. Skinfolds (SF: triceps, scapular, suprailliac, and thigh), diameters (Diam: biacromial, bi-iliac, elbow, wrist, knee, and ankle), and circumferences (Circ: biceps extended, forearm, thigh, and calf) were measured using Lange calipers, a broad blade anthropometer, and Lufkin tape with Gullick handle, respectively. Height (HT) and body weight (BW) were determined using a wall scale with Broca plane and a physician’s scale, respectively. Simple linear regression was used to examine the relationships for age versus each dependent variable in body composition and body build variable. The table below includes the mean (± SD) values for each dependent variable, the correlations (r) with age, and the yearly change rates (slope coefficients of the linear regression models).

**RESULTS:** There were significant positive relationships for age versus all dependent variables except biacromial/bi-iliac diameters.

**CONCLUSION:** These data indicated that the yearly changes in body composition and body build characteristics in young female swimmers were consistent with those of female athletes in other sports. The age-related changes in these parameters may contribute to the improvements in performance that occur across age in swimmers.

### 3052 Board #17 June 1 2:00 PM - 3:30 PM

**The Relationship between Body Composition and Performance on the Army Physical Fitness Test**

Ali Lierman, David Q. Thomas, Jeff Schusler. Illinois State University, Normal, IL.

(No relationships reported)

It is not known which parameters of body composition are the strongest predictors of physical fitness, nor is it clear whether body fat and physical fitness are related to each other, or whether they are independent risk factors. Attempts have been made to determine if body composition can be a predictor of physical performance in different populations, however the results vary.

**PURPOSE:** To determine if there is a relationship between clinical body composition assessments and performance on the Army Physical Fitness Test (APFT).

**METHODS:** Forty-one cadets (males: n=32, age: 20.5 ± 1.8 years, ht: 178.9 ± 6.41cm, mass: 79.1 ± 7.8 kg; females: n=9, age: 20.6 ± 1.5 years, ht: 163.7 ± 5.2 cm, mass: 63.4 ± 8.4 kg) participated in the study. Body composition assessments included height, weight and hip circumferences, skinfolds and air displacement plethysmography via the Bod Pod. Skinfold sites were separated into axial (abdominal, suprailliac crest, subscapular, and mid-axillary) and appendicular (appendicular skinfolds: triceps, biceps, anterior thigh and medial calf) skinfolds. Scores from the APFT included maximum number of sit-ups performed correctly in 2 minutes, maximum number of push-ups performed correctly in 2 minutes and time to complete a 2 mile run were obtained with the cadet’s consent from the Department of Military Science database.

**RESULTS:** There were no significant correlations (p > 0.05) for males between the APFT scores and any of the body composition measurements. For the female subjects, only one significant correlation was found between sit-up score and lean mass, r= 0.72 (p < 0.05). Correlation coefficients between body composition assessments and total APFT scores ranged from r= -0.03 to 0.03 for males and -0.38 to -0.08 for females.
CONCLUSION: The present study indicated that in a sample of ROTC cadets, who fall within the acceptable ranges for Army body composition standards, no significant correlations were found for body composition and APFT scores in the male subjects and only one significant correlation was found for females (lean mass and sit-up score). It may be assumed from this study that if cadets fall within Army body composition standards, body composition does not factor into their performance on the APFT.

3053 Board #18 June 1 2:00 PM - 3:30 PM  
Fat Mass: Accumulation And Distribution In Athletes And Military Personnel  
Martin E. Wennblom, William F. Brechue, FACSM, United States Military Academy, West Point, NY.  
(No relationships reported)  

Fat mass (FM) accumulation is associated with physical activity level.  

PURPOSE: Compare FM accumulation in two populations of highly trained individuals with different performance goals.  

METHODS: Male athletes (n=411; age: 21.2±3.3 yrs; NCAA, international, or Olympic level competitors) and United States Military Academy cadets (n=100; 20.5±1.4 yrs) were measured for body composition. BMI, W/H ratio and shape (modeled to a cylinder) were calculated.  

RESULTS: Height, %fat, W/H, and shape were similar, while athletes had significantly greater body mass (M), FM, FFM, and BMI. FM and FFM were significantly related in athletes (y=0.66±0.85x, R²=0.58), but not cadets (y = 0.12x + 3.1; R² = 0.04). M is predictive of %fat in athletes (y = 0.278x - 9.9802; R²=0.70) not cadets (y = 0.1833x + 0.0655; R²=0.13). Cadets (n=97) and athletes (n=333) were similar in height, %fat, FM, W/H, and shape; however, athletes had a greater M (~13 kg) and FM (~10 kg) when controlling %fat range (6-26%). %fat, FM, FFM, BMI, W/H, and shape were similar in cadets, wrestlers and boxers; each had M restrictions and when compared to the remaining athlete population (height and weight matched), the restricted M group had greater FM (~1.5 kg) and lesser FFM (~1.8 kg) while BMI, W/H, and shape were similar.  

CONCLUSIONS: In the same M range, cadets have a greater range of %fat. Athletes carry a greater percentage of FFM at a given FM and shape. Weight class restrictions appear to favor a slightly greater fat and lesser FFM accumulation without altering shape.

3054 Board #19 June 1 2:00 PM - 3:30 PM  
Anthropometry Profiles of Elite Rugby Union Players During a Competitive Season  
Michael Naylor1, Joseph B. Taylor2,3, English Institute of Sport, London, United Kingdom. 4English Institute of Sport, Manchester, United Kingdom.  
(No relationships reported)  

PURPOSE: To examine anthropometric measures in professional Rugby Union players during a competitive season and the changes between two preseasons.  

METHODS: Body weight and the sum of eight skinfolds were evaluated on five occasions between two successive preseasons for positional groups of backs (fullback, wing, centre, fly half and scrum half playing positions, n = 13), front row forwards (prop and hooker playing positions, n = 9), second row forwards (n = 5) and back row forwards (n = 5). Analyses comprised two-way repeated-measures ANOVA, one-way ANOVA and paired-sample t-tests with repeated contrasts and bonferroni post-hocs. Statistical significance was set at p<0.05 and data are reported as means with 95% confidence intervals (m, CIs).  

RESULTS: Weight differed between playing positions (F(3, 28) = 37.883, p<0.01) but did not vary across the season. Backs (m = 90.53 kg, CIs = 87.03 to 93.98) were lighter than all other positions (all p<0.01) while Back Row (m = 106.49 kg, CIs = 101.17 to 112.31), Second Row (m = 115.75 kg, CIs = 110.18 to 121.31) and Front Row (m = 115.10 kg, CIs = 110.95 to 119.25) were similar (p>0.05). The sum of eight skinfolds differed as a function of season stage and playing position (F(12, 112) = 6.575, p<0.01). Sum of eight skinfolds for front row players were greater than those of all other positions at each stage of the season (all p<0.05) while all other positions were similar (all p>0.05). The general trend within each playing position was a decrease in skinfolds from preseason one through to the end of season one and a subsequent increase at preseason two. However, the sum of eight skinfolds at preseason two did not exceed those at preseason one. Specifically, the sum of eight skinfolds decreased between preseason one and two in backs (t(12)=5.704, p<0.01) and the skinfold of 0.8 mm in 13.36) and the front row (t(0)=7.8, p<0.01, m = 32.55 mm, CIs = 22.98 to 42.14). There were non-significant decreases in the skinfolds between preseasons for second row (t(12)=1.821, p=1.43, m = 9.66 mm, CIs = -5.07 to 24.30) and back row forwards (t(8)=1.821, p=0.14, m = 18.18 mm, CIs = -0.89 to 36.45).  

CONCLUSIONS: The results show the case rugby team reduced skinfolds during the season whilst maintaining body mass. The sum of eight skinfolds were also lower at preseason two compared to preseason one in all playing positions.

3055 Board #20 June 1 2:00 PM - 3:30 PM  
Handgrip Strength Enhances the Utility of Traditional Body Composition Parameters with Predicting Percent Body Fat  
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(No relationships reported)  

Body mass index (BMI) and waist circumference (WC) are two body composition parameters with important health and fitness implications. However, these markers do not distinguish between body fat mass (FM) and fat-free mass and are not accurate predictors of total body fat percentage (BF%) when used alone. Handgrip strength (HGS) is a crude indicator of total body strength and has been shown to vary through a wide range of body masses. It is not fully known if HGS can be used with BMI and WC in a model to predict BF%.

PURPOSE: This research study was designed to determine if BF% could be predicted with BMI, WC, and HGS in a general population of men and women.  

METHODS: Sixty-four apparently healthy adults (37 men and 27 women) served as the subjects for test validation. Criterion BF% was determined via dual energy x-ray absorptiometry. The relationship between the independent variables (BMI, WC, HGS, and sex) and criterion BF% was determined via stepwise regression. An additional cohort of 23 subjects (16 men and 7 women) was used to cross-validate the regression model. Validity was confirmed by correlation, standard error of the estimate (SEE), and the method of Bland-Altman.  

RESULTS: The regression analysis showed that BMI, WC, HGS, and sex were independently associated with FM. The regression equation was as follows: predicted FM (kg) = (2.095 x BMI) - (HGS x 0.077) + (WC x 0.552) + (sex x 4.730) - 50.139 (r = 0.96, R² = 0.92, p < 0.001). Predicted BF% = (predicted FM / total body mass (kg)) x 100. When cross-validated, there was no significant difference between Criterion BF% (34.6% +/- 10.2%) and Predicted BF% (35.4% +/- 9.6%) (p = 0.34). Cross-validation revealed the following statistics: r = 0.94, p < 0.01, SEE = 3.7%. The Bland-Altman statistics indicated that the CE/Bias (predicted - criterion BF%) = 0.8% and the limits of agreement (95% confidence intervals) were -6.2% to 7.9%.  

CONCLUSIONS: This study showed that BMI, WC, HGS, and sex could potentially be used in a regression model to predict BF%. However, it should be noted that this was a pilot study that included fairly low sample sizes for the validation and cross-validation cohorts. Therefore, further research is needed to confirm the present results.

3056 Board #21 June 1 2:00 PM - 3:30 PM  
Differences in Ratings of Perceived Exertion Between Weight Classifications.  
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(No relationships reported)  

PURPOSE: The purpose of this study was to investigate OMNI rating of perceived exertion (OMNI-RPE) among normal weight and obese individuals at each stage of the modified Balke treadmill test. A secondary purpose was to determine differences between groups for OMNI-muscle hurt, RER, heart rate (HR) and oxygen consumption (VO2).  

METHODS: Participants of normal weight (BMI<25 kg/m2; n=17) and obese status (BMI<30 kg/m2; n=12) completed two days of testing. A 6-minute walk test was completed two days before the modified Balke to evaluate subject safety. A 2 X 3 mixed model ANOVA (group X stage) was used to compare all variable means for the normal weight vs. the obese group. When it was appropriate post hoc dependent t-tests were calculated when needed.
RESULTS: No interactions were found between group and stage for any variables with the exception of muscle hurt (p<.004). The obese group reported higher OMNI-RPE (p=0.002, powr=0.90), higher HR (p=0.003, powr=0.88) and significantly lower VO₂ (p=0.027, powr=0.62) than the normal weight group for all stages of the Modified Balke. These data suggest that obese women perceive exercise as harder than normal weight women during an incremental treadmill test.

CONCLUSIONS: OMNI-RPE, HR, and VO₂ data suggest that obese women have differing physiological and perceptual responses than normal weight women at the same exercise intensity, which suggests the need for modified exercise recommendations for obese women. Further research is needed to determine if these differences may explain reduced exercise participation for obese women.

3057 Board #22
June 1  2:00 PM - 3:30 PM
Lower Limb Body Composition Is Associated To Passive Knee Flexibility And Acute Mechanical Adaptations
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No relationships reported

PURPOSE: People vary in flexibility in terms of range of motion, resistance to stretch and acute mechanical adaptations during stretching. Several researchers have mentioned body composition (BC) as a main factor for flexibility differences. However, there is still controversies and unknown for the relation between flexibility and BC. The present study’s goal was to determine how BC and anthropometric measures of lower limb associates to passive knee extension (PKE) flexibility.

METHODS: Twenty-five male persons (21.6±2.9 years, 73.9±6.9 kg, 1.75±0.1m) with PKE flexibility deficit were subject to an anthropometric and BC assessment (Dual-Energy X-ray Absorptiometry, DXA) and a maximal PKE protocol of 5 repetitions (velocity of 2%; 90 seconds in static phase; and 15 seconds rest interval) without feeling discomfort or pain. Knee ‘passive torque - range of motion’ (PT-ROM), vastus medialis and semitendinosus electromyographic activity (EMG) were recorded during the protocols. All the measurements were done on the same day.

Viscoelastic stress relaxation (VSR), amplitude (N·m), knee passive stiffness (KPS, in N·m/º), and lower limb regional components of BC were determined. Specific Matlab® routines were used for data analysis. A critical level p=0.05 was considered for statistical analysis.

RESULTS: Thigh muscle and bone mass, as well as thigh perimeter, showed a moderated correlation with PT (r=0.45; r=0.6; r=0.59, respectively), ROM (r=0.46; r=0.5; r=0.5), and VSR (r=0.46; r=0.49; r=0.5). Thigh muscle mass was also correlated with KPS (r=0.42). Subjects (n=10) with larger thigh perimeter, superior thigh muscle mass, and higher thigh bone mass showed, respectively, more 41% PT, 39% VSR, and 11% ROM, when compared to the thinnest subjects. All these differences and correlations were significant (p<0.05). Muscular EMG was lower than 3% of maximal voluntary contraction in all tests.

CONCLUSIONS: Passive knee flexibility seems to be moderately related with lower limb body composition. In particular, thigh perimeter and muscle mass are associated with passive stiffness and viscoelastic stress relaxation. More research is needed to understand what influences range of motion, resistance to stretch and acute mechanical adaptations to stretching.

3058 Board #23
June 1  2:00 PM - 3:30 PM
Weight-Related Concerns & Characteristics of a Female Substance Abuse Population
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No relationships reported

Research demonstrates that more women use illicit stimulant-type drugs than men due to its appealing side effects including loss of appetite, substantial weight loss and elevation of self-esteem. During substance abuse recovery, however, women often report rapid weight gain and body dissatisfaction expressing weight concerns as a trigger for relapse. Dietary restriction, energy & dietary supplements, tobacco and anorexic & bulimic practices often become the “self treatment-of-choice”.

PURPOSE: To determine WT-related concerns of women in substance abuse treatment.

METHODS: 340 female participants were recruited from nine substance abuse treatment facilities in southern Nevada (outpatient and residential court-ordered, self-referral). Participants’ average age was 33.75 years (SD=10.75). Average length of time in recovery was 12.5 months (SD=39.4).

Participants completed questionnaires to assess drug history and WT concerns prior to completing a health and body image program. Body Measurements (WT, height, and 4-site skinfold measurements - abdomen, iliac, triceps and thigh) were also conducted pre-intervention.

RESULTS: Stimulants were the most common drug of choice (61.3% of sample) followed by alcohol (17.6%), opiates (11.6%) and all others (9.5%). Average body fat was 30.48%, (SD=7.37); average BMI was 28.26, (SD=6.31). Drugs were used as a method for WT loss often, usually or always for 34.3% of the sample. Other methods used for WT loss included exercise (49.7%), caloric restriction (41.4%), diet pills (37.9%), starvation (25.5%) and energy supplements (22.4%).

The majority (70.5%) was concerned about WT gain in recovery; 43.0% had concern that gaining WT could trigger drug relapse and 28.0% had concern about using drugs to lose WT after leaving treatment. Participants’ actual measured WT was significantly higher than the WT at which they felt most comfortable p<0.001.

CONCLUSIONS: Females in substance abuse treatment were overly concerned about their weight and weight gain. Validating these weight concerns is critical to successful recovery. Interventions that educate and address concerns associated with weight are warranted in this population. Programs that address body image and healthy lifestyles may decrease relapse and treatment dropout, especially for women.

3059 Board #24
June 1  2:00 PM - 3:30 PM
Associations Between Calf Fat And Muscle Density, Calf Soft Tissue Areas, And Total And Leg Soft Tissue Mass.
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No relationships reported

Peripheral Quantitative Computed Tomography (pQCT) is becoming increasingly used for muscle and fat area assessments. Dual Energy X-ray Absorptiometry (DXA) is often added to these studies to give body composition information since data reporting the associations between pQCT- and DXA-derived soft tissue measures are scarce.

PURPOSE: To determine associations between pQCT-derived soft tissue density and area measures and DXA-derived soft tissue mass.

METHODS: Healthy men (n = 55) and women (n = 59) ages 20-59 had their leg and total body composition (bone-free lean body mass (BFLBM), fat mass (FM), body fat %) assessed by DXA and their calf fat and muscle cross-sectional area (FCSA and MCSA) and density (FDen and MDen) measured at 66% of tibia length. Marrow fat (MarFat) was also examined. Data are reported as mean ± SE. 

RESULTS: Men had significantly (p < 0.01) greater total (61.4 ± 1.0 vs. 40.7 ± 1.1 kg) and leg (21.0 ± 0.4 vs. 14.1 ± 0.3 kg) BFLBM and MCSA (89.5 ± 1.7 vs. 69.6 ± 1.6 cm²) than women. Women had significantly (p < 0.01) greater leg (10.6 ± 0.6 vs. 7.0 ± 0.5 kg) FM, and FCSA (32.9 ± 2.1 vs. 16.9 ± 2.1 cm²) than men. FDen was significantly (p < 0.01) higher in men (9.9 ± 0.8 vs. 1.6 ± 0.4 mg/cm²), but MDen was not different between sexes. FDen was negatively correlated with FCSA, total leg FM, and body fat % (r = 0.5, 0.7, p < 0.001) and positively related to MCSA, total and leg BFLBM (r = -0.45, 0.5, p < 0.001). Total FM was predicted by FCSA, wt, FDen, ht, and age (R² = 0.89, p < 0.01), FCSA, wt, sex, and FDen predicted leg FM (R² = 0.90, p < 0.01), sex, MCSA, ht, MDen, and wt predicted total BFLBM (R² = 0.87, p < 0.01). Relative to total bone area, the proportion of ‘fatty’ marrow was not different between men and women (13.4 ± 0.6% vs. 12.5 ± 0.7%, p > 0.05), but there was a trend (p = 0.07) for the density of ‘fatty’ marrow to be greater in women (16.0 ± 5.1 vs. 14.3 ± 4.7 mg/cm³).

CONCLUSIONS: Calf soft tissue area and density, along with ht, wt, and sex, strongly predict total leg and soft tissue mass. Fat density measures appear to be especially influenced by fluid content, possibly due to differences in lipid content or levels of inflammation. Further research will be needed to determine if changes in adipose cell size can be detected by changes in fat density.
Dual x-ray absorptiometry (DXA) is becoming an effective tool to measure total body fat and lean mass characteristics in diverse populations. Software enhancements have provided options to obtain body region assessments of clinical value such as android fat. As sarcopenia has been recognized as a serious health issue, there is a need for useful methods to quantify body mass, especially lean mass, changes in specific regions of the body.

**PURPOSE:** The purpose of this study was to assess the precision of DXA measurement of lean and fat mass of the thigh in a heterogeneous population.

**METHODS:** A total of 30 subjects (14 males and 16 females), ranging from ages 24 to 88 y (n=6 < 25 y, n=9 between 25 - 50 y, n=9 between 50 - 75 y, and 6 > 75 y) had a total body DXA scan (GE Lunar Prodigy). Subjects were measured in a supine position with legs strapped together to minimize movement during image acquisition. Scans were analyzed in triplicate with Encore Version 13.40 software to quantify fat and lean mass of the right thigh, as defined by the segment between the inferior borders of the ischial tuberosity and superior surface of the intercondylar eminence. Coefficient of variations (CV) were calculated for the three separate analyses from the image for each subject, while a repeated measures ANOVA was used to test differences between the 3 measures.

**RESULTS:** There was a wide range of thigh fat mass (641.7 to 7498.7 g) and lean mass (2379.7 to 7620.0 g) between subjects. No significant differences existed between the 3 analyses for both fat and lean mass (p = 1.00). CV values ranged from 0.1 - 2.5% for fat and 0.1 - 2.0% for lean mass while mean CVs were 0.9% and 0.7%, respectively.

**CONCLUSION:** DXA imaging is capable of quantifying fat and lean mass of the thigh with a high level of precision. Regional DXA measures may provide a reasonable alternative for quantifying fat and lean mass of body segments compared to the gold standard of magnetic resonance imaging (MRI). Additional study of the potential for DXA to provide accurate regional fat and muscle mass measurements is warranted.
Thin Women Display Hedonic Treadmill Tendencies Regarding Their Weight Vs. Overweight Counterpart!

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(No relationships reported)

PURPOSE: The purpose was to examine any potential differences in self-esteem, body image, and body attitude between thin and overweight women. We expected that women who self-described themselves as thin should reveal balanced identities, whilst overweight women would exhibit unbalanced identities.

METHODS: A series of Implicit Association Tests (IAT; Greenwald, McGhee and Schwartz 1998) were used to assess the three constructs if interest: Self-Esteem, Self-Body Association, and Body Attitude. The IAT is a well-established measure in social and cognitive psychology designed to indirectly measure the strength of association between concepts in memory using a simple computer-based categorization task.

RESULTS: The ANOVA analysis revealed a significant difference on the body image and body attitude IATs, such that thin participants exhibited a stronger self-association with imagery consistent with thin body size (Mthin = 83, Moverwt = 52, p = .037) and more positive attitudes toward thin body imagery (Mthin = .51, Moverwt = .39, p = .044), but did not reveal significant increase in self-esteem compared to overweight participants (Mthin = .49, Moverwt = .51, p = .65). Further, thin individuals revealed a smaller current body image (Mthin = 3.4, Moverwt = 6.0, p < .001, smaller number is thinner), a smaller ideal body image (Mthin = 2.6, Moverwt = 3.8, p < .001), a smaller self-ideal discrepancy (Mthin = .80, Moverwt = 3.5, p < .001) than the overweight individuals. Finally, correlational analysis of the thin participants revealed a negative correlation between current body size and implicit self-esteem (such that the thinner your current body size, the lower your implicit self esteem) and a positive correlation between worry about becoming overweight and increased implicit self-esteem. None of these correlations obtained for the overweight group.

CONCLUSION: In light of these counterintuitive findings, overweight females revealed a balanced identity in memory, while thin participants did not.

Coping With Weight-related Discrepancy & Impact On Self-regulation: Development Of The WEIGHT-COPE

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(No relationships reported)

PURPOSE: To develop a reliable and valid measure (WEIGHT-COPE) to assess coping responses to weight-related discrepancy in women. The decision to create such a measure stemmed from difficulties in consistent regulation of weight-related behavior.

METHODS: The WEIGHT-COPE and other relevant measures were completed online by 470 females ages 18-35 years from all BMI categories. Data were analyzed in an exploratory factor analysis.

RESULTS: The EFA revealed a 40-item measure consisting of eight coping factors: Exercise/Physical Activity, Healthy Eating, Cutting Calories/Appetite Suppression, Supplement Use, Monitor/Planning, Disengage/Denial, Camouflage, and Acceptance/Positive Reframing. All factors were internally consistent (α = 0.71 to 0.89), and converged with other pertinent measures of weight satisfaction, weight controllability/changeability, social physique anxiety, self-esteem, weight loss efficacy, physical activity level, dietary intake and objectified body consciousness. To test theoretical implications on future self-regulation of weight loss behavior, a structural regression model was run utilizing the resulting factors. The factors interacted in a theoretically-driven pattern, illustrating that coping responses to weight-related discrepancy may have varied impacts on weight loss behavior choice.

CONCLUSIONS: The present findings provide preliminary support for the WEIGHT-COPE and suggest that individuals cope with weight-related discrepancy in different ways, which may then have various impacts on future self-regulation of weight loss behavior.

The Effects Of Two Weeks Of Sprint Interval Training In Spinal Cord Injured (SCI) Persons

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(No relationships reported)

Persons with chronic SCI exhibit a high prevalence of metabolic syndrome. The potential medicinal benefits for sprint interval training (SIT) among able-bodied individuals may have important implications for SCI, however data for arm crank ergometry (ACE) SIT are not unavailable.

PURPOSE: To elucidate the effects of two weeks of SIT in persons with SCI.

METHODS: 9 males with chronic SCI, T1-T10, completed the study that included a continuous VO2peak test and DXA to estimated body composition. Three OGTT’s were completed - baseline, 2 weeks later (Pre), and 48 hrs Post training, with 24 hr dietary recall completed for each of these tests. Six SIT sessions were completed on a Monark 891E ACE over 2 weeks. Subjects cranked against 3.5% body mass for 30 sec completing 4 sprints session 1, then 5, 5, 6, 6, and finally 7 sprints in the final session. All data are presented as medians (Q1, Q3), and a Wilcoxon test (α=0.05) was used to determine pre and post changes. Area under the curve (AUC) was calculated using the trapezoidal rule and peripheral insulin sensitivity (S) was estimated using ISI-Cederholm.

RESULTS: Men were age 47 (44, 56.8), 181.6 (168.8, 184.5) cm tall, weighed 86.8 (72.8, 94.4) kg, 34.6 (30, 37.5) %Fat, & VO2peak 1.51 (1.33, 2.05) L min-1. Dietary analysis indicated subjects consumed 1907 (1288, 2751) kcal, consisting of 50.5 (38.7, 57.8)% CHO and 31.0 (26.3, 37.9)% Fat. Participant’s average work during sprints increased from 5.66 to 6.22 kj (about 10%) between the first session and last. AUC changes for either glucose or insulin failed to show significant changes. ISI-Cederholm 151.6 (145.2, 176.0) baseline, 179.2 (162.7, 190.8) Pre, and 165.2 (141.0, 202.3) Post, also did not show significant changes either. Close inspection of the data show large variation between the three OGTT periods.

CONCLUSIONS: Persons with SCI have a high training capacity, but ACE SIT may not provide a sufficient training stimulus to overcome the metabolic changes and variability seen here. The high variability for the OGTT’s within and between subjects cannot be explained by dietary analysis and support the unique metabolic environment seen among SCI. These data also suggest that the OGTT may not be a suitable test for training evaluation in SCI. More research is needed to determine the efficacy of ACE SIT for other non-SCI populations.
Objective methods are needed to better quantify behavioral and functional outcomes following spine surgery. To date accelerometers have not been widely used to evaluate surgical outcomes despite their promise to detect small but meaningful changes in activity following surgery. Maintained lower extremity function in late life is known to reduce morbidity and mortality.

PURPOSE: To assess changes in physical activity (objective and self-report) and lower extremity function in patients with lumbar spinal stenosis undergoing spinal decompression surgery.

METHODS: Patients wore an accelerometer for 7 consecutive days (Actigraph GT3x®), completed a validated self-report physical activity questionnaire (CHAMPS questionnaire) and a short battery of lower extremity physical performance tests (Short Physical Performance Battery [SPPB]: gait, leg strength, and standing balance) at baseline (T0), 1-month post-operation (T1), and 3-month post-operation (T2). Moderate-vigorous physical activity (MVPA) was defined using published thresholds (≥1952cts/min) accelerometer data and standard metabolic equivalents (≥3.0 METS) for reported activities. Mixed-effects models were fitted within-group changes in these variables.

RESULTS: Patients (N=14) were 57% female, 43% Caucasian, overweight (27.6±5.1kg/m2), and of older age (73.4±8.1 years). Patients wore the accelerometers for 4.8, 5.5, and 3.5 valid days (defined as >10hrs of wear time) at T0, T1, and T2, respectively. Improvements in accelerometer and self-reported MVPA were not significant (p>0.05); however, effect sizes were moderate to large for accelerometer-derived MVPA at T1 (differ=9.6mins, d=0.78) and T2 (differ=8.5mins, d=0.4), and small for self-reported PA at T1 (differ=5.3mins, d=0.1) and T2 (differ=9.92mins, d=0.3). Improvements in SPPB scores were significant (F(2,19.1), p=0.01), with large effect sizes at T1 (diff=1.9, d=1.6) and T2 (diff=1.5, d=0.8). Sub-analyses revealed SPPB total score changes were due to gait and leg strength, but not standing balance.

CONCLUSIONS: Initial evidence suggests that changes in MVPA and lower extremity function following decompression surgery are detectable. Future research is needed to confirm these results in a larger sample and with longer-term follow-up.

**Board #31 June 1 2:00 PM - 3:30 PM**

**Accelerometer-derived Physical Activity And Lower Extremity Functional Changes In Patients Undergoing Spinal Decompression Surgery**

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(No relationships reported)

**Board #32 June 1 2:00 PM - 3:30 PM**

**Eight Weeks Functional Training Improves Muscle Endurance, Balance, Power, Speed In Athletes With Disabilities**

Heather Pennington, Cynthia Schroeder, Elizabeth Feutz, Meghan Reid. Lindenwood University, St. Charles, MO.

(No relationships reported)

**Board #33 June 1 2:00 PM - 3:30 PM**

**Amplified C-reactive Protein To Protein Glycation Ratio In The Frozen Shoulder Patients**

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(No relationships reported)

Exercise training is encouraged for all in the prevention and treatment of metabolic disorders. However, degenerative musculoskeletal disorder can be a barrier for exercise participation. Adhesive capsulitis of the shoulders result in limitation of active and passive range of motion of all directions and so called “frozen shoulder”. This problem causes severe pain and affects daily activity and exercise capacity. Diabetic patients have five times prevalence rate of frozen shoulder compared to general populations. Hyperglycemic protein glycation plays a critical role in low-grade chronic inflammation and may implicate degenerative join disease in elderly.

PURPOSE: This cross-sectional study aimed to compare C-reactive protein (CRP) and glycosylated hemoglobin (HbA1C) ratio between normal and frozen shoulder patients.

METHODS: Fifty middle-aged subjects were divided into 4 groups according to the cut-off criteria of pre-diabetes: fasting glucose (FG> 100) and glycosylated hemoglobin A1C (HbA1C> 5.7%) for CRP comparison. CRP to HbA1C ratio in 3 frozen shoulder patients (aged 54.3±1.2 years) was measured against 12 age-matched normal subjects (aged 54.3±1.2 years).

RESULTS: Among fifty subjects, CRP levels increased with HbA1C ratio (3 folds) against the normal subjects. This preliminary finding provides ground for investigating the possible metabolic origin of frozen shoulder, and the possibility of using hypoglycemic intervention as an adjuvant therapy of conservative treatment modality treating degenerative joint disease.

CONCLUSION: Our data suggest that chronic inflammation amplified with protein glycation among middle-aged subjects. Frozen shoulder patients displayed an amplified CRP to HbA1C ratio (3 folds) against the normal subjects. This preliminary finding provides ground for investigating the possible metabolic origin of frozen shoulder, and the possibility of using hypoglycemic intervention as an adjuvant therapy of conservative treatment modality treating degenerative joint disease.

**Board #34 June 1 2:00 PM - 3:30 PM**

**Hip Muscle Strength, Bilateral Ratios, Antagonistic Ratios and Single Leg Squat Performance in Persons with Low Back Pain and Controls**

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(No relationships reported)

Many persons suffer from lower back pain (LBP), but causes are not fully understood. Few studies have examined the hip musculature strength differences in persons with LBP history and whether it contributes to movement deviations during the single leg squat.

PURPOSE: To compare isometric strength, antagonistic ratios, bilateral ratios of the hip muscules and qualitative single leg squat performance between healthy and persons with a history of LBP.

METHODS: Fifteen men with (1.78±0.0m, 80.7±15.6kg, 21.9±3.9yrs, Oswestry Disability Questionnaire score=29.1±22.8 ) and without (1.78±0.0m, 72.7±11.8kg, 20.2±2.5yrs) LBP history completed isometric strength evaluation of the hip flexor, extensor, adductor (HAD), abductor (HAB), internal rotation, external rotation (HER), and standing balance strength assessments on a standard flat surface. Strength assessment order was randomly determined for each subject. Average strength values across three trials were computed and normalized to body mass. Antagonistic and bilateral strength ratios were computed. Furthermore, participants completed the National Academy of Sports Medicine (NASM) single leg squat assessment (SLSA), however only errors associated with hip musculature balance were considered for analysis. A pilot reliability study for the strength assessments yielded intra-class correlational coefficients (3, k) between .91 to .98. Three factor analyses of variance (ANOVA) were conducted for the strength values (group by limb by muscle action) and antagonistic ratios (group by limb by ratio). Two factor ANOVA were conducted for the bilateral ratios (group by muscle action). Chi square analyses were used to compare errors during the SLSA.
RESULTS: No significant (P<.05) isolated strength or bilateral ratios differences between the groups existed. Post hoc analysis of a significant group by antagonist ratio interaction (P=.009) for HAb:HAd revealed the LBP group to have a 19% lower ratio than the control group (P=.007). There were no significant SLSA error differences between the groups.

CONCLUSIONS: Although the isometric strength and bilateral ratios did not differ between the LBP and control groups, the LBP demonstrated significantly smaller HAb:HAd ratios than the controls. This study also shows that the NASM SLSA did not detect HAb:HAd differences between LBP sufferers and non-LBP sufferer.

3070 Board #35 June 1 2:00 PM - 3:30 PM
Reducing Injuries is NOT Enough - It Also Helps to Win
Jeremy A. Gentles, East Tennessee State University, Johnson City, TN.
(No relationships reported)

Much of the current literature related to injuries in sport has addressed the influence of a specific exercise intervention on a specific type of injury without considering changes in sport performance.

PURPOSE: To investigate an interdisciplinary approach to athlete development and its initial effects on injury rates and measures of performance in collegiate baseball.

METHODS: In October 2008, an NCAA Division I baseball team began working with a sport performance enhancement group (SPEG) which consists of a collaborative effort between sport coaches, sport medicine and sport science departments. Injury rates were calculated for each academic year from 2006/2007 through 2010/2011. As part of the athlete monitoring program provided through SPEG, peak force was measured using an isometric mid-thigh pull from 2008/2009 through 2010/2011. Team win percentage and home runs were also reported from 2003/2004 through 2010/2011.


CONCLUSIONS: These results seem to indicate that the collaborative efforts of SPEG were able to substantially reduce injury rates while increasing lab based and on-field performance.

3071 Board #36 June 1 2:00 PM - 3:30 PM
Influence Of Verbal Instruction For Center Of Gravity Position And Sex On Landing Muscle Activity
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(No relationships reported)

We have reported that the verbal instruction to move a center of gravity (COG) forward was used, and multiple comparisons by LSD with all variables and tasks as within-subject variable and sex as between-subject variable.

PURPOSE: To evaluate the efficacy of verbal instructions on COG position to alter landing muscle activity in female subjects, and compared with the results using male subjects.

METHODS: A cross-over interventional study. Seven healthy female students [mean age (SD): 19.8 (0.7) yrs] performed 3 jumping and landing tasks: normal landing (N); landing after the instruction to move a COG forward (ANT); landing after the instruction to move a COG backward (POS). Sagittal plane motion, ground reaction force and electromyography of quadriceps (the vastus medialis (VM) and vastus lateralis (VL) muscles) and hamstring (the semitendinosus (ST) and biceps femoris (BF) muscles) were recorded during the landing phase (i.e. the interval from initial contact round to kick peak flexion). The HF ratio was calculated as the mean activation of ST and BF to mean activation VM and VL. For statistical analysis, 3-way ANOVA was used.

RESULTS: In female subjects, the results of ankle dorsiflexions (degree) at N, ANT, and POS were 24.4 (4.26), 26.2 (2.79), and 18.7 (6.47), knee flexions were 94.1 (6.08), 94.2 (4.15), and 92.0 (7.61), hip flexions were 97.3 (5.98), 94.3 (15.0), and 101.2 (7.66), and trunk anterior tilts were 27.6 (5.68), 26.3 (12.02), and 27.9 (9.39), respectively. In female and male, ankle dorsiflexion at POS was significantly smaller than at N and ANT. Between sexes, knee and hip angle, and trunk anterior tilts in female were smaller than in male. The HF ratio in female were 43.4 (10.08), 38.7 (22.10), and 31.3 (21.56), respectively at N, ANT, and POS. The HF ratio had no sex difference (in male: 33.15 (17.52), 48.4 (18.92), and 27.1 (7.68), respectively).

CONCLUSION: Sex differences were not recognized in muscles activity during landing tasks. Therefore, changing of movement during landings should be emphasized as part of ACL injury prevention programs.

3072 Board #37 June 1 2:00 PM - 3:30 PM
Reliability of Translation of Center of Force Using Portable Pressure Mapping Device in Older Adults
Marjorie A. King1, Marie E. Trombulak1, William I. Eissler1, Ryan S. Kerpness1, Thomas R. Boucher1, Jean P. Boucher, FACSM2, 3
Plymouth State University, Plymouth, NH. 1University of Quebec at Montreal, Montreal, QC Canada. 2Dartmouth College, Hanover, NH.
( M.A. King: Contracted Research - Including Principle Investigator; Tekscan.)

Falls in the elderly are the most common cause of non-fatal injuries and hospital admissions from trauma (CDC 2011). Falls prevention screening is a critical element in the efforts to reduce these injuries. A portable testing device allows for the screen to be brought to the elderly rather than have them travel to a testing site.

PURPOSE: To determine the reliability of a portable measurement device, utilizing pressure mapping, for measuring translation of center of force in older adults.

METHODS: Forty-five (10 males; 35 females) physically active older adults (m = 71.8 ± 4.6 y., m = 162.7 ± 12.3 cm, m = 75.6 ± 17.9 kg) participated in balance testing across three days after signing an informed consent document.Five measures across six conditions were tested within 24 to 72 hrs. of the previous test day. The variables of area, distance, variability (SD of distance), A-P and R-L excursion were computer generated under the six conditions of two-feet open (2FOE), two feet closed (2FEC), right foot open (RFEO) and eyes closed (RFEC), left foot eyes open (LEFOE) and eyes closed (LEFEC). Subjects were asked to stand quietly for 30 seconds, for five trials, with arms relaxed at side,viewing an eye level target on the wall. A tracing of foot position was taken to ensure similar stance positioning within each day across trials.

RESULTS: ICCs (2,3) ranged from moderate (0.67 for variability 2FOE) to high (0.93 for distance 2FEC. Thirteen out of the 15 eyes open ICCs are at 0.73 or better, while all 15 eyes closed ICCs are at or over 0.71. One of the lowest ICC values (0.68) was for the LFOE condition with 41 of 45 being R foot dominant. The ICCs in all the other measurements and conditions range from good (0.71) to very good (0.93), for both eyes opened and closed.

CONCLUSIONS: This portable pressure mapping device provides several stable measurements for postural balance in an older adult population across days without constraining arm position. This device appears to be an appropriate tool to measure postural balance in the older adult. Future research should address validation of the variables to current clinical measures for falls risk. (NIH-NINR) NIH Grant Number 1P20RR030360-01 from the NINR Program of the National Center for Research Resources(CFD#A 93.389)

3073 Board #38 June 1 2:00 PM - 3:30 PM
Effect Of Topical Menthol Gel On Power Output During 30-second High Intensity Anaerobic Exercise
Will C. Hawkins, Michael E. Rogers, FACSM, Jeremy A. Patterson, FACSM, Cali K. Simmons. Wichita State University, Wichita, KS.
(No relationships reported)

Menthol-based gels have been reported to reduce acute pain and reduce inflammation. However, the effect of topically applied menthol on power output during high intensity anaerobic bouts has not been studied.

PURPOSE: To determine if the topical application of menthol enhances power output during a 30-second sprint.
Adaptations In Scapular Kinematics Among Pitchers And Position Players Over The Course Of A Baseball Season

Robert Lynall, Kevin Laudner, FACSM, Keith Meister, Illinois State University, Normal, IL, 2Texas Metroplex Institute for Sports Medicine and Orthopedics, Arlington, TX.

(No relationships reported)

Baseball pitchers have been reported to have an increased prevalence of shoulder injury compared to position players. Such injuries have been empirically linked to scapular dyskinesis.

PURPOSE: To determine if throwing arm scapular kinematic differences exist between baseball pitchers and position players over the course of a baseball season.

METHODS: Sixteen asymptomatic professional baseball pitchers and 16 position players participated. We measured scapular upward rotation at 0°, 60°, 90°, and 120° of humeral elevation, as well as forward scapular posture prior to (covariate) and at the conclusion (dependent variable) of a 140 game baseball season. We conducted separate 1-way analyses for all measurements (p<.01).

RESULTS: The covariate adjusted means for position players’ scapular upward rotation at 0°, 60°, 90°, and 120° of humeral elevation were 3.9° ± 4.8°, 11.6° ± 4.7°, 24.4° ± 2.36°, and 38.5° ± 2.7°. The covariate adjusted means for the pitchers’ scapular upward rotation at each humeral elevation angle were 4.9° ± 2.7°, 8.7° ± 6.4°, 20.7° ± 5.0°, and 37.6° ± 3.8°. The position players had significantly greater scapular upward rotation at 60° (p = .007, between group mean difference = 2.9°, effect size = .45) and 90° (p = .006, between group mean difference = 3.6°, effect size = .73) of humeral elevation compared to the pitchers. There were no significant differences for scapular upward rotation at 0° (p = .93) or 120° (p = .29) of humeral elevation. The covariate adjusted means for the position players’ and pitchers’ forward scapular posture were 0.54mm ± 0.44mm and 0.30mm ± 0.69mm. Forward scapular posture was not significantly different between groups (p = .23).

CONCLUSIONS: Our results show that position players have significant increases in scapular upward rotation at 60° and 90° of humeral elevation at the conclusion of the baseball season compared to pitchers. Due to the repetitive arm elevation required for the throwing motion over the course of a season, the increased scapular upward rotation demonstrated by position players may be beneficial in reducing their risk of injury. However, this lack of increase in pitchers may make them more susceptible to such injuries and may partially explain their higher incidence of shoulder injury compared to position players.

Supported by Hygienic Corporation

With Menthol
Without Menthol

Peak Power over 30 sec (W) 604.7 ± 268.9 790.0 ± 272.8
Average power over 30 sec (W) 61.5 ± 159.7 547.5 ± 156.8
Average power 0-5 sec (W) 741.1 ± 241.4 712.9 ± 237.7
Average power 5-10 sec (W) 638.5 ± 191.6 634.4 ± 189.6
Average power 10-15 sec (W) 614.4 ± 168.0 556.1 ± 166.0
Average power 15-20 sec (W) 505.3 ± 148.2 500.2 ± 148.8
Average power 20-25 sec (W) 456.8 ± 128.5 452.5 ± 130.1
Average power 25-30 sec (W) 409.6 ± 110.4 406.1 ± 112.1
Fatigue Index (%) 91.0 ± 0.12 90.0 ± 0.14

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Low back pain is a common issue among adults. Muscle weakness is related to pain. During rehabilitation patients perform back strengthening exercises to help alleviate their back pain. Some patients are not able to assume a prone unsupported lumbar extension position used to strengthen back muscles. To address this issue, two new sitting lumbar extension exercises have been introduced; assessment of their efficacy is important.

**PURPOSE:** To compare 3 lumbar extensor strengthening exercises’ activation of lumbar erector spinae (LES), lumbar multifidus (LM), and external oblique (EO).

**METHODS:** Eighteen healthy people (age 31 ± 13 years, weight 68.6 ± 11.7 kg, height 1.77 ± 0.08 m) with no back pain were recruited to participate in the study. Three EMG surface electrodes were placed on participants’ right back and abdomen over the LM, EO, and LES muscles. Each participant performed three maximal voluntary isometric contraction tests in order to normalize the data for comparison. Three isometric exercises were then performed in random order; muscle activation was recorded for each of the three exercises: 1) Prone unsupported lumbar extension; 2) sitting isometric lumbar extension against a resistance band with varying direction of resistance; 3) sitting isometric lumbar extension against a weighted pulley. EMG data were analyzed using customized software in Matlab. Repeated measures ANOVA was performed (SPSS 19).

**RESULTS:** No significant differences in muscle activation were seen across exercises (p > .05 in all comparisons).

**CONCLUSIONS:** Muscle activation was comparable across the three exercises. Each of these exercises may be used to strengthen lumbar extensors.

<table>
<thead>
<tr>
<th>Normalized EMG (% MVIC) comparison of three isometric lumbar strengthening exercises</th>
<th>Prone Unsupported Extension</th>
<th>Sitting Band</th>
<th>Sitting Pulley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Lumbar Erector Spinae</td>
<td>0.7 ± 0.9</td>
<td>0.9 ± 0.8</td>
<td>0.7 ± 0.6</td>
</tr>
<tr>
<td>Right Lumbar Multifidus</td>
<td>0.4 ± 0.6</td>
<td>0.5 ± 0.4</td>
<td>0.4 ± 0.4</td>
</tr>
<tr>
<td>Right External Oblique</td>
<td>0.8 ± 0.4</td>
<td>0.2 ± 0.6</td>
<td>0.6 ± 0.3</td>
</tr>
</tbody>
</table>

**Board #44 June 1 2:00 PM - 3:30 PM**

**Benefits of Partnered Strength Training in Couples Coping with Prostate Cancer: The Exercising Together Project**

Kerri M. Winters-Stone, FACSM, Karen S. Lyons, Jessica Dobek, Lillian M. Nail, Jill A. Bennett, Tomasz M. Beer, Oregon Health & Science University, Portland, OR.

**PURPOSE:** To evaluate the benefits of a 6-month partnered strength-training program, Exercising Together (ET), on physical function and body composition in PCS and spouses.

Prostate cancer impacts not only the patient but also the family and particularly, spouses that provide care. Physical health is compromised in prostate cancer survivors (PCS) and in spouse caregivers, but no intervention has addressed this problem in both partners simultaneously.

**RESULTS:**

**CONCLUSIONS:** Because of this high prevalence of shoulder pain, we think that the clinical examination of the shoulder has to be incorporated to the annual assessment of disabled sportsmen. We have also to educate sportsmen to accomplish the good movement on the wheelchair.
METHODS: 64 couples, consisting of an older PCS (>60 years old) and his spouse, were randomized to the ET program or usual care (UC). Data from couples completing the study were used for preliminary analysis (ET: n=32, UC: n=27). Outcomes were upper and lower body strength measured by 1-RM bench press (BPmax; lbs) and leg press (LPMax; lbs) and timed 5-time chair rise and sit (CHAIR; sec); gait by 4m walk speed (UW; m/s); physical function by the physical performance battery (PPB); and body composition by DXA (% body fat (%BF); lean mass (LM; kg); fat mass (FM; kg). Repeated measures ANCOVA, controlling for age, tested for significant group differences over time on each outcome within patients and spouses. The impact of androgen deprivation therapy (ADT) on patient outcomes was explored by repeating analyses excluding men on ADT (n=11).

RESULTS: Among the full sample of PCS significant group differences were found for BPmax only (p<0.03); however, when excluding PCS on ADT, significant group differences were found for BPmax (ET: +13.0 lbs vs. UC: +6.1 lbs, p=0.03); LPMax (ET: +12.8 lbs vs. UC: +3.9 lbs, p=0.01) and %BF (ET: -0.7% vs. UC: +0.2% p=0.04). Among spouses, significant group differences were found for BPmax (ET: +8.0 lbs vs. UC: -0.2 lbs; p=0.001), LPMax (ET: +11.7 lbs vs. UC: +2.3 lbs; p=0.001), CHAIR (ET: -1.1 sec vs. UC: +0.3 sec; p=0.03), and PPB (ET: +0.5 vs. UC: -0.1; p=0.03), with near significance for LM (ET: +0.6 kg vs. UC: -0.1 kg; p=0.05).

CONCLUSIONS: Our preliminary analysis suggests that Exercising Together may be an effective and efficient strategy to maintain physical health in couples coping with prostate cancer. Supported by NIH grant R21 CA137272.
consumed either 190 proof grain alcohol (EtOH) equal to 1.086 g of alcohol per kg lean mass (82-122 ml total) or no alcohol (Placebo) diluted in an artificially sweetened and calorie free beverage. The participants were blinded to conditions and the order of conditions was counter-balanced. Blood alcohol concentration (BAC) was measured using a breathalyzer. Sixty-five minutes pre-exercise, participants ingested a meal replacement beverage (33.5 kJ per kg body mass). Before the AHRET (PRE) and the following morning (AM), participants performed three high pulls and three bench press throws with 30% of 1-RM, and 10 consecutive vertical jumps, all at maximal effort. Peak power was measured for all exercises. Muscle soreness was measured using analog scales at PRE and AM.

RESULTS: BAC peaked 60-90 min post-exercise in all participants (0.084 ± 0.017 g·dl⁻¹) on alcohol ingestion days. No effect of alcohol was found for peak power in the high pull (EtOH, PRE: 1658 ± 432 W, AM: 1659 ± 260 W; Placebo, PRE: 1599 ± 397 W, AM: 1579 ± 301 W), bench press throw (EtOH, PRE: 1120 ± 276 W, AM: 1105 ± 295 W; Placebo, PRE: 1119 ± 202 W, AM: 1089 ± 257 W), or vertical jump (EtOH, PRE: 52.6 ± 13.5 W·kg⁻¹, AM: 48.5 ± 6.3 W·kg⁻¹; Placebo, PRE: 52.2 ± 9.4 W·kg⁻¹, AM: 47.9 ± 9.0 W·kg⁻¹). Leg soreness increased moderately from PRE to AM with no difference between conditions.

CONCLUSION: A moderate BAC does not appear to affect explosive upper or lower body power capability on the morning following a heavy squat session that induces only limited muscle damage.

PURPOSE: To determine whether acute oral nicotine administration affects measures of muscle force, vertical power or anaerobic performance.

METHODS: Nine physically active males (24 ± 3 y, 78 ± 13 kg; 179 ± 13 cm) completed three trials in which 30 min prior to testing subjects chewed 2 mg (LO) or 4 mg (HI) of nicotine gum or a flavor-matched placebo (PLA) gum, the order of which was randomized. During each trial, measures of peak and average peak isometric, concentric and eccentric leg extensor force were made followed by 3 vertical counter-movement jumps and a 30 sec Wingate test. Heart rate was measured before and after administration and venous blood samples were obtained for determination of pH, HCO₃⁻ and to confirm the presence of nicotine.

RESULTS: No order effects were observed for any performance or physiological data, whilst nicotine was confirmed (n = 3). Peak and average peak isometric and eccentric force were significantly affected (LO > PLA; all p < 0.05) whilst peak and average peak concentric force were similar across trials (both p > 0.05). Counter-movement jump height was similar across trials (p > 0.05). Peak power (LO < PLA; p < 0.05) and anaerobic fatigue (LO & HI < PLA; p < 0.05) during the Wingate test were significantly affected but anaerobic capacity remained similar across trials (p > 0.05), pH and HCO₃⁻ showed similar responses across trials (both p > 0.05) although both were reduced following the Wingate (both p < 0.05), whilst heart rate was significantly affected (LO & HI > PLA; both p < 0.05).

CONCLUSION: 2 mg nicotine administration via gum 30 min prior to exercise significantly improved isometric and eccentric leg extensor force and reduced anaerobic fatigue and peak power during a 30 sec Wingate test.

3084 Board #49 June 1 3:30 PM - 5:00 PM
The Effects of Momordica Charantia Supplement Diets and Endurance Training on Bone Material in Rats
Ting-yu Lin¹, Young-Yu Liang¹, Sandy S. Hsieh², Hung-Hao Wang². ¹National Cheng Kung University, Tainan, Taiwan. ²National Taiwan Normal University, Taipei, Taiwan.

Mormodica charantia (MC) supplement has been verified regarding its capability in activating peroxisome proliferate-activated receptors (PPARs) downstream pathways. PPAR downstream pathways are related to skeletal homeostasis. Thus, it would be valuable to investigate MC supplement on bone metabolism. Besides, whether regular exercise interacts with MC on bone metabolism is also unknown.

PURPOSE: To investigate the effects of endurance exercise (EXE) and MC supplement diets on bone qualities in growing rats.

METHODS: Seventy-two male SD rats (7 weeks old) were randomly divided into six groups, which were the 0%MC, 5%MC, 8%MC, 0%MC+EXE, 5%MC+EXE, and 8%MC+EXE groups (n=12 for each). After six-week experimental period, all animals were sacrificed. Bone samples were collected and stored for biomechanical properties analysis.

RESULTS: In main effect exercise, exercise groups showed significantly lower body weight (g) (EIXE: 393.9±6.6 < non-EIXE: 422.0±6.6, p<0.05) and lower epididymis fat tissue weight (g) (EIXE: 0.96±0.06 < non-EIXE: 1.64±0.06, p<0.05). In MC main effects, the MC supplement groups showed significant lower values in cortical bone thickness (mm) (8%MC: 0.69±0.10 & 5%MC: 0.70±0.10 < 0%MC: 0.74±0.10, p<0.05), the area of cortical bone (mm²) (8%MC: 7.92±0.15 & 5%MC: 8.29±0.15 < 0%MC: 8.76±0.16, p<0.05), the area of total cross section (mm²) (8%MC: 13.6±0.32 & 5%MC: 14.0±0.32 < 0%MC: 14.9±0.33, p<0.05), and yield load (N) (8%MC: 117.1±2.9 & 5%MC: 117.7±2.9 < 0%MC: 128.4±3.0, p<0.05). Regarding MC×EIXE interaction, significant level was shown in fracture load (N) (post hoc: comparison of simple main effects: 5%MC: 130.3±0.8 < 5%MC+EXE: 143.5±13.1; 0%MC: 171.0±22.6 > 5%MC: 130.3±0.8 & 8%MC: 137.0±16.0, p<0.05), stiffness (0%MC: 300.8±75.1 > 5%MC+EXE: 249.3±30.0, 5%MC: 220.1±37.9 > 5%MC+EXE: 254.3±53.3, 0%MC: 300.8±75.1 > 5%MC: 220.1±37.9 & 8%MC: 232.5±37.0, p<0.05) and cross-sectional moment of inertia (0%MC: 12.35±3.10 > 5%MC: 9.34±1.58 & 8%MC: 9.17±1.93, p<0.05).

CONCLUSIONS: There seemed to be negative effects of the MC supplement on bone materials. Endurance exercise showed modification on MC’s effects in bone material.
3086 Board #51 June 1 3:30 PM - 5:00 PM Stage Specific Effects Of Curcumin On Intestinal Polyp Development In ApcMin/+ Mice

Jamie L. McClellan, Jennifer L. Steiner, Reilly Enos, J. Mark Davis, FACSM, E. Angela Murphy. University of South Carolina, Columbia, SC.

(No relationships reported)

Numerous pre-clinical studies argue for curcumin’s chemopreventive potential in colon cancer. In fact, we recently reported that curcumin can reduce polyp size and number in the ApcMin/+ mouse model of intestinal tumorigenesis. However, there is no evidence on its stage-specific effects in colon cancer.

PURPOSE: Our overall purpose was to conduct a prevention study (to reduce disease incidence), intervention study (to reduce disease progression in animals with incident disease), and prevention plus intervention study (to examine the prevention to progression continuum) with a 0.2% curcumin diet.

METHODS: Male ApcMin/+ mice were randomly assigned to either placebo or 0.2% curcumin diet. Mice were further assigned to their specific treatment stage as follows: Prevention (4-11 wk), Intervention (11-18wks), or Prevention + Intervention (4-18 wks). Tissues were collected at 18 weeks of age and intestines were analyzed for polyp number and size (>2 mm, 1-2 mm, and <1 mm).

RESULTS: The Prevention treatment reduced overall intestinal polyps by 26% (P<0.05) that was largely attributed to a decrease in the number of medium sized polyps (52%) (P<0.05). Similarly, the Prevention + Intervention treatment reduced total polyps by 26% (P<0.05) and medium polyps by 44% (P<0.05). However, the Intervention treatment increased overall polyp number by 56% (P<0.05), medium sized polyps by 47% (P<0.05) and large sized polyps by 62% (P<0.05).

CONCLUSION: While curcumin’s chemopreventive effects in colon cancer have been well documented there have been no studies that have examined the stage-specific responses. We show a beneficial effect of curcumin on administration as a Prevention or Prevention + Intervention treatment. However, administration of curcumin as an Intervention results in an increase in polyp number and size. These findings highlight the importance of examining stage-specific effects of various bioactive dietary components in order to determine appropriate timing of effective treatment.

This work was supported by a grant from the National Cancer Institute (R21 CA135377) to E.A.M.

3087 Board #52 June 1 3:30 PM - 5:00 PM Prevalence of Combining ADHD Medications with Exercise Among College Students

Jennifer M. Rivero, Kirsten Granados, Richard Viskochil, Cameron C. Carter, Barry Braun, FACSM. University of Massachusetts, Amherst, MA.

(No relationships reported)

Attention-deficit/hyperactivity disorder (ADHD) is commonly treated using stimulant medications. Use of these medications in combination with intense and/or prolonged exercise can elevate body temperature and blood pressure more than exercise alone. It is well documented that ADHD medications are used without a prescription on college campuses for the purposes of enhancing academic performance, frequently in conjunction with energy drinks that are typically high in caffeine. Combining exercise with ADHD medications and energy drinks may be dangerous but the scope of the potential problem is unknown.

PURPOSE: To determine the prevalence of college students who exercise while using ADHD medications, with or without energy drinks, on the University of Massachusetts Amherst campus.

METHODS: 10,000 full-time undergraduate students at the University of Massachusetts, Amherst were randomly selected from a list generated by the University’s Registrar office. These students were invited (via e-mail) to participate in an online survey. The survey was composed of 5 questions regarding the use of ADHD medications and frequency with which students combined them with exercise and/or energy drinks.

RESULTS: 517 students (5.2%) responded to the surveys sent. 25.3% of respondents reported taking ADHD medications, of which 71.0% (18.0% of total respondents) reported taking them without a prescription. Of the 93 students who took ADHD medications without a prescription, 37 reported combining the medications with exercise and 19 of those students reported also consuming an energy drink within 3 hours of exercising.

CONCLUSION: Although preliminary, data from over 500 undergraduate students at UMass Amherst suggests that 7.1% (1,526 students if the sample is representative) are exercising while using ADHD medications without a prescription. With so many students using ADHD medications with no medical oversight, understanding the potential health risks of combining these medications with exercise and energy drinks is imperative.

3088 Board #53 June 1 3:30 PM - 5:00 PM Erythropoietin Administration Acutely Stimulates Resting Energy Expenditure In Healthy Young Men


(No relationships reported)

PURPOSE: Treatment with recombinant human erythropoietin (rHuEpo) improves insulin sensitivity in patients with end-stage renal disease. Furthermore, animal studies indicate that Epo increases fat oxidation. However, the metabolic effects of rHuEpo have never been experimentally studied in healthy humans. The aim was to investigate the effects of an acute rHuEpo bolus on substrate metabolism and insulin sensitivity in healthy young men.

METHODS: Ten healthy young men (Age: 23 ± 0.7, BMI: 23.5 ± 0.4 kg/m², Hemoglobin: 9.5 ± 0.2 mmol/l, Hematocrit: 44.8 ± 0.6 %) were recruited after written informed consent in accordance with the declaration of Helsinki. They were studied in a single-blinded, randomized, cross-over design with a 2-week wash-out period and received 400 IU/kg rHuEpo or placebo on two separate occasions. Substrate metabolism was evaluated by indirect calorimetry and amino acid and glucose tracer infusions, insulin sensitivity with a hyperinsulinemic euglycemic clamp, and PCR and western blotting was performed on skeletal muscle biopsies measured protein expression and content, respectively.

RESULTS: Resting energy expenditure (REE) increased significantly after rHuEpo (Basal; 1863.3 ± 67.2 (kcal/day) (placebo) vs. 2041.6 ± 81.2 (rHuEpo) p<0.001, Clamp; 1903.9 ± 68.3 (placebo) vs. 2015.7 ± 114.4 (rHuEpo), p=0.03). This increase in REE could not be explained by changes in mRNA levels of uncoupling protein 2 or 3. Fat oxidation in the basal state tended to be higher after rHuEpo, and the relative degree of suppression of fat oxidation during the clamp was higher during rHuEpo treatment as compared to placebo (Basal; 0.71 ± 0.06 (mg/kg/min) (placebo) vs. 0.97 ± 0.10 (rHuEpo), p=0.053). Clamp: 0.44 ± 0.07 (placebo) vs. 0.55 ± 0.10 (rHuEpo), p=0.491. Interaction: p=0.033). These changes could not be explained by changes in mRNA levels of CPTI and PPARα, or AMPK and ACC protein phosphorylation, all proteins involved in fat metabolism. Insulin stimulated glucose disposal, glucose metabolism, and whole-body and forearm protein metabolism did not change significantly in response to rHuEpo.

CONCLUSIONS: A single injection of rHuEpo acutely increases REE in healthy human subjects. This calorigenic effect is not accompanied by distinct alterations in the pattern of substrate metabolism or insulin sensitivity.

3089 Board #54 June 1 3:30 PM - 5:00 PM Australian Coaches’ Knowledge Of Prohibited Substances And The Wada Anti-doping Policy

Rhonda Orr, Matthew Grasmayr, Rona Macniven, Anne Grunseit, Adrian Bauman, Cloe Cummins. The University of Sydney, Sydney, Australia. (Sponsor: Mike Clemstein, FACSM)

(No relationships reported)

Athletes consult coaches as a trusted source of knowledge about performance enhancing and prohibited substances and anti-doping. Yet, little is documented of coaches’ knowledge in these areas.

PURPOSE: To determine Australian coaches’ knowledge of the WADA Prohibited Substances List and Anti-Doping Policy.
CONCLUSIONS:
and particularly dynamic postural control can be mitigated by salsa dancing in older adults. Program parameters (e.g., duration/frequency of dance training) as well as the high initial physical activity level of our participants could be responsible for the non-significant findings in gait variability and leg extensor power.

RESULTS:

on a force plate

11%, all p > 0.05) and leg extensor power (12%, p > 0.05) for stride length (6%, p < 0.01), and for stride time (4%, p < 0.01) in favor of the INT group. However, salsa dancing did not have significant effects on various measures of gait variability (4-30%, 50%, and 70% of thigh length) and posterior (hamstring [HM] 50% and 70% of thigh length) aspects of the thigh and the anterior (tibialis anterior [TA] 30% of lower leg length) and posterior (triceps surae [TS] 30% of lower leg length) aspects of the lower leg. Significant Group x Test interactions were found for stride velocity (11%, p < 0.01), but not the MTH of the thigh. There was no significant (P>0.05) correlation between duration time of light exercise and MTH of the thigh and lower leg. However, duration time of moderate exercise was positively correlated (p<0.05) with the TA-30% MTH (r=0.35) and TS-30% MTH (r=0.35), and vigorous exercise duration time was not only correlated (p<0.05) with the lower leg MTH (TA-30%, r=0.30; TS-30%, r=0.28), but also with QF-50% MTH (r=0.29).

CONCLUSIONS:
Amount of daily step count and moderate/vigorous exercise duration are associated with lower leg MTH. Quadriceps MTH is only associated with vigorous exercise.

3091
Board #56
June 1 2:00 PM - 3:30 PM
Effects Of Salsa Dance Training On Measures Of Balance And Muscle Power In Older Adults
Thomas Muehlbaier1, Urs Granacher2, Stephanie A. Bridenbaugh3, Madeleine Wolf4, Ralf Roth5, Yves Gschwind6, Irene Wolf7, Rui Mata8, Reto W. Kessig9.
1University of Basel, Basel, Switzerland. 2University of Basel, Basel, Switzerland. 3University of Basel, Basel, Switzerland. 4University of Tokyo, Kashiwa, Japan. 5Toyo Gakuen University, Nagareyama, Japan. 6University of Tokyo, Kashiwa, Japan. 7University of Mississippi, Oxford, MS. 8University of Oklahoma, Norman, OK. 9Friedrich-Schiller-University Jena, Jena, Germany.

It has been reported that dual X-ray absorptiometry (DXA)-measured appendicular muscle mass is associated with daily physical activity (average step count and duration time of moderate exercise >30 MTEIs) in the elderly. Although age-related site-specific muscle loss was observed in the lower body, the relationship between age-related change in lower body muscle distribution and daily physical activity is unknown. PURPOSE: To investigate the relationship between muscle distribution of lower body and accelerometer-determined daily physical activity.

METHODS: Fifty-one elderly women (mean age 66.0 [SD 7.1] yrs) volunteered. Muscle thickness (MTH) was measured by B-mode ultrasound at seven sites on the anterior (quadriceps [QF] 30%, 50%, and 70% of thigh length) and posterior (hamstring [HM] 50% and 70% of thigh length) aspects of the thigh and the anterior (tibialis anterior [TA] 30% of lower leg length) and posterior (triceps surae [TS] 30% of lower leg length) aspects of the lower leg. Habitual daily activities during consecutive 30 days were recorded using an accelerometer, and the exercise intensity was classified 10 graded levels from sedentary (level 0) to light (levels 1-3), moderate (levels 4-6) and vigorous (levels 7-9) exercise. Total duration time for each level of exercise intensity as well as average daily step count was calculated.

RESULTS: The daily step count and total duration times of light, moderate and vigorous exercise averaged 7826 (SD 3183) steps per day and 59 (SD 20), 22 (SD 17) and 2 (SD 2) min per day, respectively. Absolute MTH did not correlate (P>0.05) to limb length. Average daily step count was positively correlated with the TA-30% MTH (r=0.31, p<0.05) and TS-30% MTH (r=0.35, p<0.01), but not the MTH of the thigh. There was no significant (P>0.05) correlation between duration time of light exercise and MTH of the thigh and lower leg. However, duration time of moderate exercise was positively correlated (p<0.05) with the TA-30% MTH (r=0.35) and TS-30% MTH (r=0.35), and vigorous exercise duration time was not only correlated (p<0.05) with the lower leg MTH (TA-30%, r=0.30; TS-30%, r=0.28), but also with QF-50% MTH (r=0.29).

CONCLUSIONS: Amount of daily step count and moderate/vigorous exercise duration are associated with lower leg MTH. Quadriceps MTH is only associated with vigorous exercise.

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CONCLUSION: The subjects were 260 retired Japanese males (mean age 66.9 ± 4.0 years) living in metropolitan areas. The Japanese version of SOC-3 (Togari et al., 2007) was used to estimate the level of SOC. Additional questions were asked concerning the habit of exercising (e.g., “How frequently and how long have you taken part in exercising?”. “What did you get from continuing to take part in exercising?”). RESULTS: Subjects were divided into two groups: one with the habit (HS) and the other without the habit (NS) of exercising. A Mann-Whitney test showed that the SOC score in the HS group (n = 182, mean ± SD: 9.0 ± 2.1) was significantly higher than that in the NS group (n = 78, mean ± SD: 8.3 ± 2.1) (U = 5696, p < 0.05). Multiple-regression analysis showed the enhancement of respondents’ sense of fulfillment (β = 0.24, p < 0.01) and the improvement of their life skills (β = 0.24, p < 0.01), were positively associated with SOC (R² = 0.12, p < 0.001) individually. Therefore, these respondents might show that SOC is enhanced by exercising.

CONCLUSIONS: These results suggested that successful experiences such as getting a sense of fulfillment and improved life skills through the habit of exercising enhanced SOC.

INTRODUCTION: There are many physiological declines that occur with aging, two of which involve muscular strength and power. Previous research indicates that muscular power may be the better predictor of functionality for this population. Additional research should be conducted to investigate this further using a variety of functional measures. This research would assist in providing evidence for the case and help health professionals understand which health component(s) to focus on when attempting to help senior adults maintain functionality.

PURPOSE: The purpose of this study was to determine if strength and power are predictors of functional fitness for senior adults and if so, which the better predictor is.

METHODS: Forty-six senior adults over the age of 75 years completed the Short Physical Performance Battery (SPPB), hand-grip (HG) assessment, the Senior Fitness Test (SFT), chair stand power test, and one-repetition maximum (1RM) testing. SPPB, HG, and SFT were utilized as functional measures. The SPPB is a survey functional assessment evaluating balance, gait, and chair stands. Handgrip was measured with a handgrip dynamometer. The maximum of each hand was averaged as the measurement. The SFT includes chair stands (CS), arm curl (AC), 8-foot Up-and-Go (UpGo), sit-and-reach (SR), back scratch (BS), and 6-Minute walk (WALK). The chair stand power test was utilized to determine average power and involved 10 explosive chair stand trials. Lastly, six 1RM tests were combined to quantify total strength. Multiple regression analyses were conducted to determine whether strength or average power was the best predictor for functional fitness.

RESULTS: Strength and power were indicated as significant predictors collectively for SPPB, CS, AC, UpGo, and HG (p < .004, r = .867, r = .016, r = .036, and r < .001, respectively). When comparing power and strength, power emerged as the only significant individual predictor for SPPB, CS, AC, and UpGo (r = .002, r = .001, r = .042, and r = .001, respectively). Conversely, total strength was indicated as the significant predictor for HG (p < .001). Neither strength nor average power was indicated as a significant predictor for WALK, BS, and SR.

CONCLUSION: These results suggest that average power may be a better predictor for the functional fitness of older adults than strength.

INTRODUCTION: Participation in recreational soccer (association football) is an effective way of improving performance levels. In addition, life-long exposure to football training has been shown to preserve explosive muscle power in elderly male football players. However, the effect of soccer training on physical performance in untrained elderly has not been investigated.

PURPOSE: To examine the effects of 16 weeks of recreational soccer training or explosive strength training on aerobic, intermittent and strength performance in sedentary elderly men.

METHODS: Twenty-four healthy, sedentary elderly men (age: 69 ± 0.7 yrs) were assigned to either a soccer training group (SOG; N=9), strength training group (STG; N=9) or control group (CG; N=6). Subjects in SOG and STG trained 2×10 min per week. SOG performed small-sided soccer games (4×4, 4x12 min game periods). STG performed heavy load leg exercises (4x8 repetition maximum). Oxygen uptake (VO_2max), heart rate (HR) and respiratory exchange ratio (RER) were determined during an exhaustive incremental cycle exercise test. Intermittent endurance capacity was examined using the Yo-Yo intermittent endurance test level 1 (Yo-Yo IE1). Isometric maximal voluntary contraction (MVC) and rate of force development (RFD) was evaluated at 70 degree knee flexion. Values are mean ± SEM.

RESULTS: After 16 weeks of training, maximum oxygen uptake was increased (p<0.05) in SOG (27.5±1.8 vs. 32.1±1.7 mL·min⁻¹·kg⁻¹), but not altered in STG and lowered (p<0.05) in CG. RER and HR at exhaustion were not different between trials in any group. Yo-Yo IE1 performance was improved (p<0.05) only in SOG (455 ± 92 vs. 588 ± 148 mL. HR) at the end of Yo-Yo IE1-test did not differ between trials. Peak RFD was improved (p<0.05) in STG (133±175 vs. 167±132 Nm/s), but not in SOG and CG. MVC was unchanged in all groups.

CONCLUSION: Participation in recreational football training is an effective way of improving aerobic fitness and intermittent endurance capacity in elderly males, whereas, explosive strength training is superior to soccer training in the development of neuromuscular function in elderly.

Inform consent was obtained from all participants. The study was supported by FIFA-Medical Assessment and Research Centre (F-MARC) and The Danish Ministry of Culture. Conflicts of interest: none declared.

INTRODUCTION: Sixteen weeks of recreational soccer improves the cardiovascular risk profile in elderly sedentary men, especially with marked increase in cardio-respiratory fitness.

PURPOSE: To determine the effects of 16 weeks of recreational soccer on the cardiovascular risk profile in elderly healthy men.

METHODS: Fifteen sedentary men (age 68.6±3.5 years) were randomized to a soccer control group (SG; n=9) or a control group (CG; n=6). In addition, 12 master elite soccer players (age 69.2±3.7 years) served as an active control group (EG). SG trained twice weekly for 45-60 min (mean 1.5 times/week, average heart rate 81 %), EG continued with the usual soccer training (2 times/week). Testing was performed at baseline and after 16 weeks with measurements of maximum oxygen uptake (VO_2max), resting heart rate, blood pressure, body composition (DEXA scan), oral glucose tolerance test (OGGT), lipid profile and vascular function with peripheral arterial tonometry.

RESULTS: During the study period SG reduced body mass index (BMI) (26.1±1.3 to 25.5±1.2 kg/m²), with no change in CG and a decrease in EG (24.2±0.6 to 23.9±0.5; p<0.05). Reductions in total body fat percentage (28.2±2.3 to 26.6±2.5%; p<0.05), android fat mass (37.1±4.3 to 34.7±3.0 kg; p<0.05), and gynoid fat mass (31.0±2.0 to 28.7±2.4 kg; p<0.05) were observed in SG, with no change in CG and EG. Cardiovascular fitness improved in SG with a 11% reduction of resting heart rate (65±3.3 to 58±2.2 bpm; p<0.001) and 17% increase in VO_2max (27.5±1.8 to 32.1±1.7 mL·kg⁻¹·min⁻¹; p<0.001), while VO_2max decreased in CG (29.8±1.7 to 27.2±1.8 mL·kg⁻¹·min⁻¹; p<0.05) and EG (35.7±0.8 to 33.9±0.8 mL·kg⁻¹·min⁻¹; p<0.05). Two subjects in SG had impaired glucose tolerance (IGT) at baseline, which was normalized after 16 weeks of soccer. Two subjects in CG and 2 in EG developed IGT during the study period. Lean body mass, lipid profile, vascular function, and blood pressure remained unchanged in all groups.

CONCLUSION: Sixteen weeks of recreational soccer improves the cardiovascular risk profile in elderly sedentary men, especially with marked increase in cardio-respiratory fitness. Recreational soccer is an attractive physical intervention aimed at reduction of cardiorespiratory risk.

Inform consent was obtained from all subjects. The study was supported by FIFA-Medical Assessment and Research Centre (F-MARC) and the Danish Ministry of Culture.
Maximal aerobic power (VO\textsubscript{2max}) is generally accepted as the best measure of cardiopulmonary fitness. However, there is skepticism whether a true VO\textsubscript{2max} is achievable in healthy, sedentary seniors.

PURPOSE: 1) Determine whether an elderly population is able to achieve previously published VO\textsubscript{2max} criteria, and 2) Establish test-retest reliability of maximal metabolic and hemodynamic variables in seniors.

METHODS: We studied 59 healthy, sedentary senior men and women (ages 67.5 ± 5.4). VO\textsubscript{2max} was measured using the Douglas Bag (DB) method during an incremental treadmill protocol where a constant speed was established and the grade was increased 2% every two minutes. DB gas fractions were measured with a mass spectrometer. DB ventilation volume and heart rate (HR) were measured via Tissot spirometry and a 12-lead ECG, respectively. Predicted maximum HR was calculated using the formula 210 - (0.65 x age). All participants completed the identical protocol on two occasions separated by a mean of 5.4 ± 4.8 weeks.

RESULTS: Maximal values are in the table below. In 115 of the 118 total tests performed (98%), at least two of three criteria (RER > 1.0, VO\textsubscript{2} change in last two work loads ≥ 150 ml/min and HR < 85% of age predicted maximum) for VO\textsubscript{2max} were achieved. Typical error expressed as a coefficient of variation (%) between visits 1 and 2 maximal values for VO\textsubscript{2}, HR and respiratory exchange ratio (RER) were 3.9, 2.2 and 4.4, respectively.

CONCLUSION: The present study suggests that reliable VO\textsubscript{2max} measurements are achievable in healthy, non-frail seniors. This knowledge will enhance the quality of exercise prescription in older adults.

<table>
<thead>
<tr>
<th>VO\textsubscript{2max} acceptance criteria</th>
<th>Visit1</th>
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<th>Visit1 VO\textsubscript{2max}</th>
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<th>Visit2 RER</th>
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<td>Mean</td>
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<td>23.4</td>
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<td>66.1</td>
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<td>1.19</td>
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<td>SD</td>
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*VO\textsubscript{2} = VO\textsubscript{2max} (ml kg\textsuperscript{-1}min\textsuperscript{-1})

**A VO\textsubscript{2} change in absolute VO\textsubscript{2} between the VO\textsubscript{2max} stage and the previous workload (ml/min)

Maximal Exercise Can Be Accurately And Reliably Achieved In Healthy, Sedentary Seniors

Dean Palmer, Graeme Carrick-Ranson, Kara Boyd, Naoki Fujimoto, Sheryl Livingston, Dan Creson, Jeff Hastings, Benjamin Levine, FACSM. IEEM, Dallas, TX.

(No relationships reported)

Maximal aerobic power (VO\textsubscript{2max}) is generally accepted as the best measure of cardiopulmonary fitness. However, there is skepticism whether a true VO\textsubscript{2max} is achievable in healthy, sedentary seniors.

PURPOSE: 1) Determine whether an elderly population is able to achieve previously published VO\textsubscript{2max} criteria, and 2) Establish test-retest reliability of maximal metabolic and hemodynamic variables in seniors.

METHODS: We studied 59 healthy, sedentary senior men and women (ages 67.5 ± 5.4). VO\textsubscript{2max} was measured using the Douglas Bag (DB) method during an incremental treadmill protocol where a constant speed was established and the grade was increased 2% every two minutes. DB gas fractions were measured with a mass spectrometer. DB ventilation volume and heart rate (HR) were measured via Tissot spirometry and a 12-lead ECG, respectively. Predicted maximum HR was calculated using the formula 210 - (0.65 x age). All participants completed the identical protocol on two occasions separated by a mean of 5.4 ± 4.8 weeks.

RESULTS: Maximal values are in the table below. In 115 of the 118 total tests performed (98%), at least two of three criteria (RER > 1.0, VO\textsubscript{2} change in last two work loads ≥ 150 ml/min and HR < 85% of age predicted maximum) for VO\textsubscript{2max} were achieved. Typical error expressed as a coefficient of variation (%) between visits 1 and 2 maximal values for VO\textsubscript{2}, HR and respiratory exchange ratio (RER) were 3.9, 2.2 and 4.4, respectively.

CONCLUSION: The present study suggests that reliable VO\textsubscript{2max} measurements are achievable in healthy, non-frail seniors. This knowledge will enhance the quality of exercise prescription in older adults.

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**A VO\textsubscript{2} change in absolute VO\textsubscript{2} between the VO\textsubscript{2max} stage and the previous workload (ml/min)

Validity of USB Electronic Pedometer Using 3D Accelerometer Technology for Assessing Physical Activity Intensity

Ken Rung Tu1, Shun Ping Lin1, Jin jong Chen1. National Yang-Ming University, Taipei, Taiwan. 2China University of Science and Technology, Taipei, Taiwan. 3Exercise and Health Science Research Center, Taipei, Taiwan.

(No relationships reported)

Pedometer was the most popular intervention tool used to promote daily walking. It has been demonstrated that walking performance (speed and distance) is highly correlated with longevity and cognitive function in elderly population. Unfortunately, traditional pedometers can only indicate total activity but not speed or physical activity (PA) intensity. An USB electronic pedometer using 3D accelerometer technology to detect and record the up-down steps was designed not only to record total PA but also walking speed (steps per minute, SPM). However, the relationship between physiological PA intensity (MET) and SPM during daily locomotion activities has not been studied.

PURPOSE: The purposes of this study were (1) to investigate the correlation between SPM and MET of level locomotion activity, and (2) to determine the SPM cut-points for moderate and vigorous locomotion PAs.

METHODS: Fourteen male college students (mean age: 20.4±1.65yrs, height: 1.70±0.74cm, weight: 74.9±16.8kg) were recruited to perform 4 different speed level locomotion activity: normal walking (3km/hr), brisk walking (5km/hr), jogging (7km/hr), and running (8km/hr). During each activity, step frequency (SPM) was measured using an USB electronic pedometer, and physiological PA intensity (O\textsubscript{2} consumption) was also measured using a metabolic measurement system. The SPM cut-points of the pedometer for moderate PA and vigorous PA were determined using MET and MET for each individual respectively.

RESULTS: The O\textsubscript{2} consumption of 3km/hr, 5km/hr, 7km/hr, and 8km/hr were 10.26±1.45, 15.66±1.44, 26.98±2.02, and 33.61±2.53ml/min/kg respectively. A significant and strong correlation between SPM and MET was found (r=0.90, p<0.0001). The MET moderate PA and MET vigorous PA were normal walking and jogging. The SPM cut-points of the pedometer for moderate and vigorous PAs were 95±5 SPM and 125±10 SPM, respectively.

CONCLUSION: The correlation between SPM and MET of level locomotion activities was high. Two step frequencies, 95±5 SPM and 125±10 SPM from the USB electronic pedometer, were recommended to be moderate and vigorous PAs cut-points. The accumulated evidence herein provides ample support that the USB electronic pedometer is a valid option for assessing total PA and intensity in research and practice.

The health-related quality of life has been assessed by a number of measures including the individual perception of health. The SF-36v2 questionnaire is one of the instruments widely used at population level and comprises eight measures including physical functioning (PF) and role physical (RP). Grip strength and walking ability are known to be associated with muscular functioning and activities of daily living. Any decreasing or impairment may predict disability and mobility deficits. Whether functional capacity status is related to individual perception of health in older diabetic and hypertensive adults it is not well established.

PURPOSE: the aim of the study was to investigate the relationship between the perception of health and health predictors, as assessed by grip test (HandT) and 6 minutes walking test (6MW), in older diabetic (DG)/non-diabetic (nDG) and hypertensive (HTG)/non-hypertensive (nHTG).

METHODS: one hundred and nine (24 DG and 85 nDG; 50 HTG and 50 nHTG) older adults (77.0 ± 5.3 yrs, 68.2 ± 9.7 Kg, 1.55 ± 0.10 m), were recruited from local population. The subjects were tested on HandT and 6MW, and completed the SF-36v2. ANOVA was performed to detect group differences. Pearson coefficient of correlation was used to assess the relationship between PF and RP subscales, and physical fitness tests. Significance was set at p < 0.05.

RESULTS: Non-significant differences were found between DG and nDG in all variables. The nHTG showed high scores on fitness tests (HandT left; [F (1, 107) = 7.119, p < 0.01], HandT right;[F (1, 107) = 5.721, p < 0.05], and 6MW; [F (1, 107) = 3.957, p < 0.05]) than HTG, but no significant differences were found on PF and RP. In the nDG, both the RP and PF were related with fitness tests (r = 0.35 to 0.46, p < 0.01). In the HTG the RP and PF were related with fitness tests (r = 0.33 to 0.57, p < 0.01) while in the nHTG only the PF was related with fitness test (r = 0.36 to 0.45, p < 0.01).

CONCLUSION: The diabetes does not appear to affect the perception of health and functional capacity. Hypertensive patients appear to influence functional capacity but do not affect their perceptions of health. The findings also indicate that low scores on perception of health status may indicate difficulties in performing activities of daily living especially within older individuals experiencing hypertension.
**3102 Board #67 June 1 2:00 PM - 3:30 PM**  
Effects Of Navy SHAPE On Fitness Parameters, Functional Movement Screening (FMS) And Self-reported Sitting Time.  
Carol Kennedy-Arnbruster, Lisa Sexauer, William Wyatt, John B. Shea. *Indiana University, Bloomington, IN. Navy CNIC, Washington, DC. (Sponsor: Ellen Evans, PhD, FACSM)*  
(No relationships reported)

Evaluation of the efficacy of site-based fitness interventions to enhance health status, especially for military active duty, is costly and time consuming. Few interventions have targeted the 40+ age group in the military.

**PURPOSE:** To evaluate the effects of a supervised exercise program (SHAPE) on fitness, functional movement screening (FMS) and self-reported sitting time.  
**Method:** Two health fitness specialists (HFS) were placed on three Navy bases to deliver SHAPE (6 mos; personal training, group exercise, education and lifestyle physical activity encouragement) to military volunteers (44.5 ± 5 y) from 2007 to 2011; n=75 assessments after 2-4 months; n=28 assessments after 4-6 months. Health status measures included sub-maximal oxygen consumption, blood pressure, weight, strength, flexibility and adiposity assessed via Polar Trifit 4.9.1 system and functional movement screening (FMS). Self-reported sitting time, reflected in % of day was also collected.

**RESULTS:** Collapsing across training site average improvements in fitness were achieved for VO2 (+7%), flexibility (+13%), strength (+5%), adiposity (-4%), and body weight (-1%) after 2-4 months. All biometric tests except for weight (-1%) at the 4-6 month reassessment continued to improve; VO2 (+9%), flexibility (+19%), strength (+9%), and adiposity (-5%) and remained significant. SBP and DBP were also significant at the 4-6 month reassessment (SBP = (-3%), DBP = (-6%), p<0.05). FMS improved at 2-4 months (p=0.012) and continued to improve at 4-6 months (p<0.01). FMS average scores were 13.7 for assessment 1; 15.1 assessment 2 and 15.5 assessment 3. A strong trend existed for reductions in sitting time at 2-4 mos (p=0.058) which continued at 4-6 mos (p=0.056) with the latter representing a reduction of 22.3% in the # of individuals who sit 75% or more of the day.

**CONCLUSION:** Site based fitness programs with active duty military participants (>40 yrs) can improve biometric fitness indices up to 4-6 months. Functional movement capacity improved and Self-reported sitting time may also be reduced in response to the intervention.

Support: Navy headquarters (CNIC) & Indiana University service contract (HDQMWR-08-C-0036)

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**3103 Board #68 June 1 2:00 PM - 3:30 PM**  
Fitness Secular Trends of Shanghai Older Women and Local District Impact: 2000-2010  
Chunhua Zhang, Benhao Fan, Xin Liu, Weimao Zhu, FACSM. *Shanghai University of Sport, Shanghai, China. Shanghai Sports Bureau, Shanghai, China. Shanghai Research Institute of Sports Science, Shanghai, China. University of Illinois at Urbana-Champaign, Urbana, IL.*  
(No relationships reported)

The population of aging women in Shanghai, China, as in many other cities around the world, is rapidly increasing. While in general many older Shanghai women are concerned about their health and participate in exercise regularly, some participation difference across local districts was observed. No study has confirmed these differences using fitness outcomes.

**PURPOSE:** To examine the 2000-2010 trends of older women’s physical fitness across Shanghai districts, China.  
**METHODS:** The Shanghai data from the Chinese National Fitness Surveys in 2000 and 2010, including samples from six districts, were used for the analysis and only 60-69 year old females were included. The means and confidence intervals of six fitness measures were computed and were compared by district using ANOVA.

**RESULTS:** Means of fitness measures by district and year are summarized in the table below. Some district differences were confirmed in the fitness changes between 2000 and 2010 (*p<0.05). For example, BMI change was found only in one district.

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<tr>
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<td>1803</td>
<td>1482</td>
<td>1667*</td>
<td>1434</td>
<td>2023*</td>
<td>1802</td>
<td>1797</td>
<td>1554</td>
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<tr>
<td>Flexibility (cm)</td>
<td>5.06</td>
<td>6.48</td>
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<tr>
<td>Reaction Time (s)</td>
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<td>0.5039*</td>
<td>0.6709</td>
<td>0.9747</td>
<td>0.5776*</td>
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<tr>
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<td>11.43*</td>
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<td>6.10</td>
<td>9.50*</td>
<td>4.54</td>
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<tr>
<td>Grip Strength (kg)</td>
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<td>22.70</td>
<td>25.24*</td>
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<td>64.29</td>
<td>64.10</td>
<td>64.07</td>
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<td>64.21</td>
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</table>

**CONCLUSION:** While the older Shanghai women population maintained a good level of physical fitness during the past decade, some district differences were confirmed. Future study should explore and examine key factors that contribute to the differences and develop intervention plans accordingly.

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**3104 Board #69 June 1 2:00 PM - 3:30 PM**  
Impact of Moderate Intensity Physical Activity on the Functional Fitness of Older Women  
Amy L. Morgan, FACSM, Nicole L. Rogers, Nobuo Takeshima, Sahar Amini, Samuel Olei-Dodoo. *Bowling Green State University, Bowling Green, OH. Wichita State University, Wichita, KS. National Institute of Fitness and Sports, Kanoya, Japan.*  
(No relationships reported)

As adults reach advanced ages, the purpose of physical activity shifts from disease prevention to functional fitness (FF) and mobility. Higher levels of FF contribute to the ability to live independently.

**PURPOSE:** To determine the amount of activity necessary to positively impact functional fitness, by determining cutoff points in which additional minutes in moderate/vigorous physical activity (MVPA) do not further improve functional fitness.

**METHODS:** FF was assessed by the Senior Fitness Test (Chair Stand, Arm Curl, 6 min Walk, Up-and-Go, Sit and Reach, and Back Scratch) in 125 women (73.42 ± 8.84 yrs) from 2 Midwestern communities. Participants wore an accelerometer for 7 days without altering their normal activity. Accelerometer data were downloaded, MVPA determined via proprietary filtering, and time spent in each intensity (sedentary, low, moderate, vigorous) was calculated. A 5 day average of time spent in MVPA was organized into 4 groups (see Table).

**RESULTS:** ANOVAs revealed significant differences between groups on all measures except sit and reach. Results indicate a threshold of 20 min, suggesting that engaging in more MVPA yields no additional statistical gain on the lower body strength and mobility measures of chair stand, up-and-go, and 6 min walk. With regard to upper body strength and flexibility, less than 10 min of MVPA is detrimental to performance.
Therefore, evaluations of CMJ performances in older individuals should not rely solely on flight time estimates. Furthermore, DeltaHCM highlighted the presence of knee flexions at landing, which increase flight time and lead to overestimates of jump heights. Considered representative of functional ability in old individuals, muscle power of lower limbs is routinely evaluated from estimates of countermovement jump (CMJ) height. In field studies, optical cells and contact mats are widely used, assuming that the height of the center of mass at take-off and landing coincide. For this reason, individuals are required to maintain a vertical alignment during the jump and to land with their lower limbs fully extended. However, no study investigated if older individuals actually meet these criteria.

CONCLUSIONS: A threshold of 20 min of MVPA per day is recommended to assist in the maintenance of lower body function in older women. While ACSM recommends that to maintain health all adults accumulate at least 30 minutes of MVPA 5 days/wk, our data suggest that at least 20 min may be sufficient to maintain lower body function in older women.

### Table 1. Functional Fitness

<table>
<thead>
<tr>
<th>MVPA (min)</th>
<th>Duration (min)</th>
<th>n</th>
<th>6 min Walk (yd)</th>
<th>Chair (#)</th>
<th>Up &amp; Go (s)</th>
<th>Curl (#)</th>
<th>Scratch (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00-0:49</td>
<td>0</td>
<td>32</td>
<td>464±137*</td>
<td>11±3.5*</td>
<td>2.05±2.24*</td>
<td>5.6±5.0</td>
<td>2.7±23.5</td>
</tr>
<tr>
<td>0:00-1:49</td>
<td>0</td>
<td>27</td>
<td>536±174*</td>
<td>14±3.0*</td>
<td>3.56±1.16*</td>
<td>20.0±6.01</td>
<td>6.6±8.35</td>
</tr>
<tr>
<td>0:00-2:49</td>
<td>0</td>
<td>14</td>
<td>474±95</td>
<td>15±4.0</td>
<td>4.4±1.19</td>
<td>20.0±6.51</td>
<td>1.8±8.78</td>
</tr>
<tr>
<td>20+</td>
<td>0</td>
<td>12</td>
<td>384±49</td>
<td>16±5.5</td>
<td>3.2±24.95</td>
<td>20.3±4.01</td>
<td>0.9±6.32</td>
</tr>
</tbody>
</table>

* different from 0:00min (p < .05) † different from 0:00 (p < .05)

### Table 2. Changes in Health-related Physical Physique Measures of Shanghai Older Males between 2000 and 2010

<table>
<thead>
<tr>
<th>Test Year/BMI</th>
<th>UW</th>
<th>NW</th>
<th>OW</th>
<th>OB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>8.78%</td>
<td>56.10%</td>
<td>28.48%</td>
<td>6.64%</td>
</tr>
<tr>
<td>2005</td>
<td>4.05%</td>
<td>52.96%</td>
<td>35.48%</td>
<td>4.62%</td>
</tr>
<tr>
<td>2010</td>
<td>5.38%</td>
<td>50.62%</td>
<td>46.56%</td>
<td>10.45%</td>
</tr>
</tbody>
</table>

### 3010 Board #70 June 1 2:00 PM - 3:30 PM

**Evaluation of Countermovement Jump in Old Women: Are Center of Mass Position Requirements Met?**

Cristina Cortis, PhD¹, Pietro Picerno, PhD², Michela Cavallucci², Caterina Pesce, PhD³, Laura Capranica³. ¹University of Cassino, Cassino, Italy. ²Sensorize Motion Sensing Technology, Rome, Italy. ³University of Rome “Foro Italico”, Rome, Italy. (Sponsor: Carl Foster, FACSMD) (No relationships reported)

CONCLUSIONS: Findings indicate that peak force may not be the best measure to assess vertical jump performance of older individuals, who strongly rely on their capability to coordinate fast and powerful muscle contractions. Furthermore, DeltaHCM highlighted the presence of knee flexions at landing, which increase flight time and lead to overestimates of jump heights. Therefore, evaluations of CMJ performances in older individuals should not rely solely on flight time estimates.

### 3016 Board #71 June 1 2:00 PM - 3:30 PM

**Changes in Health-related Physical Physique Measures of Shanghai Older Males between 2000 and 2010**

Benhao Fan, Xin Liu, Chunhua Zhang, Weimo Zhu, FACSM. Shanghai Sports Bureau, Shanghai, China. Shanghai Research Institute of Sports Science, Shanghai, China. Shanghai University of Sport, Shanghai, China. University of Illinois at Urbana-Champaign, Urbana, IL. (No relationships reported)

CONCLUSION: Several keys health related physical physiques of Shanghai older males showed a negative change during the past decade. Actions to stop and revise the negative change trend are urgently needed.
Mechanics between treadmill and over-ground walking may be different potentially due to gait. Differences in metabolic costs and energy expenditure associated with these bouts of activity are largely unknown for older adults.

**PURPOSE:** To compare metabolic demands, accelerometer counts, energy expenditure and physiologic parameters associated with treadmill and over-ground walking in older adults.

**METHODS:** Ten people (mean±SD age 70.6 ± 6.4 years) participated in a physical activity (150 min/week of treadmill walking) and weight loss intervention. The short physical performance battery (SPPB) measured physical function. Mean oxygen consumption (COSMED K4b2), accelerometer counts (GT1M, ActiGraph, Pensacola, FL) and age-predicted heart rate (APHR) were measured concurrently during two walking bouts: usual pace 40m over-ground walk (mean gait speed 1.1 m/s, range 0.9 - 1.3 m/s) and usual pace 2 minute treadmill walk at the same gait speed. Energy expenditure in metabolic equivalents (METs) was obtained from averaging breath-by-breath COSMED samples for each bout.

**RESULTS:** Participants were high-functioning with mean SPPB scores of 10.4 ± 1.6 out of 12. A separate treadmill protocol measured mean VO2peak (27.3, range 21.5 - 38.3 ml/kg/min). At the same gait speed, mean VO2 was 15% higher during the treadmill bout (10.0 ± 2.6 ml/kg/min) compared to over-ground walking (8.7 ± 1.1 ml/kg/min). Further, energy demand was 16% higher (mean 2.9, range 1.5 - 3.7 vs 2.5, range 1.8 - 3.1 METs) and activity counts were 20% higher (mean 1375, range 540 - 2496 vs 1147, range 504 -1588 counts/min), for treadmill and over-ground walking, respectively. Participants reached an average of 68% (range 37 - 84%) of APHR during the treadmill compared to 57% (range 37 - 72%) for over-ground walking. All results are p<0.10.

**CONCLUSION:** Preliminary findings suggest that metabolic cost, accelerometer counts, energy expenditure and physiologic parameters related to treadmill walking are higher at the same gait speed, potentially due to biomechanical differences. Using a treadmill for exercise testing or training in older adults may lead to premature fatigue or undesirable physiologic challenge.

Supported by Pittsburgh Claude D. Pepper Center NIH P30 AG 024826

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**Board #72**  
**June 1  2:00 PM - 3:30 PM**  
**Over-ground Vs. Treadmill Walking In Older Adults: Comparison Of Accelerometry Counts And Metabolic Demands**  
Nancy W. Glynn1, Adam J. Santanasto1, Mark A. Newman1, Christopher A. Taylor2, Anne B. Newman1, Bret H. Goodpaster1.  
1University of Pittsburgh, Pittsburgh, PA.  
2Centers for Disease Control, Atlanta, GA.  

**(No relationships reported)**

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**Board #73**  
**June 1  2:00 PM - 3:30 PM**  
**Jump Test Performance and Sarcopenia Status in Older Men and Women**  
Michael Bemben, FACSM, Harshvardhan Singh, Daeyeol Kim, Eunho Kim, Debra Bemben, FACSM. University of Oklahoma, Norman, OK.  

**(No relationships reported)**

Jumping mecanography uses maximal countermovement jumps to test measures such as jump power (JPow). Recently, it has been shown to be a safe method for assessing muscle function in older adults, however, little is known about the relationships between JPow, muscle strength, and sarcopenia status.

**PURPOSE:** To investigate the relationships between jump performance variables, muscle strength, and sarcopenia status in older men (n=27) and women (n=33) (55-75 years).

**METHODS:** Body composition was measured by a total body DXA scan to obtain appendicular skeletal muscle mass (ASM), bone free lean body mass (BFLBM) and relative skeletal muscle mass index (RSMI). Subjects were classified as sarcopenic if they had a RSMI < 7.26 kg/ht2 for men and < 5.45 kg/ht2 for women. Three vertical jumps on a jump mat were performed to assess JPow, jump velocity (Jvel), and jump height (JH). Leg strength was measured by 1-RM testing for leg press (LP), right (RHAb) and left hip abduction (LHAb) isometric resistance exercises.

**RESULTS:** Sarcopenia was found in 20% of the subjects: 24% of women and 14% of men. Sarcopenia (n=12) and normal (n=48) groups did not differ in age, or in physical activity levels. There was a significant group difference (p<0.01) in JPow, which was about 24% lower in sarcopenia group compared to the normal group (651.1 ± 41.7 watts vs. 851.0 ± 27.4 watts). JPow, JVel, and JH were significantly (p<0.01) positively correlated with ASM and BFLBM. There also were significant (p<0.01) positive correlations (r = .43 to .71) between jump test variables (JPow, JVel, JH) and leg strength measures (LP, RHAB, LHAB).

**CONCLUSION:** Jump test variables, especially jump power and jump height, were correlated with lean tissue and leg strength in older adults. The large difference in jump power between sarcopenic and normal subjects suggests this test may be useful for muscle function screening in aging populations.
RESULTS: For the men, their 1-RM lower-body strength was 258.1 ± 94.6 lbs and measured power was 338.1 ± 160.3 W or 3.7 ± 1.5 W/kg. For the women, their 1-RM lower-body strength was 172.4 ± 44.8 lbs and measured power was 145.7 ± 74.7 W or 2.2 ± 1.1 W/kg. The calculated power during stair climbing was 335.2 ± 94.8 W or 3.7 ± 1.0 W/kg for the men and 198.9 ± 59.3 W or 3.1 ± 0.9 W/kg in the women. Normal gait speed was 1.14 ± 0.22 m/s in men and 1.22 ± 0.29 m/s in the women. Stair climb power was correlated with measured power (r = 0.74, p = 0.001), gait (r = 0.57, p = 0.001), balance (r = 0.68, p = 0.001), and age (r = 0.55, p = 0.001) in the whole group.

CONCLUSIONS(S): These data suggest that a portable 4-step stair climb task is a valid measure of lower body power and muscle function in the elderly and that this task appears to require greater than 70% of maximal effort.

3111  June 1  2:00 PM - 3:30 PM
Relationship of Body Composition and Muscular Strength in Young AND Middle-Aged Women
Pamela D. Swan, FACSM, Robin De Weese. Arizona State University, Phoenix, AZ.

PURPOSE: To determine the relationship of fat mass (FM), fat free mass (FFM), and body size (BMI) to knee extensor peak torque (PT) and muscular fatigue in young (Y) and middle-aged (MA) women.

METHODOLOGIES: 132 women from two age cohorts (Y: 18-33 yrs, n = 70 and MA: 45-65 yrs, n = 62) participated. Subjects with musculoskeletal problems and those who had participated in strength training in the previous three months were excluded. Body composition was estimated by bioelectrical impedance analysis. Isokinetic PT of the knee extensors was assessed at 60°/sec and the fatigue index (FI) was calculated as the percent decline of PT during 50 maximal repetitions at 240°/sec. Data were assessed for normality and appropriate correlation techniques were used to compute correlations between PT and FI with body composition variables. Differences in PT between age and BMI groups (normal, N: 18-24 kg/M2; overweight, OW: 25-29 kg/M2; obese, O: 30+ kg/M2) were assessed by ANOVA.

RESULTS: Both cohorts were similar (p > 0.05) in body weight (Y: 68.1 ± 18.6 kg; MA: 70.6 ± 13.0 kg) and BMI (Y: 45.9 ± 5.2 kg; MA: 45.1 ± 3.9 kg) but MA had significantly (p<0.05) higher FM (Y: 22.2 ± 13.8; MA: 25.5 ± 10.0). In Y, PT was significantly correlated with PT (r=0.63; p<0.001). There were no significant correlations between FFM or FM and PT in MA. PT was correlated with BMI in the combined groups (r=0.18; p=0.04) but PT was significantly lower (greater endurance) in MA than Y. PT normalized for body mass or FFM was similar between age groups. Relative PT significantly decreased with increasing BMI categories: N: 1.2 lb/kg; OW: 1.05 lb/kg; O: 0.8 lb/kg; p<0.001.

CONCLUSION: MA women had less PT but greater muscular endurance than Y. MA women were not detrimental to absolute PT in Y or MA, but was detrimental to relative PT in both groups. As women get larger, their strength relative to their body weight decreases. FM may attenuate the relationship between PT and body mass in both Y and MA women, but may enhance muscular endurance in MA women.

Partial Funding Support by: ACSM, Paffenbarger-Blair Endowment for Epidemiological Research and the ASU Graduate and Professional Student Organization.

3112  June 1  2:00 PM - 3:30 PM
Self-paced Walking Is Predicted By Leg Strength And VO2max And Not The Ventilatory Threshold.
Konstantina Katsoulis1, Catherine E. Amara1, Bradley C. Hansen2, Liza Stathokostas2, John J. Koval12, Donald H. Paterson, FACSM1, David A. Cunningham, FACSM, 1University of Toronto, Toronto, ON, Canada. 2University of Western Ontario, London, ON, Canada.

PURPOSE: To determine the key factors predicting self-paced walking (SPW) speeds in a large random survey of healthy and independently living men and women aged 55 to 86 years.

METHODOLOGIES: Older men (70.5y ± 8.8; n=208) and women (71.5y ± 8.4; n=231) performed 4 X 20 metre indoor walk at the following self-selected paces: slow, normal, fast and very fast with time being recorded to the nearest second and averaged among trials. In addition, maximum aerobic power (VO2max) was determined on a treadmill with subsequent determination of the ventilatory threshold (TVE2max). Measures of other potential walking pace predictors included, plantar flexion (PF) strength, hip flexion, height, body mass and symptom of anxiety and depression scale score. Multiple linear regression analyses were used to determine key predictors (p < 0.05) of walking speeds.

RESULTS: SPW at slow speed was significantly related to anxiety/depression (r2=.150 and .107 for male and females, respectively); this factor did not enter the regression at any other speed. The major contributors to SPW were VO2max (r2 = 0.171 and 0.396 in normal and very fast walking, respectively), PF strength (r2 = 0.416 in very fast walking) and BMI (r2 = 0.228 and 0.437 in normal and very fast walking, respectively) in men, while in women the strongest predictor of normal pace was VO2max (r2 = 0.237) and VO2max and PF strength (r2 = 0.518 and 0.534, respectively) for very fast walking. VO2max was correlated with TVE2max (r=0.84 and .83 for men and women, respectively), but in the presence of VO2max, TVE2was not a significant determinant of SPW.

CONCLUSIONS: VO2max is a stronger predictor of SPW speeds than TVE2max, accounting for a greater portion of the variance with increasing speeds. PF strength further improves the prediction of walking performance at very fast speeds. Together, these results suggest that the amount and quality of muscle are important determinants of self-paced speeds of walking.

3113  June 1  2:00 PM - 3:30 PM
Resting Metabolic Rate Changes in Women Following Different Exercise Training Programs
Trista Manikowske, Donna J. Terbizon, FACSM, John Schuna, Jared Tucker, Bryan Christensen, Audith Bruni, Yeong Rhee. North Dakota State University, Fargo, ND.

Research examining changes in resting metabolic rate (RMR) following an exercise training program has shown inconsistent results. While evidence suggests resistance training (RT) increases fat-free mass (FFM) and subsequently RMR, results of some studies have suggested that FFM increases in women may not elicit increases in RMR. Additional research in women is needed to explore the effects of RT, and combined resistance and aerobic training (COM) on FFM and RMR.

PURPOSE: The purpose of this study was to evaluate FFM and RMR changes in women after a 12 week RT or COM program.

METHODOLOGIES: Eighteen women aged 38-61 years were randomized to a RT or COM group, with training occurring three times per week. Both groups participated in resistance workouts which included 30 min of upper and lower body exercises where fatigue occurred between 8-12 repetitions. The COM group then participated in 30 min of moderate intensity cardiovascular exercise. Pre- and post-test RMR data was collected in a fasted state, following 30 min of rest, for a minimum of 20 min. FFM was calculated by subtracting fat mass from total body mass, where fat mass was derived by multiplying total body mass by percent body fat measured via the Jackson-Pollock skinfold technique. Two-factor (group x time) repeated measures analysis of variance (ANOVA) was used to evaluate group differences and time-related changes in FFM and RMR. The relationship between FFM and RMR change scores was evaluated using a Pearson correlation. Alpha was set < 0.05 for all analyses.

RESULTS: Significant increases (mean ± SE) in FFM (+1.5 ± .7 kg, p = .045) and RMR (+7.7 ± 2.61 kcal, p = .01) were found for the entire sample from pre- to post- test. No significant differences in FFM (RT = 54.1 ± 2.2 kg, COM = 50.9 ± 2.0 kg, p = .30) or RMR (RT = 1477.5 ± 73.1 kcal/day-1, COM = 1427.9 ± 65.4 kcal/day-1, p = .62) were found between the RT and COM groups. In addition, no significant group x time interactions were found for the FFM (p = .85) and RMR (p = .41) analyses. FFM and RMR change scores were highly correlated (r = 0.68, p < 0.01).

CONCLUSIONS: Results indicate that FFM and RMR significantly increased among women in this sample after 12 weeks in a RT or COM exercise program. Neither training modality (RT or COM) proved superior in eliciting RMR or FFM changes in this study.
3114 Board #79 June 1 2:00 PM - 3:30 PM The Portable 4-step Stair Climb Task Is a Valid Measure of Muscle Power and Function in Community Living Older Adults Petra Martins, Amy Rolston, Lucinda Salvaggio, Taylor Marcell. California State University Stanislaus, Turlock, CA. (No relationships reported)

PURPOSE: Falls in the elderly are often caused by frailty and have been shown to be a leading cause of mortality and morbidity. Stair climbing is an essential task of daily living and may be a useful measure in the evaluation of frailty in older adults. The purpose of this study was to evaluate the reliability of using the portable 4-step stair climb task as a quick assessment of muscle power and its relationship to measures of health and balance in a community of living older adults.

METHODS: Subjects consisted of 219 women with an average (± SD) age of 70.6 ± 8.5 yrs, height 160.4 ± 7.9 cm, weight 73.0 ± 16.7 kg, and BMI of 28.4 ± 6.1 kg/m²; there were also 91 men with an average age of 75.5 ± 7.7 yrs, height 174.8 ± 9.5 cm, weight 84.9 ± 14.8 kg, and BMI of 27.7 ± 4.5 kg/m². Subjects participated in community based health fairs held in the Central Valley of California; they performed the Fullerton Senior Fitness Battery, a standardized balance assessment, gait analysis, and timed 4-step stair ascent. Stair climbing power was calculated using body weight (kg), vertical distance climbed (m), and time (sec). For data analysis, subjects were divided by age groups and sex and the data compared using 2 x 3 ANOVA (IBM SPSS v 19).

RESULTS: Stair climb power was correlated with age (r = 0.27, p = 0.001), unipedal balance (r = 0.34, p = 0.001), balance summary score (r = 0.27, p = 0.001), functional reach (r = 0.16, p = 0.03), grip strength (r = 0.39, p = 0.001), chair stands (r = 0.30, p = 0.001), gait speed (r = 0.46, p = 0.001), and the 8’ timed up and go test (r = -0.57, p < 0.001). Significant sex differences were observed for body weight (84.6 ± 13.2 men vs 71.4 ± 15.4 women), body fat (31.3 ± 4.6% men & 39.3 ± 6.6% women), and grip strength (80.2 ± 20.1 lb men & 49.6 ± 13.9 lb women), however there were no sex differences in balance, flexibility, chair stands (#), or the TUG. Stair ascent power was greater in men in both absolute (244.9 ± 106.6 W men & 172.0 ± 68.8 W women) and relative (2.89 ±1.12 W/kg men & 2.42 ± 0.87 W/kg women) terms. These power values also decreased between the seventh and ninth decades in both men and women.

CONCLUSION(S): The portable 4-step stair climb task appears to be both a reliable and valid measure of muscle power as it is highly correlated with common measures of function in community-dwelling older adults.

3115 Board #80 June 1 2:00 PM - 3:30 PM Influence Of Age-Related Skeletal Muscle Mass Loss On Serum Lipid/Lipoprotein Profiles And Blood Pressure In Healthy Japanese Men Takashi Abe1, Michael Bemben, FACSM2, Mark Lottin, FACSM2. 1University of Oklahoma, Norman, OK. 2University of Mississippi, Oxford, MS. (No relationships reported)

It has been postulated that age-related skeletal muscle mass (Sarcopenia) contributes to metabolic and cardiovascular diseases, although these relationships have not been confirmed by published research.

METHODS: Six hundred eighty-seven men were screened with those exhibiting clinically relevant diseases (mostly hypertension and diabetes) excluded. As a result, 414 healthy men aged 40-76 years (239 middle-aged [aged 40-59 years] and 175 older [aged 60-76 years]) were used for data analyses. Muscle thickness (MTH) and subcutaneous fat thickness (FTH) were measured by ultrasonography at nine sites on the anterior and posterior aspect of the thigh. FTW and body fat were estimated from total body mass, from which fat mass and fat-free mass (FFM) was calculated, and MTH was used to estimate the total body and thigh MTH. Serum total (TC) and high-density lipoprotein cholesterol (HDLC) concentrations were measured using overnight fasting samples. Resting systolic (SBP) and diastolic (DBP) blood pressure were also measured.

RESULTS: Percent body fat (%Fat) was similar (P>0.05) between middle-aged (16.9 [SD 3.0] %) and older (16.3 [SD 3.2] %) groups, while percent SMM (whole body SMM divided by body weight) was lower in the older group (32.6 [SD 3.1] % than in the middle-aged group (34.1 [SD 2.8] %). Whole body and thigh SMM were lower (P<0.01) in the older group (17.8 [SD 3.0] kg and 6.4 [SD 1.2] kg, respectively) than in the middle-aged group (20.7 [SD 2.8] kg and 7.5 [SD 1.2] kg). %Fat was directly correlated with TC (r=0.327, P<0.001), SBP (r=0.098, P=0.046) and DBP (r=-0.183, P<0.01), and inversely correlated with HDLC (r=-0.333, P<0.01) and HDL/TC (r=-0.487, P<0.01). Percent SMM was directly correlated (P<0.01) with HDLC (r=0.170) and HDL/TC (r=0.147), and inversely correlated with SBP (r=-0.106, P=0.03). However, there were inverse correlations between absolute SMM as well as SMM index (divided by height square) and HDLC or HDL/TC.

CONCLUSIONS: Age-related SMM loss appears to be associated with lower risk profiles. Percent SMM as well as %Fat is a good predictor of measured risk factors.

3116 Board #81 June 1 2:00 PM - 3:30 PM Muscle Quality Measurement Techniques: Changes Among Age-Stratified Elderly Adults Abbie E. Smith1, Jeffrey R. Stout2, Kristina L. Kendall1, David H. Fukuda3, Joel T. Cramer, FACSM4, Jordan R. Moon5. 1University of North Carolina Chapel Hill, Chapel Hill, NC. 2University of Oklahoma, Norman, OK. 3Oklahoma State University, Stillwater, OK. 4United States Sports Academy, Daphne, AL. (No relationships reported)

Muscle quality (MQ) is muscle strength expressed relative to segmental muscle mass and may be important for identifying early onset sarcopenia. PURPOSES: To evaluate upper- and lower-body MQ measurements and body composition [fat mass (FM); muscle mass (MM); percent fat (%Fat)] using dual-energy x-ray absorptiometry (DEXA) and segmental bioelectrical impedance spectroscopy (BIS) across age cohorts.

METHODS: 93 elderly men and women (Mean SD; age: 72.6 ± 6.0 yrs; Ht: 168.4 ± 8.9 cm; Wt: 72.6 ± 13.8 kg) were stratified by age (65-67 yrs = Grp 1; 68-71 = Grp 2; 72-75 = Grp 3; 76-79 = Grp 4; 80-89 = Grp 5). Body composition, arm, and leg MQ was measured with DEXA and BIS, while upper- and lower-body muscle strength was assessed with handgrip dynamometry (GRIP) and maximal concentric isokinetic leg extensions (EXT 60°/s), respectively. MQ was calculated for DEXA and BIS-derived MM for upper- [GRIP (kg)/MM (kg)] and lower-body [EXT 60°/s (Nm)/MM (kg)].

RESULTS: For upper- and lower-body BIS MQ, Grp 1>5, Grp 2>5, and Grp 3>5 (p<0.05). For lower-body DEXA MQ, Grp 1>5, Grp 2>5, and Grp 4>5 (p<0.05). There were no differences among age groups for upper-body DEXA MQ (p>0.05). When collapsed across age, BIS over-predicted MM compared to DEXA for upper- (19.2 ± 9.5 kg vs. 11.7 ± 2.1 kg; p<0.05) and under-predicted lower-body (6.9 ± 2.7 kg vs. 8.1 ± 2.4 kg; p<0.05). There were no differences among measurement techniques or age groups for FM (p=0.055-0.866).

CONCLUSION: MQ may be a good indicator of early-onset sarcopenia when changes in MM are too small to quantify with BIS or DEXA alone. Based on stronger correlation coefficients, DEXA may be better for upper-body MQ, while both BIS and DEXA methods are suitable for lower-body MQ measurements. Future studies are needed to establish normative MQ and changes in MQ with strength training. Study sponsored by Abbott Nutrition, Columbus, Ohio

3117 Board #82 June 1 2:00 PM - 3:30 PM Vitamin D Status is Not Associated with Muscle Mass or Physical Function in Older Adults Chad Straigh1, Christie Ward1, Mina Mojtabahed2, Rudy Valentine3, Mary Ann Johnson1, Ellen Evans, FACSM1. 1University of Georgia, Athens, GA. 2University of Illinois, Urbana-Champaign, IL. (No relationships reported)

Low vitamin D concentrations have been implicated in the age-related decline in muscle mass and physical function evident in older adults. However, the relationship between vitamin D status and physical function remains incompletely characterized.

PURPOSE: Therefore, the aim of this study was to investigate the association between vitamin D status, lean mass, and indices of lower-extremity physical function (LEPF) in older adults.

METHODS: Community-dwelling older adults (n=139, 73 male; 59.3±6.6 years) underwent assessments for vitamin D status, body composition and LEPF. Serum concentrations of 25-hydroxyvitamin D [25(OH)D] were ascertained via ELISA and low vitamin D was defined as serum 25(OH)D < 20 ng/ml. Whole-body and regional soft tissue composition was assessed via dual-energy X-ray absorptiometry. Muscle quality (MQ) was calculated as maximal voluntary contraction of the quadriceps muscle normalized for mineral-free lean mass (MFLM) of the upper leg. LEPF was measured via the timed up-and-go test (UPGO), 400-m walk, and 30-second chair stand test. Partial correlations controlled for sex and month of blood draw were performed to
examine the association of vitamin D concentration with body composition and LEPF. Analysis of covariance adjusted for sex and month of blood draw was conducted to analyze differences in MQ, MFLM and LEPF between those with low vitamin D and those with serum 25(OH)D ≥ 20 ng/ml.

**RESULTS:** Approximately 64.0% of the cohort had low serum 25(OH)D concentrations (serum 25(OH)D < 20 ng/ml). Vitamin D levels were not significantly associated with upper leg MQ or MFLM of the total or upper leg. Likewise, there was no association between 25(OH)D and UPGO time, 400-m walk time, or performance on the 30-second chair stand test. There were no differences in upper leg MQ or total leg MFLM between those with low serum 25(OH)D and those with serum 25(OH)D ≥ 20 ng/ml (both p > 0.05). Moreover, there were no differences between groups in UPGO time, 400-m walk time, or 30-second chair stand performance (all p > 0.05).

**CONCLUSION:** These data suggest that vitamin D status is not associated with measures of body composition or LEPF in older men and women. Further research should attempt to elucidate the role of potential mediators of the relationship between vitamin D and physical function in older adults.

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**3118 Board #83 June 1 2:00 PM - 3:30 PM Predicting 8-foot Up Go From Exercise Self-efficacy, Balance Confidence, Depressive Symptoms, And Life Satisfaction**

Zac Geary, University of Central Oklahoma, Edmond, OK.

(No relationships reported)

Zac Geary1, Kelsey Hubble1, Pam Farris1, Justin Steltz2, Dalton Delaney1, Simon Smith, Tyler Karnes1, Blake Hamill1, Taniqua Ward1, Kayla Garver1, Paul House1, Melissa Powers1, and Michelle Gray1. University of Central Oklahoma, Edmond, OK1, University of Arkansas, Fayetteville, AR2.

In order to initiate programs to prevent or reverse the deterioration in functional fitness which can be found in an aging population, it is important to have effective screening tools that can help determine the functional fitness levels in this population. Screening surveys are easy to administer and can be conducted from remote locations which allows more individuals to be screened quickly.

**PURPOSE:** The purpose of this study was to determine if exercise self-efficacy, balance confidence, depressive symptoms, and life satisfaction can predict performance on the 8-foot Up-and-Go (UpGo) test.

**METHOD:** Thirty-six senior adults over the age of 75 years who volunteered to participate in an exercise program completed the following surveys: Exercise Self-Efficacy (ESE), Activities-Specific Balance Confidence (ABC), Center for Epidemiological Studies Depression Scale (CESD), and Satisfaction with Life Scale (SLS). Participants also completed the UpGo test which is a measure of functional dynamic balance and agility and is part of the Senior Fitness Test developed by Rikli and Jones (1999). A multiple regression analysis was conducted to examine the aforementioned predictive variables on the UpGo test.

**RESULTS:** Overall, 67% of the variability in UpGo performance can be attributed to ESE, ABC, CESD, and SLS. In this model, ABC, CESD, and SLS were indicated as significant predictors of UpGo (p = .001, r = .38, p = .03, respectively). The ESE was not a significant predictor for the UpGo (r = .319), while the ABC was the strongest predictor for the UpGo with a partial correlation of r = .761 (p = .001).

**CONCLUSION:** These results indicate that the ABC, CESD, and SLS surveys are effective in predicting functional fitness levels in a senior population. Utilizing these surveys allow health-care professionals to identify elders at-risk for functional limitations and to recommend programs designed to improve function. This early intervention can possibly help reduce the need for assistance and loss of independence.

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**3119 Board #84 June 1 2:00 PM - 3:30 PM The Association Between Incidental Physical Activity and Cardiorespiratory Fitness**

Trevor O’Neill, Morgan Craig-Broadwith, Robert Ross, FACSM. Queen’s University, Kingston, ON, Canada.

(No relationships reported)

Cardiorespiratory fitness (CRF) is a strong predictor of cardiovascular disease and mortality. The association between structured physical activity (activity that meets consensus guidelines) and CRF is well established. Yet, the association between incidental physical activity (IPA; sporadic, unstructured physical activity that does not meet consensus guidelines) and CRF remains unclear.

**PURPOSE:** The primary objective of this study was to determine whether the duration and the expenditure of objectively measured IPA were associated with CRF in abdominally obese, adult men and women. A secondary objective was to determine whether sporadic moderate physical activity (MPA; accrued in bouts less than 10 min) was associated with CRF.

**METHODS:** Participants were abdominally obese (waist circumference >102 cm in men and >88 cm in women), self-reported inactive and weight-stable men (n=26) and women (n=62). IPA encompassed light physical activity (LPA; 1-2.99 METs), sporadic MPA (3-5.99 METs) and sporadic vigorous physical activity (VPA; ≥6 METs). IPA was measured using the SenseWear Pro Armband (SWA) collected over a period of 7 days, and was categorized into duration (min/day) and expenditure (MET-min/day). CRF was measured as peak oxygen consumption per unit of time (peak VO2), was assessed using a graded treadmill test.

**RESULTS:** Participants accumulated an average of 318.6 ± 125.2 min of IPA per day, which was composed of 277.3 ± 117.3 min of LPA and 40.8 ± 16.8 min of MPA. Both duration (r=0.45, p<0.05) and expenditure (r=0.44, p<0.05) of IPA were significantly associated with CRF independent of sex, however upon further control for body mass index (BMI) and age neither association remained significant (p>0.10). Both duration (r=0.65, p<0.05) and expenditure (r=0.66, p<0.05) of sporadic MPA were significantly associated with CRF after control for covariates.

**CONCLUSIONS:** The principle finding is that IPA is not associated with CRF after control for BMI; however, sporadic MPA remains an independent predictor of CRF in abdominally obese adults. This finding suggests that while intensity of physical activity is important for improvement in CRF, benefits are not restricted to MPA that conforms to consensus guidelines. These initial findings have important public health implications.

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**3120 Board #85 June 1 2:00 PM - 3:30 PM Functional Outcomes of Exercise Progression Models in the Elderly**

Jason D. Allen1, Jennifer L. Robbins1, Neil Johansen1, Mitch VanBruggen1, Daniel Creuder, FACSM1, Brandon Hollis1, Johanna L. Johnson1, Timothy Church1, William E. Kraus, FACSM1, Eric Ravussin1, Conrad Earnest1, Katherine L. Hann1, Carl Pieper3, Michael A. Welsch, FACSM1, 2Duke University Medical Center, Durham, NC, 1Pennington Biomedical Research Center, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA.

(No relationships reported)

A challenge for our aging nation is to define interventions that can abate the decline in functional capacity and prevent a loss of independence.

**PURPOSE:** To determine differences between: (A) 4 weeks of a regionally specific training stimulus (RSTS) versus standard aerobic exercise training (AET); and (B) the effects of subsequent 8 weeks of progressive whole-body training protocol; on VO2peak and combined 1RM strength (C1RM); and (2).

**METHODS:** Subjects over 70yr, who scored between 218-490yards on a 6MWT were randomized to AET or RSTS for the first 4 weeks (Phase 1). AET consisted of walking/biking at 40-60% of HRR. RSTS consisted of specific muscle group exercises focused on the calf, thigh, buttocks, arms, shoulders, and torso. Each exercise was performed for 3 to 5 mins, at ~40-70% of the MVC of the primary muscle group of interest. Subjects in both groups exercised for 60mins 3days per week and were progressed as tolerated. Subsequently, all subjects were advanced to a well-rounded, whole-body exercise program using established ACSM guidelines (Phase 2).

**RESULTS:** Both groups included 54 subjects, age ≥76±5yrs. After adjustment for baseline, there was a group by time interaction in VO2peak following phase 2 (see fig). Additionally, RSTS showed greater gains than AET in C1RM following both phase 1 (+40lbs vs. +17lbs, p≤0.01) and phase 2 (+35lbs vs. +19lbs, p≤0.01).

**CONCLUSION:** The gains in aerobic capacity and maximal strength at the end of phase 2 were superior in those who used RSTS during phase 1. These results suggest RSTS may serve as a physiological primer able to remove peripheral barriers that limit functional capacity, in the elderly.

Supported by R1C1AG035822-01 and the Duke University Claude D. Pepper OAIC (AG0287) to JDA.
Endurance exercise such as marathon running has been shown to induce immunological responses similar to those seen in inflammation. It has also been identified as potentially leading to hemolysis. Hepcidin, recently recognized as a key regulator of systemic iron metabolism, has been found to be increased following a marathon race possibly induced by an exercise related increase in interleukin-6 (IL-6), a marker known to induce an acute phase response. It remains unknown whether ultra-endurance exercise leads to a more pronounced hepcidin response due to a cumulative effect of hemolysis and acute phase response.

**METHODS:** Venous blood samples were obtained from seven highly-trained male athletes (mean (SD): 52.0 (10.6) yrs, 176.6 (9.4) cm, 75.9 (7.8) kg) before the start of the race, after 42 km and after termination of the race for the analysis of the above listed markers.

**RESULTS:** Il-6 did not change significantly during the race (g/l): 14.3 (0.6) to 14.8 (1.0), 14.0 (1.2), p>0.05. Leukocytes and CRP at test termination were 11.7 (2.1) x10^9 /l and 33.2 (22.4) mg/l, higher (p<0.05) compared to pre-run (6.0 (1.3) x10^9 /l and 1.0 (0.6) mg/l) and 42 km (8.4 (2.4) x10^9 /l and 1.0 (0.5) mg/l). Hepcidin was decreased at 42 km (g/l: 0.60 (0.16) vs. 0.83 (0.22) pre-run, p<0.001) with no significant change thereafter (0.68 (0.29) g/l). IL-6, below detection level (< 2 mg/l) at km10, showed a significant increase at 42 km (8.8 (3.9) mg/l, p<0.001). The further increase at test termination (17.2 (16.7) ng/l) did not reach statistical significance. Hepcidin levels did not change significantly during the race (μg/l: 183.4 (59.7); 182.6 (70.2); 167.4 (49.0), p>0.05).

**CONCLUSIONS:** The clear increases in leukocytes and CRP throughout the race indicate inflammation probably induced by the increase of IL-6 in the early phase of the race. The hepcidin decrease after 42 km demonstrates some hemolysis during the same period. Although inflammation has been described previously to stimulate hepcidin production, hepcidin remained unchanged during this ultramarathon in non-anemic males.

Supported by Limbach Laboratory, Heidelberg, Germany.

822
**Board #89 June 1 3:30 PM - 5:00 PM**

**Chronic Changes In Serum IL-6 And TNF-α Following 12 Weeks Of Concurrent Resistance And Aerobic Exercise Are Dependent On Exercise Mode And May Affect Adaptation.**

Brad S. Lambert, Justin P. Dobson, Dr. Stephen F. Crouse, FACSM. Texas A&M University, College Station, TX.

(No relationships reported)

**PURPOSE:** To examine physiological responses and land treadmill training (RT-LTM) compared to concurrent resistance and aerobic treadmill training (RT-ATM) and the chronic effect of each on serum TNF-α and IL-6 (cytokines associated with chronic inflammation, CVD, and skeletal muscle metabolism).

**METHODS:** Twenty-six untrained subjects (M: n=13, 98.6±17.1kg, 182.2±6.2cm, 34±11yrs; F: n=13, 78.9±14.0kg, 165.1±5.3cm, 38±11yrs) were screened to assess VO_{max}, Bcomp (DEXA), and strength (Lifts: leg press, chest press, leg curl, lat pull, leg ext, triceps push-down, biceps curl). Subjects were then randomized into 2 groups (RT-LTM=12, RT-ATM=14).

Each performed progressive RT (2×wk, 3×8-12 @ 60%-->~80% 1RM) for 12 wks. Both groups also performed 12 wks of aerobic ATM or ATM (60-->85%VO_{max}) respectively. ATM or LT occurred immediately following RT sessions and in isolation on a 13rd day during the wk. Kcal/session: Wk 1-6 = 250-->500 kcal/session, Wk 6-12 = 500 kcal/session.

Baseline tests were re-performed at wk 6 and after training. Blood samples were obtained in the rested state before and after training. Serum TNF-α and IL-6 was analyzed using a multiplex assay kit (Luminex®, Millipore®). A 2×2 Mixed Model ANOVA w/ repeated measures was used to examine absolute and relative changes in the independent variables listed in the table.

**RESULTS:**

<table>
<thead>
<tr>
<th>INDEP. VAR</th>
<th>Mean ± SE</th>
<th>%Δ</th>
<th>%Δ</th>
<th>%Δ</th>
<th>%Δ</th>
<th>%Δ</th>
<th>%Δ</th>
<th>%Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lean Mass (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT-LTM</td>
<td>40.86 ± 3.65</td>
<td>35.91 ± 3.13</td>
<td>42.08 ± 2.48</td>
<td>29.90 ± 1.99</td>
<td>1457.42 ± 135.12</td>
<td>4.62 ± 1.57</td>
<td>7.07 ± 1.87</td>
<td></td>
</tr>
<tr>
<td>RT-ATM</td>
<td>51.12 ± 3.98</td>
<td>51.09 ± 2.78</td>
<td>37.04 ± 2.32</td>
<td>32.13 ± 1.63</td>
<td>1552.83 ± 145.91</td>
<td>4.64 ± 1.58</td>
<td>7.86 ± 1.48</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSION:** Chronic RT-LTM and RT-ATM training elicit different effects on markers of chronic inflammation which may be related to differing health and fitness outcomes observed between our groups.

**Board #90 June 1 3:30 PM - 5:00 PM**

**Effects of Exercise Training on Inflammatory and Hypoxic Gene Expression in White Adipose Tissue**

Melissa A. Linden¹, Yair Pincu¹, Stephen A. Martin¹, Jeffrey A. Woods, FACSM, Tracy Baynard². ¹University of Illinois at Urbana-Champaign, Champaign, IL. ²University of Illinois at Chicago, Chicago, IL.

(No relationships reported)

Obesity contributes to the development of inflammation and lifestyle related diseases, such as type II diabetes mellitus. Exercise training can have anti-inflammatory effects but it is unclear if it is a potent enough stimulus to positively affect white adipose tissue (WAT) and glucose regulation in the presence of an obesigenic diet.

**PURPOSE:** To determine the effect of 12 weeks of a very high fat (VHF) diet and/or exercise training (EX) on glucose regulation and inflammatory and hypoxic gene expression within white adipose tissue.

**METHODS:** Male C57Bl/6J mice (n=39) were randomized into four groups: low-fat (LF)/sedentary (SED), LF/EX, VHF/SED, and VHF/EX. The VHF and LF diets were 60% and 10% fat, respectively. The mice were placed on the diet and exercise intervention concomitantly. Exercise training consisted of treadmill running 5 d/wk at 12 m/min, 5% incline, 40 min/d for 12 weeks. A subset of mice had intraperitoneal glucose tolerance tests (IPGTT). Quantitative real-time PCR was used to determine gene expression of inflammatory and hypoxia markers within white adipose tissue.

**RESULTS:** Animals on the VHF diet gained more weight than mice on the LF diet (p<0.05) but weight gain was partially attenuated by exercise training (p<0.05). The VHF diet also increased epididymal fat pad weight relative to total body mass (p<0.05). Animals on the VHF diet had impaired glucose tolerance as indicated by increased area under the glucose curve (p<0.05), with exercise training having no effect (p>0.05). The VHF diet increased gene expression markers of inflammation, tumor necrosis factor alpha, interleukin-1 receptor antagonist (IL-1ra), interleukin-6 (IL-6), and interleukin 10 (IL-10) (p<0.05), within the WAT. Exercise was able to reduce the expression IL-1ra in animals on a VHF diet (p<0.05). The VHF diet increased hypoxia inducible factor 1α (HIF-1α) but exercise training did not attenuate HIF-1α gene expression in the VHF diet fed animals (p>0.05).

**CONCLUSION:** Concomitant exposure to moderate exercise training for 12 weeks may help reduce body weight but does not show robust effects in stemming inflammation within the WAT. Supported by University of Illinois Research Board seed grant.

**Board #91 June 1 3:30 PM - 5:00 PM**

**Effects of Exercise Training in Mice Models of Graft Versus Host Disease**

Carmen Fizua_Luces¹, Africa González-Murillo¹, Isabel Colmenero², Jesús Martínez Palacio³, Alejandro Lucia¹, Manuel Ramírez². ¹Univesidad Europea de Madrid, Madrid, Spain. ²Hospital Infantil Universitario Niño Jesús, Madrid, Spain. ³CIEMAT, Madrid, Spain. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

Graft vs. host disease (GVHD) is a major complication of hematopoietic stem cell transplantation (HSCT), with a morbimortality of 30-40%. We evaluated the effects of post-HSCT aerobic training on several aspects of GVHD in a murine acute (cytotoxic, C57Bl/6J) and chronic model (inflammatory, BALB/c): clinical course, post-HSCT immune cell reconstitution and cytokine profile.

**METHODS:** Twenty C57BL/6J (H-2b) and twenty-eight BALB/c (H-2d) female adult recipient mice (age: 8-12wk) were assigned to an exercise (EX; n=11 C57BL/6J mice, and n=15 BALB/c) or sedentary control group (CONT; n=9 C57BL/6J, n=13 BALB/c). All mice were adapted to treadmill running 3d before completing a maximal test; thereafter they were total-body irradiated before HSCT. All mice were transplanted through the tail vein (with donor bone marrow cells (10x10^7/mouse) and donor splenocytes (2x10^7/mouse (C57Bl) and 10x10^7/mouse(BALB/c)). The exercise program started 2d after HSCT, lasted 11wk (5 sessions/wk), and ended with a second maximal test; running speed and inclination, and exercise duration were gradually increased over time. GVHD was monitored daily with a severity score that incorporates (individually and in combination) 5 clinical parameters: weight loss, posture (hunching), activity, fur texture, and...
skin integrity. Before HSCT, 21d and 54d post-HSCT, and in the day of death, we collected blood samples for immune cell reconstitution (B220, CD3, CD4, CD8, Mac1 subpopulations) and cytokine analysis (IL-2, IL-4, IL-6, IL-17A, TNF-α and INFγ).

RESULTS: In C57BL/6J, physical capacity significantly increased in EX and decreased in CONT whereas in BALB/C, the decline in physical capacity was attenuated in EX (P<0.001 and P=0.021 for the between-group comparison, respectively). We found a significant group*time interaction effect for total clinical score (P=0.002) and mice hair (P<0.001) in C57BL/6J, and for activity (P=0.001) and hunching (P=0.045) in BALB/C, all reflecting a beneficial effect of exercise. The exercise benefits were not accompanied by significant improvements in immune cell reconstitution or inflammatory profile (P>0.05 for interaction effects).

CONCLUSIONS: Aerobic exercise seems to have a beneficial effect on the clinical course of GVHD, especially in its less severe model

3127  Board #92  June 1  3:30 PM - 5:00 PM
Changes Of Tlr4 Signaling-mediated Protein Expression With Endurance Exercise In Rats

Hyo Jeong Kim, Hyo Seong Yeo, Hyoeng Tae Kwon, Chang Keun Kim. korea national sport univ., seoul, Korea, Democratic People’s Republic of.

The innate immune response is the first line of defense against infectious disease. A group of proteins that comprise Toll or Toll-like family of receptors (TLRs) has been suggested as one of the markers associated with immune and inflammatory responses. TLR4 among the TLRs produces a response by lipopolysaccharide (LPS) and controls inflammatory responses.

PURPOSE: This study was performed to demonstrate the change of TLR4 signaling-mediated protein expressions in skeletal muscle during the recovery of intensive endurance exercise.

METHODS: Sprague-Dawley rats (12weeks, n=35) were randomly divided into five groups(n=7 each) to time period of the exercise (pre, post 0 h, 30min, 1 h and 6 h). The rats ran on the rodent treadmill for 1 hour at the level of 75-80% VO2max (26min). The change of TLR4, MYD88 protein expression and NFκBp65 DNA binding activity were analyzed by western blotting in Extensor Digitorum Longus (EDL) muscle.

RESULTS: TLR4 protein expression was significantly decreased by 41%(p=036) with the intensive endurance exercise, whereas MyD88 was not changed. NFκB significantly increased by 51%(p=014) at 1h of recovery, but returned to the resting level 6 h post exercise.

CONCLUSIONS: These results suggest an interaction between TLR4 and NFκB suggesting that intensive-induced change of TLR4 expression may serve as a messenger molecules to defence inflammatory response in rat skeletal muscle.

3128  Board #93  June 1  3:30 PM - 5:00 PM
Lymphocyte Apoptosis And TNF-α In Smokers And Non-smokers Following Different Intensity Of Exercises

Kyu-Shin Park1, Yang Lee2, Brian K. McFarlin, FACSM1, 2Texas A&M International University, Laredo, TX, 2Texas A&M University, College Station, TX. 1University of Houston, Houston, TX.

Chronic smokers have an antioxidant imbalance and suppressed immunity, which may make them more susceptible to post exercise immune suppression. It is possible that the concentration of inflammatory cytokines may be differentially altered after exercise in smokers vs. non-smokers.

PURPOSE: The purpose of the study was to examine changes in inflammatory cytokines and lymphocyte apoptosis after exercise in smokers compared to non-smokers.

METHODS: Fourteen physically inactive smokers (SM, ≥ 1 pack year, n=7) and non-smokers (NS, n=7) aged 18 to 26 (SM: 20.6±7.96 vs. NS: 20.17±2.6, Mean±SE) were recruited. Each subject completed three treadmill runs at different intensities in a random order (60%, 70%, and 80% of VO2max). Running distance for all three runs was equivalent to 30-min run at 70% VO2max. Lymphocyte apoptosis and levels of inflammatory cytokines (TNF-α, IL-4,6,10) were analyzed at rest (PRE), immediately after (POST), and 1 h following (1H) each run. Data was analyzed using two-way repeated measures ANOVA with P<0.05.

RESULTS: Lymphocyte apoptosis increased following all three running trials in dose dependent manner to exercise intensity (P<0.01). SM had greater lymphocyte apoptosis than NS at POST following 60% (12.5±0.62% vs. 9.97±0.51, P=0.008) and 70% trials (17.53±0.57% vs. 15.6±0.41, P=0.018). There was no significant difference for lymphocyte apoptosis for either SM or NS at POST following 80% VO2max run. SM showed higher level of TNF-α as compared to NS (47.0±4.1pg/ml vs. 30.4±4.7, P=0.025) and TNF-α at POST was significantly higher in both SM (55.5±5.1, P=0.023) and NS (34.0±5.5, P=0.023) than PRE (SM:41.3±4.3, NS:29.5±4.7) and 1h post (SM:44.2±4.1, NS:27.6±4.3).

CONCLUSIONS: Smokers had greater lymphocyte apoptosis compared to non-smokers following runs at 60% and 70% VO2max, but not following a run at 80% VO2max; however, changes in TNF-α did not appear to explain this effect. More research is needed to understand the mechanisms that contribute to the apoptosis following exercise in smokers.

3129  Board #94  June 1  3:30 PM - 5:00 PM
Circulating TWEAK Is Affected By High-intensity Intermittent Exercise In Healthy Children

Thanh Nguyen1, Joyce Obeid1, Hilde E. Ploeger1, Tim Takken2, Brian W. Timmons1, 1McMaster University, Hamilton, ON, Canada, 2University Medical Center Utrecht, Utrecht, Netherlands. (Sponsor: Boguslaw Wilk, FACSM)

Tumor necrosis factor related weak inducer of apoptosis (TWEAK) is a potent muscle degrading cytokine. In children, the rate of muscle growth is greatest around the age of peak height velocity (PHV). While physical activity is considered a biological requisite for healthy growth and development, the mechanisms translating exercise into healthy growth during childhood are not well understood.

PURPOSE: To examine the effects of moderate-intensity continuous exercise (MICE) and high-intensity intermittent exercise (HIEE) on TWEAK in healthy children at different stages of growth.

METHODS: Twenty-five healthy children (mean age: 13.6±2.4 years, 5 females) had their peak aerobic metabolic power (PMP) determined using an incremental cycling test. MICE, consisting of 2 x 30-min bouts of cycling at 50% PMP, and HIEE, consisting of 6 sets of 4 x 15-sec bouts of cycling at 100% PMP, were performed one week apart. Venous blood was drawn at rest (REST), at end of exercise (EX-END) and after 60 min of recovery (REC). Serum was analyzed for TWEAK using ELISA. Comparisons were done between children at the age of PHV (n=7, 2 females) who were either before or after the age of PHV using repeated measures two-way ANOVA.

RESULTS: In response to HIEE, TWEAK decreased at EX-END (718.8 ± 136.7 pg/ml, p<0.05) compared to REST (1144.3 ± 534.5 pg/ml, p<0.05) in children at the age of PHV. TWEAK at EX-END was lower in children at the age of PHV (718.8 ± 136.7 pg/ml, p<0.05) compared to children who were not (1112.8 ± 389.4 pg/ml, p=0.014) at 1h of recovery, but returned to the resting level 6 h post exercise.

CONCLUSIONS: These results suggest an interaction between TLR4 and NFκB suggesting that intensive-induced change of TLR4 expression may serve as a messenger molecules to defence inflammatory response in rat skeletal muscle.

3130  Board #95  June 1  3:30 PM - 5:00 PM
Circus Physical Exercise Decrease Partially Excessive Activation Of T Lymphocytes In Overweight Children

Cesar Miguel Momesso1, Silvia Guirado2, Kim Caçula1, Cristiane Borges1, Vinicius Coneglian2, Tania Pithon-Curi1, Rui Curi2, Renata Gorjão1, 1UNICUSL, São Paulo, Brazil, 2USP, São Paulo, Brazil.

Obesity associated with sedentary lifestyle can lead to changes in the immune system function, resulting in the development of inflammatory diseases. The occurrence of these diseases may be related to a change in the primary control exerted by T lymphocytes.
CONCLUSION: The aim of this study was to compose 60 children, of which 24 were divided into four subgroups: Overweight Children (OWC) (10.67 ± 0.90 years old and BMI 23.02 ± 0.74); Overweight Exercise (OWE) (10.00 ± 1.41 years old and BMI 24.64 ± 3.03); Eutrophic Children (EC) (11.00 ± 1.24 years old and BMI 17.51 ± 0.98); and Eutrophic Exercise (EE) (10.60 ± 0.06 years old and BMI 16.80 ± 2.53). OWE group practiced exercise twice a week, during six months. CD95 and CD25 expression in CD4+ lymphocytes and T regulatory cells (Treg) percentage were evaluated by flow cytometry; proliferative capacity by incorporation of thymidine and lymphocyte mRNA expression of IL-35, TGF-beta, IL-2 and IL-10 was determined by real time PCR.

METHODS: A higher lymphocyte proliferative capacity was observed in OWC and OWE groups when compared to EC (350 ± 4887.2; 2694 ± 560.4 and 1768 ± 208.2, respectively). The same was observed in comparison to EE (2133 ± 1111 cm) groups. In the CD95 expression, EC (593.9 ± 101.2) and EE groups (773.7 ± 194.6) showed higher values than the OWC group (552.1 ± 125) and OWE group (551.6 ± 144.5). The percentage of Treg was lower in OWC than in EE and EE groups. mRNA expression of IL-35 and IL-10 was lower in OWC and OWE groups in relation to EC and EE. Plasma cytokine concentration was not altered in any group. These results indicate that an unbalance in lymphocyte regulation occurs in overweight children. These cells are involved in the suppression of excessive activation of peripheral lymphocytes evidenced by proliferation assay. In addition, a lower expression of CD95 is related to a fail in the inhibition of excessive lymphocyte proliferation.

CONCLUSIONS: These alterations indicate that overweight children are more prone to develop diseases related to immune system function and exercise exercises partially revert these factors.
Oxidative stress is associated with the increased risk of atherosclerosis and cardiovascular disease. Oxidative stress or chronic inflammation increase with advancing age and regular exercise exerts anti-oxidant/inflammatory effects. However, it remains unclear whether exercise at an amount lower than currently recommended confers such anti-oxidant/inflammatory effects in older adults.

**PURPOSE:** The purpose of this study was to investigate the effects of 12 weeks of supervised walking program below the current recommended amount of exercise on oxidative stress and antioxidant capacity in older adults.

**METHODS:** Twenty-eight older adults (65-78 yr) were assigned into either control (N = 14) or exercise (N = 14) group. Exercise program consisted of walking 30-60 min/session on 2 days of the week for 12 weeks. Blood samples were taken at baseline and after 12 weeks in both groups. Fasting plasma concentration of reactive oxygen metabolites (d-ROMs), myeloperoxidase (MPO), biological antioxidant potential (BAP), thioredoxin (TRX) and activity of superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX) were measured.

**RESULTS:** Plasma d-ROMs concentrations tended to be decreased only in the exercise group after 12 weeks compared with the baseline values (P<0.05). Compared with the control group, there was a significant decrease in plasma AOPP concentrations after 12-weeks walking program (P<0.05). Plasma BAP, TRX concentrations and GPX activity were significantly increased only in the exercise group after 12 weeks compared with the baseline values (P<0.05). Plasma CAT activity was significantly decreased only in the exercise group after 12 weeks compared with the baseline values (P<0.05). Plasma TBARS, MPO concentrations and SOD activity did not change significantly in both groups after 12 weeks.

**CONCLUSIONS:** These findings demonstrate that a 12 week of walking program equivalent to an amount of exercise below the current minimum recommendation in older adults may attenuate basal oxidative stress and increase protection against oxidative stress by increasing antioxidant capacity.

**Board #100**  
**June 1**  
**3:30 PM - 5:00 PM**  
**Physical Exercise And Immunosenesence: Can We Play For Healthy Ageing?**  
Elisa Calabria1, Silvia Pogliaghi1, Kenneth Dyar2, Gianluca Salvagno2, Carlo Morandi1, Gian Cesare Guidi1, Stefano Schiaffino1, Federico Schena1, Carlo Capelli1.  
1University of Verona, Verona, Italy. 2Venetian Institute of Molecular Medicine, Padova, Italy.  
(No relationships reported)

**Board #101**  
**June 1**  
**3:30 PM - 5:00 PM**  
**Lymphocyte Subset Response To An Acute Bout Of Exercise Following A Night Of Sleep Disruption**  
Lesley Ingram1, Richard Simpson1, Eva Malone1, Geraint Florida-James1, Edinburgh Napier University, Edinburgh, United Kingdom. 2University Of Houston, Houston, TX.  
(No relationships reported)

**Board #102**  
**June 1**  
**3:30 PM - 5:00 PM**  
**The Effect of Tai Chi Chuan on Th1 / Th2 Balance in Middle-aged and Older Women**  
BeiBei Luo, Ru Wang, Yajun Zhang, Peijie Chen, Shanghai University of Sport, Shanghai, China.  
(No relationships reported)

**Board #103**  
**June 1**  
**3:30 PM - 5:00 PM**  
**The Effect of Tai Chi Chuan on Th1 / Th2 Balance in Middle-aged and Older Women**  
BeiBei Luo, Ru Wang, Yajun Zhang, Peijie Chen, Shanghai University of Sport, Shanghai, China.  
(No relationships reported)

**Board #104**  
**June 1**  
**3:30 PM - 5:00 PM**  
**The Effect of Tai Chi Chuan on Th1 / Th2 Balance in Middle-aged and Older Women**  
BeiBei Luo, Ru Wang, Yajun Zhang, Peijie Chen, Shanghai University of Sport, Shanghai, China.  
(No relationships reported)

**Board #105**  
**June 1**  
**3:30 PM - 5:00 PM**  
**The Effect of Tai Chi Chuan on Th1 / Th2 Balance in Middle-aged and Older Women**  
BeiBei Luo, Ru Wang, Yajun Zhang, Peijie Chen, Shanghai University of Sport, Shanghai, China.  
(No relationships reported)
transforming growth factor-β (TGF-β), interleukin-10 (IL-10), cytotoxic T lymphocyte antigen 4 (CTLA-4), IL-4 and IFN-γ, normalized by GAPDH. And CD4+/CD25+CD127low Treg cells in peripheral blood were detected by flow cytometry.

RESULTS: Before TCC exercise program, there were no significant differences between TCC group and CON group in mRNA expression of cytokines and co-stimulatory molecules, or the percentage of Treg cells in CD4+ T cells. After TCC exercise, the mRNA expression of IFN-γ (TCC: 2.60±0.46, CON: 1.08±0.22, p<0.01) and IFN-γ/IL-4 ratio were significantly increased in TCC group (TCC: 5.12±1.15, CON: 3.38±0.22, p<0.05). The percentage of Treg cells in CD4+ T cells in TCC group was higher than control group (TCC: 5.12±1.15, CON: 3.38±0.22, p<0.01). In addition, we found an increase in mRNA expression of TGF-β (PRE: 4.48±0.46, POST: 1.46±0.53, p<0.01), CTLA-4 (PRE: 55.6±16.03, POST: 208.27±26.31, p<0.01) and IL-10 (PRE: 68.3±3.70, POST: 102.6±17.18, p<0.01) in TCC group after 32-week exercise. It indicates that Treg cells mediators negatively affect the Th2 cytokines mRNA expression, therefore increase Th1 cytokines mRNA expression.

CONCLUSIONS: Long-term TCC exercise enhances the number of Treg cells and the mRNA expression of Treg cells mediators that helps to improve Th1/Th2 balance in middle-aged and older women.

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3139  Board #104  June 1  3:30 PM - 5:00 PM
Estradiol β-Receptor Expression on Human B-lymphocytes in Response to Acute Heavy Resistance Exercise

Estradiol has previously been attributed for mediating gender differences in physiological responses to tissue damage. Since the neuro-endocrine and immune systems coordinate the body’s response to stress, we hypothesized that estradiol-β-receptors (ER) on b-lymphocytes may coordinate such communications and explain the protective responses previously reported in women.

PURPOSE: The purpose of this investigation was to examine ER expression on circulating b-lymphocytes in response to an acute bout of heavy resistance exercise in men and women.

METHODS: Using a within subject design, fifteen resistance trained women (n=7; ages 22±3 y) and men (n=8; ages 25±5 y) performed a heavy resistance exercise squat protocol (6 sets of 5 reps at 90% 1RM) (EX) and a control test (CON) in a balanced, randomized order. Blood samples were collected before, during and after the exercise and control trials. ER expression on circulating lymphocytes was evaluated with flow cytometry and serum estradiol was assayed by ELISA.

RESULTS: Serum estradiol did not significantly differ between men (CON=48.0±22.3 pg•ml⁻¹) and women (CON=86.5±60.5 pg•ml⁻¹) nor change during recovery to the exercise stress in men (6 HR POST-EX = 49.7±13.6 pg•ml⁻¹; 24 HR POST-EX=60.1±15.1 pg•ml⁻¹) or women (6 HR POST-EX = 73.9±35.6 pg•ml⁻¹; 24 HR POST-EX=105.4±66.9 pg•ml⁻¹). ER on b-lymphocytes showed large inter-individual variations before exercise (relative fluorescence = 22.3 - 28.8) and trends for differences at 6-hours post-exercise (relative fluorescence = 32.1 - 54.4). However, no significant gender differences or changes in response to the exercise protocol were observed.

CONCLUSIONS: Present findings reveal that estradiol-β receptors on b-lymphocytes likely explain gender differences in physiological responses to tissue damage elicited by acute heavy resistance exercise. It is possible that interactions may occur beyond the recovery period measured in the present study or it may be that ER on muscle tissue, rather than b-lymphocytes, dictate the protective effects of estradiol previously reported in women.
Board #106 June 1 2:00 PM - 3:30 PM

Acute Responses of Lipoprotein Fractions Following a Single Bout of Exercise in Postmenopausal Women with Hypercholesterolemia

Yunsoo Koh, Allen Sexton, Kayva Cheili,an, Daniel Chil, Douglas Boatwright, Rick Carter, FACSM. Lamar University, Beaumont, TX.

Purpose: To examine the acute responses of serum lipoprotein fractions (α, β, and preβ) over the 48-hour period following a single bout of moderate intensity aerobic exercise in hypercholesterolemic postmenopausal women.

Methods: Sixteen sedentary, hypercholesterolemic (defined as TC ≥ 200 mg/dl; average TC = 241.7 mg/dl) postmenopausal women (age = 57.4 years), who were not on hormone replacement therapy or lipid lowering medications, volunteered for the study. Participants performed both exercise and rest trials in random order. For the exercise trial, participants performed a single bout of aerobic exercise at 60% of heart rate reserve on the treadmill until 400 kcal were expended. Participants came to the laboratory for blood draws only during the rest trial. Serum samples were collected at pre (0), 24, and 48 hours after each trial (exercise or rest) to analyze the lipoprotein fractions using electrophoresis.

Results: A 2 X 3 (trial (exercise and rest) X time (0, 24, and 48 hours)) repeated measures ANOVA revealed that the α-lipoprotein fraction in the exercise trial (35.67%) was significantly higher (p = 0.006) than the rest trial (34.85%), while the β-lipoprotein fraction in the exercise trial (56.79%) was significantly lower (p = 0.001) than the rest trial (57.63%). As for the main effect for time, the β-lipoprotein fraction at 24 hours (56.27%) was significantly (p = 0.008) lower than 0 (57.83%) or 48 hours (57.53%). However, there was no trial X time interaction in changes in the β-lipoprotein fraction. The pre-β fraction remained unchanged.

Conclusion: A single bout of aerobic exercise requiring 400 kcal can positively modify the serum α- and β-lipoprotein fractions in postmenopausal women with hypercholesterolemia.

Board #107 June 1 2:00 PM - 3:30 PM

Exercise Energy Expenditure and Postprandial Lipoaemia in Girls

Keith Tolfrey, Alex Engstrom, Caoileann Murphy, Alice Thackray, Robert Weaver, Laura Barrett. Loughborough University, Loughborough, United Kingdom.

(Sponsor: Keith George, FACSM)

Purpose: To examine the effect of 30 and 60 min of moderate intensity treadmill walking on postprandial [TAG] in healthy girls.

Methods: Fourteen 10 to 14 year old girls completed three, 2 day trials in a counter-balanced crossover design separated by 14 days. On day one, they rested (CON), or completed 30 min (EX30) or 60 min (EX60) of intermittent treadmill exercise at 56% peak VO2 inducing energy expenditure of 752 and 1487 kJ respectively. On day two, after a 12-h fast, a capillary blood sample was taken for fasting [TAG] before a high-fat milkshake (80 kJ·kg⁻¹ body mass) was consumed. Further blood samples were taken hourly over a 6-h postprandial rest period for [TAG].

Results: Differences in fasting [TAG] were small across the conditions (Effect Size (ES) = 0.08, P = 0.07), with a trend for lower [TAG] in EX60 compared with CON (P = 0.05). Postprandial [TAG] was lower during EX30 and EX60 compared with CON (ES = 0.41, P = 0.01). The total area under the [TAG] versus time curve was lower by 17% in EX30 (95% confidence interval (CI) -33 to 2%, P = 0.05) and by 29% in EX60 (95% CI -48 to -4%, P = 0.04) compared with CON; EX30 and EX60 were not different from each other (14%; 95% CI -34 to 11%, P = 0.21).

Conclusion: This study demonstrates for the first time that both 30 and 60 min of walking, with energy expenditures of 752 and 1487 kJ, attenuated postprandial [TAG] in girls. However, the difference between EX30 and EX60 did not support a dose-response change in postprandial lipaemia.

Board #108 June 1 2:00 PM - 3:30 PM

Low Rip140 Expression Uncovers The Central Role Of The Akt-pkczeta Axis In The Regulation Of Insulin-mediated Fatty Acid Oxidation In Skeletal Muscle Cells

Silvana Constantinescu, Lorraine P. Turtcote, FACSM. University of Southern California, Los Angeles, CA.

Receptor Interacting Protein 140 (RIP140) is a well-known negative regulator of oxidative capacity and prior data from our lab has shown low expression of this transcription factor increases insulin-mediated FA oxidation in skeletal muscle cells.

Purpose: To provide mechanistic insights for this metabolic shift, we measured the effects of low RIP140 expression on the mRNA and protein expression of proteins and signaling intermediates implicated in the regulation of FA oxidation (COX4, PGC-1α, (FAT)/CD36, FATP1, CPT1, MCAD, ACT, PKC-ζ).

Methods: L6 myotubes were treated with siRNA sequences for either RIP140 (RIP140) or a negative control (control) and incubated with insulin.

Results: Treatment with RIP140 siRNA sequences significantly (P<0.05) reduced RIP140 mRNA (47%) and protein (54%) content and significantly (P<0.05) increased COX4 (98%) and PGC-1α (77%) mRNA expression indicating that, as expected, oxidative capacity was increased in RIP140 siRNA-treated cells. Down-regulation of RIP140 increased (P<0.05) FATP1 (317%), (FAT)/CD36 (51%) and CPT1 (84%) mRNA expression but unexpectedly decreased (P<0.05) MCAD mRNA expression (34%). Interestingly, at the protein level, RIP140 down-regulation did not affect (P>0.05) protein content of CPT1 and FATP1 but it decreased (P<0.05) total (38%) and plasma membrane (50%) (FAT)/CD36 protein content. Down-regulation of RIP140 decreased AKT[Ser473] (23%) and PKC-ζ[Thr403/410] (56%) phosphorylation but did not affect AKTp[Thr308] phosphorylation.

Conclusion: Our data suggest that the high rates of insulin-mediated FA oxidation that accompany low RIP140 expression are mediated by a reduction in AKT and PKC-ζ signaling.

Board #109 June 1 2:00 PM - 3:30 PM

Comparison Of Fat Oxidation And Total Energy Expenditure During Interval And Continuous Training Sessions

Ken J. Hetlelid, Karianne V. Brovold, Stephen Seiler, FACSM. University of Agder, Kristiansand, Norway.

This study was conducted to quantify fat metabolism among endurance-trained men during high-intensity interval running.

Purpose: We: 1) quantified the total energy expenditure and substrate oxidation among well-trained men during a high-intensity interval session and a continuous session matched for average workload, 2) compared relative fat oxidation during a high-intensity interval session and a continuous session to the maximal fat oxidation rate identified by fatmax protocol and 3) compared the energy expenditures after a high-intensity interval session and a continuous session, based on EPOC.

Methods: Nine well-trained male runners (VO2max: 68.1 ± 3.6 ml·kg⁻¹·min⁻¹) completed preliminary testing followed by an interval session and a continuous session in randomised order. Blood lactate (La-) and blood gases were quantified throughout. The sessions lasted 48 minutes and were performed at a 1.7% incline. Individual running velocities were calculated
corresponding to 40% (rest periods), 65% (continuous session) and 90% (work periods) of VO2max. Interval bouts consisted of 6 x 4 minutes work periods separated by 4 minutes rest periods. Substrate oxidation was calculated from gas exchange with corrections for RER >1.0.

**RESULTS:** Despite identical work, a significant difference was found in energy expenditure between the interval session and the continuous session, 3207 ± 325 kJ vs 2962 ± 309 kJ (p < 0.001). Fat oxidation tended to be higher during the continuous session (755 ± 440 kJ) compared with interval exercise (533 ± 219 kJ), but the difference was not significant (p = 0.170). Fat mass occurred at 65 ± 8% of VO2max (0.55 ± 0.17 g.min-1), while fat oxidation accounted for 25 ± 14% (0.39 ± 0.22 g.min-1) and 17 ± 8% (0.27 ± 0.11 g.min-1) during continuous and interval sessions respectively. Blood pH and [HCO3-] stabilized from work bout one to six, (from 7.35 ± 0.03 to 7.35 ± 0.05) and from 20.8 ± 1.9 to 19.4 ± 3.5 mmol.L-1) respectively. We found no difference in energy expenditure based on 15 min EPOC between the continuous session (25 ± 28 kJ) and interval session (27 ± 28 kJ).

**CONCLUSION:** Well-trained runners oxidized significant amounts of fat during high-intensity exercise, equal to ~50% of fat oxidation achieved at max.

**3145 Board #110 June 1 2:00 PM - 3:30 PM Physical Training Reduces Serum Leptin In Rats, But Not Adiponectin Emidio M. Mato-Neto, Michele Trindade, Francisco Torres-Leal, Lucas Pantaleão, Miriam Fonseca-Alaniz, Marcelo M. Rogerio, Julio Tarpegui. University of São Paulo, São Paulo, Brazil.

(No relationships reported)

**Physical training reduces serum leptin in rats, but not adiponectin**

Emidio M. Mato-Neto, Michel C.C. Trindade, 2 Francisco Torres-Leal, Lucas C. Pantaleão, 3 Miriam H. Fonseca-Alaniz, 4 Marcelo M. Rogerio, 1 Julio Tarpegui. 1 Faculty of Pharmaceutical Sciences, 2 Institute of Biomedical Sciences, 3 Heart Institute, University of Sao Paulo 4 School of Public Health, University of Sao Paulo, Sao Paulo,SP.

Physical training (PT) is an effective intervention in reducing the risk and in the treatment of chronic diseases associated with low-grade systemic inflammation. In this regard, studies show that this effect may be mediated via body fat reduction, with decreased release of proinflammatory adipokines and increased synthesis and release of anti-inflammatory adipokines.

**PURPOSE:** To investigate the effects of PT on body composition and serum concentrations of leptin and adiponectin in rats.

**METHODS:** Fifteen male adult Wistar rats (259.4 ± 1.27 g), under standard experimental conditions, received AIN-93M diet and water ad libitum. Animals with similar weights were distributed into two groups: trained group (TG) (n = 8) and sedentary group (SG) (n = 7). TG underwent PT on a treadmill for 8 weeks in the dark cycle. For morphometric analysis, aliquots of cell suspension were assessed under an optical microscope with graduated scale in order to evaluate adipocyte volume. Serum leptin and adiponectin levels were assessed by multiplex immunoassay using commercial kits.

**RESULTS:** Food intake was 107.4 ± 2.99 g/week for TG and 93.69 ± 4.83 g/week for SG. There was no significant difference in body mass changes between SG and TG (364.5 ± 19 g and 340.1 ± 3.96 g, respectively, p = 0.15). TG animals showed significantly fat reduction (32.57 ± 2.22%) compared to SG (74.79% ± 16.14%). We found that the adipocyte volume in the TG was significantly reduced (258.7 ± 27.74 pl), compared to SG (604.2 ± 138.3 pl) (p = 0.01). Serum leptin levels of TG animals were significantly reduced (8.68 ± 0.78 ng/mL) compared to TG (19.2 ± 2.3 ng/mL). (SG, p = 0.001), but there was a significant difference in the adiponectin levels (33.07 ± 3.89 pg/mL (TG) vs. 34.16 ± 1.14 pg/mL, (SG), p = 0.083).

**CONCLUSION:** Physical training was able to reduce body fat, adipocyte volume and leptin levels, but did not promote change in adiponectin levels.

**FINANCIAL SUPPORT:** FAPESP, CNPq

**3146 Board #111 June 1 2:00 PM - 3:30 PM Metabolic Inflexibility in the Acute Exercise Response of Type 2 Diabetics. Ciara O’Hagan1, Paul Medlow2, Josianne Rodrigues Krause3, Colin Murphy1, Gerard Colleran1, Gareth W. Davison, FACSM1, Colin AG Boreham, FACSM2, Giuseppe De Vito1, 1University College Dublin, Dublin, Ireland. 2University of Ulster, Belfast, United Kingdom. 3Institute of Technology Tallaght, Dublin, Ireland.

(Sponsor: Carl Foster, FACSM)

(No relationships reported)

**Metabolic flexibility (MF) has been defined as the ability to match fuel use to fuel availability. It is suggested that MF is diminished in type 2 diabetes and in obese, insulin-resistant adults, and that this is related to the accumulation of intramuscular lipids. Chronic exercise training has been shown to improve MF in response to hyperinsulimemic clamping and acute or chronic feeding of high-fat or high carbohydrate diets in type 2 diabetics, but MF responses to acute exercise bouts have not been investigated.**

**METHODS:** 16 overweight males [8 control (CON), 8 type 2 diabetic (T2D)] participated in this study. Subjects completed an incremental treadmill test from which an estimated VO2max was obtained, and workloads corresponding to 25%, 35% and 45% of estimated VO2max were calculated. On a separate visit after an overnight fast, fasted respiratory exchange ratio (RER) was obtained by indirect calorimetry, as an average over 10 minutes of measurement after 15 minutes of supine rest. Subjects then completed a 6 minute steady-state exercise bout on the treadmill at each of the pre-determined individualised intensities. ARER was calculated as the difference between fasted and steady-state exercise RER.

**RESULTS:** Data are presented as means ±SD. Between group differences were analysed by unpaired Student’s T-test, with significance set at p < 0.05.

**RESULTS:** CON were younger (51±5.7 vs 59 ±6.4 years) and fitter (37.2±3.6 vs 30.2±8.1 ml/kg/min estimated VO2max) than T2D (32.2 ±5.1 vs 30.7 ±14.4 kg/m²). T2D had significantly higher glycosylated haemoglobin (7.7 ± 0.8 vs 5.7 ± 0.3 %) and fasting plasma glucose (8.6 ± 1.5 vs 5 ± 2.6 mmol/L) than CON. There was no difference in resting RER between the groups (T2D 0.79 vs CON 0.78). Exercise RER was consistently higher in CON than T2D, and this was reflected by significant differences in ARER at the 25% and 35% intensities (25%: -0.03 ± 0.09 vs 0.35%: -0.02 ± 0.05 and a non-significant difference at 45% (+0.06 vs -0.3). **CONCLUSION:** These data suggest that individuals with type 2 diabetes have impaired MF in response to acute submaximal exercise challenges, relative to healthy controls. Supported by grants from the Irish Research Council for Science, Engineering and Technology, and the Higher Education Authority Technological Sector Research: Strand 3.

**3147 Board #112 June 1 2:00 PM - 3:30 PM Strength Training Ameliorates Non-alcoholic Fatty Liver Disease And Adiposity In Rats Fed On Fructose-rich Diet José D. Botezelli, Lucieli T. Cambri, Pedro F. Scarioti, Ana C. Ghezzi, Leandro F. Moura, Rodrigo A. Dalia, Carla Ribeiro, Amanda C. Silva, Maria A. Mello. Sao Paulo State University, Rio Claro-SP, Brazil.

(No relationships reported)

**Strength Training Ameliorates Non-alcoholic Fatty Liver Disease And Adiposity In Rats Fed On Fructose-rich Diet**

José D. Botezelli, Lucieli T. Cambri, Pedro F. Scarioti, Ana C. Ghezzi, Leandro F. Moura, Rodrigo A. Dalia, Carla Ribeiro, Amanda C. Silva, Maria A. Mello. Sao Paulo State University, Rio Claro-SP, Brazil.

(No relationships reported)

**PURPOSE:** Over the last three decades, the fructose consumption in developed countries increased almost 500%. The timing of the increase in the prevalence of obesity coincides with the increase of fructose in the diet in developed countries. Physical exercise is a powerful weapon used to reduce weight gain and triglyceride content in human beings and experimental model. The aim of this study is to analyze the effect of strength exercise on the development of T2D in rats (TG) concentration in the liver (non-alcoholic fatty liver disease marker), heart and visceral adipose tissue (adiposity marker).

**METHODS:** Thirty two male Wistar (120 days old) rats were randomly separated into four groups with eight rats per group: C (AIN-93 diet), F (High-fructose diet), CS (AIN-93 diet+ Strength training) and FS (High-fructose diet+ Strength training). C was composed by animals fed on balanced diet (AIN-93) whereas the F group by animals fed on a fructose rich diet (60% fructose). The 5 groups were subjected to a strength training protocol consisting in four series of ten jumps in water separated by one minute of rest, five days/week. After eight weeks the animals were killed via sodium thiopental administration to evaluate the triglyceride concentration (μmol/ml) using commercial kit. The results were statistically analyzed by two-way ANOVA and the significance level was set at p<0.05, different letters indicate significant difference.

**RESULTS:** Liver [TG] was higher in the F groups compared to C groups: Cs = 6.4±1.9, Cs = 9.2±2.7, F =72.8± 25.2, F=22.8± 6.2. No difference was observed on heart [TG]: C = 0.6±0.2, Cs = 0.6±0.1, F = 0.6±0.1, F=0.6±0.2. Mesenteric [TG] was lower in C group compared to other groups: C = 46.1±5.2, Cs = 59.6±5.6, F = 57.5±10.2, F=51.2±12.9. Retroperitoneal [TG] was higher in F group compared to the others. also CS group showed the lowest [TG]: C = 70.1±5.4, Cs = 56.1±8.0, F =11.5±2.85, F= 65.7±4.9. **CONCLUSIONS:** Fructose consumption led the animals to adiposity and non-alcoholic fatty liver disease. The heart [TG] of animals was not affected by diet or exercise training. Strength physical training was effective to protect the animals against the triglycerides infiltration in the liver and in the visceral adipose tissue. Supported by FAPESP Grant: 2009/15336-9
Obese subjects with impaired glucose tolerance (IGT) are more susceptible to oxidative stress and cardiovascular disease than healthy individuals.

**PURPOSE:** This randomised controlled investigation was designed to test the hypothesis that α-lipoic acid supplementation and exercise training may elicit favourable clinical changes in obese subjects with IGT.

**METHODS:** All data were collected from 24 obese (BMI ≥ 30 kg/m²) IGT patients. Following participant randomisation into two groups, fasting venous blood samples were obtained at baseline, and before and following intervention. The first group consisted of 12 participants who completed a 12 week control phase followed by 12 weeks of chronic exercise at 65% HReuc for 30 minutes a day, 5 days per week, while ingesting 1 gram per day of α-lipoic acid for 12 weeks. The second group consisted of 12 participants who completed the same 12 week control phase, but this was followed by 12 weeks of 1 gram per day of α-lipoic acid supplementation only (no exercise).

**RESULTS:** The main findings show a comparatively greater rate of low density lipoprotein (LDL) oxidation in the group consisting of α-lipoic acid only (p<0.05 vs. pre intervention), although total oxidant status was lower post intervention (p<0.05 vs. baseline) in this group. However, exercise and α-lipoic acid in combination attenuates LDL oxidation. Furthermore, in the α-lipoic acid plus exercise training group, total antioxidant capacity was significantly increased (p<0.05 vs. baseline and pre intervention). Body fat percentage and waist and hip circumference decreased following exercise training (p<0.05 vs. post intervention). There were no selective treatment differences for a range of other clinical outcomes including glycemic regulation (p>0.05).

**CONCLUSION:** These findings report that α-lipoic acid ingestion may increase the atherogenicity of LDL when ingested in isolation of exercise, suggesting that in IGT the use of this antioxidant treatment does not ameliorate metabolic disturbances, but instead may detrimentally contribute to the pathogenesis of atherosclerosis and development of CVD. However, when α-lipoic acid is combined with exercise, this atherogenic effect is abolished.

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**3148 Board #113 June 1 2:00 PM - 3:30 PM**  
**Exercise Training Combined With α-Lipoic Acid Ingestion Attenuates LDL Oxidation In Obesity With Improved Glucose Tolerance**  
Andrea McNeilly¹, Jane McEneny², Marie H. Murphy, FACSM³, Nida Nadeem³, Tom Trinick³, Ellie Duly³, Anna Novials³, Gareth W. Davison, FACSM³, ¹University of Ulster, Belfast, United Kingdom, ²Queens University, Belfast, United Kingdom, ³Ulster Hospital, Dundonald, United Kingdom. ¹Hospital Clinic, Barcelona, Spain.  
(No relationships reported)

**CONCLUSION:** was higher in lean children in both cases (p<0.01). However, glucose responses were not dependent on exercise between the two meals (p=0.37).

**RESULTS:** Exercise training has been deemed a beneficial treatment for obesity and insulin resistance induced by a high fat diet and may modulate its metabolic effects via AMPK activation, a key signaling molecule in metabolic regulation.

**PURPOSE:** To determine whether AMPKα2 activity in skeletal muscle is required to obtain exercise training benefits while under high fat-fed conditions.

**METHODS:** Wild type (WT) and AMPKα2 dominant negative (DN) male C57BL/6 mice were divided into control diet ± voluntary wheel running (CD, n=12; VWR, n=12) or high fat diet (60% fat Bio-Serv) ± VWR (HFD, n=12; VWR+HFD, n=12). After 6 wks, hindlimbs were perfused (550µM palmitate, 6nm glucose, [1-13C]palmitate, and 450µU/ml insulin).

**RESULTS:** As expected, obese children had poor lipolytic suppression following a meal vs. lean counterparts (delta MD glycerol: -12.3 ± 18.3 vs. -35.1 ± 32.3 uM, respectively; p<0.01). The lipolytic response in obese children to a second identical meal was no longer different from lean children (delta MD glycerol: -4.4 ± 19.2 vs. -8.1 ± 17.2 uM, obese vs. lean, respectively; p=0.36), and was dependent on an acute exercise bout between the meals (p<0.001). MD glucose was increased following both meals (p<0.001) prior to and following exercise, and this response was higher in the children in both cases (p<0.01). However, glucose responses were not dependent on exercise between the two meals (p=0.37).

**CONCLUSION:** These results suggest that poor suppression of lipolysis following feeding in obese children can be improved by implementation of a pre-meal exercise bout; however, glucose responses to a subsequent meal do not seem to be sensitive an exercise bout.

Acknowledgments: Funding support provided by NIDDK Grant R01 DK-071081.

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**3149 Board #114 June 1 2:00 PM - 3:30 PM**  
**AMPKα2 Down-Regulation Prevents Voluntary Wheel-Running-Induced Changes in Glucose Uptake But not in Fatty Acid Uptake in Mouse Skeletal Muscle**  
Marcia J. Abbott, Lorraine P. Tircotte, FACSM. University of Southern California, Los Angeles, CA. (Sponsor: Lorraine P. Tircotte, FACSM)  
(No relationships reported)

**RESULTS:** OverNight fasted obese (n=56) and lean (n=34) children (>95th and <85th percentile of age-adjusted BMI, respectively) had microdialysis (MD) probes (CMA/20, CMA/47) placed in subcutaneous abdominal adipose tissue (SCAT). Following 60 min of equilibration, interstitial metabolites (glycerol and glucose) were collected in 200 µl aliquots for 2 h.

**CONCLUSION:** Under HFD conditions, AMPKα2 signaling appears to be required for VWR-induced changes in GU but not for changes in FA metabolism that may be maintained by a rise in ERK1/2 signaling.
CONCLUSIONS:

was observed for Vmax PCoA in TGW (+17%, ns). In addition, sensitivity to PCoA was decreased after training (-100%, p<0.05), but treatment by GW compensated this effect (p<0.05) compared to 19% in SV. Nevertheless, compared to TV rats, Vmax PC increased in TGW (+37%, p<0.05) and PC relative utilization level is corrected at 18%. A lesser modification increase of 3-HAD activity (+59% ; p<0.001) after training, both Vmax for PC and PCoA were not altered. Normalized to maximal oxidative capacities, Vmax PC decreased to 13% in TV

δ

one of the molecular basis underlying the crossover concept since fatty oxidation would be shifted to higher LCFA concentration.

CONCLUSION:

Lean mass and body fat percentage were observed in both groups

RESULTS:

homeostasis model assessment of IR (HOMA-IR) (In addition, abdominal obesity is associated with negative balance of adiponectin and leptin. Leptin and adiponectin were not significantly improved compared to pre EX values (18.2 ± 2.4 vs 13.8 ±1.9 ng/ml, and 6.2±0.8 vs 7.9±0.1 µg/ml, P<0.07, respectively). No significant changes in lean mass and body fat percentage were observed in both groups.

CONCLUSION: 12-weeks of aerobic exercise training improves IR and A/L ratio occurred independently of significant changes in adiponectin and leptin levels. Therefore, A/L ratio may be a better indicator of changes in obesity as a consequence of aerobic training than individual adipokine changes in obese girls.

3152 Board #117

June 1  2:00 PM - 3:30 PM

Aerobic Exercise Training Improves Adiponectin Ratio And Insulin Resistance In Obese Adolescent Girls

Song Y. Park,1 Yeong H. Baek,2 Kook-Eun Seo3, Marcos A. Sanchez-Gonzalez3, Robert D. Sawyer4, Do-Joon Seo2, Jin Han2, Arturo Figueroa.1 1University of Utah, Salt Lake City, UT; 2Pusan National University, Busan, Korea, Republic of; 3Florida State University, Tallahassee, FL; 4Utah Valley University, Orem, UT; 5Inje University, Busan, Korea, Republic of.

No relationships reported

INTRODUCTION: Increased body fat, particularly in the abdomen, is associated with metabolic abnormalities including insulin resistance (IR) and resultant hyperinsulinemia in adolescents. In addition, abdominal obesity is associated with negative balance of adiponectin and leptin.

PURPOSE: The purpose of this study was to examine the effect of aerobic exercise training on IR and metabolic risk factors in obese girls.

METHODS: Twenty five obese girls (mean ± SEM, body mass index: 30 ± 3 kg/m and age: 16 ± 1.6 years) were randomly assigned to a control group (CON, n= 10) or exercise training group (EX, n=15; 30 min of supervised treadmill exercise at 65-70% of heart rate maximum, 3 days/week) for 12 weeks. Fasting levels of glucose, homeostasis model assessment of IR, insulin, adiponectin, and leptin as well as body composition (bioelectrical impedance) were assessed pre and post. Blood was drawn in adipoexin to leptin (A/L) ratio (P<0.05) and decreases in homeostasis model assessment of IR (HOMA-IR) (P<0.01), insulin (P<0.01), body weight (P<0.05), waist circumference (P<0.01), and BMI (P<0.01) were evident after EX compared with CON. The changes in adiponectin (+1.7±0.7 µg/mL, P<0.05) and leptin (-4.4±1.9 ng/ml, P<0.05) in EX were significantly changed as compared to CON. However, post EX values of leptin and adiponectin were not significantly improved compared to pre EX values (18.2±2.4 vs 13.8±1.9 ng/ml, and 6.2±0.8 vs 7.9±0.1 µg/ml, P<0.07, respectively). No significant changes in lean mass and body fat percentage were observed in both groups.

CONCLUSION: 12-weeks of aerobic exercise training improves IR and A/L ratio occurred independently of significant changes in adiponectin and leptin levels. Therefore, A/L ratio may be a better indicator of changes in obesity as a consequence of aerobic training than individual adipokine changes in obese girls.

3153 Board #118

June 1  2:00 PM - 3:30 PM

Brisk Walking Alters Postprandial Lipemia After Fructose Ingestion Differently In Normal-weight And Obese Individuals

Tim Heden, Ying Liu, Monica L. Kearney, Lauren J. Sims, Kevin C. Dellsperger, Adam T. Whaley-Connell, Anand Chockalingam, Lauryn M. Nyhoff, Michael H. Thomas, Jill A. Kanaley, FACSM. University of Missouri, Columbia, MO.

No relationships reported

Elevated postprandial triacylglycerol (TAG) concentrations are an independent risk factor for cardiovascular disease. Ingestion of fructose rich mixed meals amplifies the postprandial TAG response compared to fructose free mixed meals. Aerobic exercise performed prior to ingestion of a mixed meal lowers postprandial TAG concentrations. However, it has not been established if prior aerobic exercise lowers postprandial TAG to a fructose rich mixed meal.

PURPOSE: To determine the effect of 1 h of brisk walking performed 12 h prior to ingestion of a fructose rich mixed meal on postprandial lipemia in normal-weight and obese individuals.

METHODS: On two separate occasions 10 normal-weight (BMI < 25 kg/m²) and 10 obese (BMI > 30 kg/m²) individuals ingested a 600 calorie meal (45% carbohydrate [7.3% fructose], 40% fat, and 15% protein) in the morning after a 12 h overnight fast. Brisk walking (1 h, 55-60% maximal oxygen consumption) was performed 12 h prior to one of these two occasions (EX) while no exercise was performed prior to the other (NoEX). Blood samples were taken at baseline and 1, 2, 3, 4, and 6 h after the meal and analyzed for TAG, total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), and low density lipoprotein cholesterol (LDL-C). The incremental area under the curve (iAUC) was used to quantify postprandial responses. A mixed model ANOVA with Bonferroni post hoc tests were used to compare iAUC values.

RESULTS: In normal-weight individuals, EX significantly reduced the postprandial TC concentration 150% (EX: -10 ± 26 mg/dL 6h, NoEX: 20 ± 31 mg/dL 6h, P = 0.02) and LDL-C response 143% (EX: -17 ± 12 mg/dL 6h, NoEX: 8 ± 20 mg/dL 6h, P = 0.02). In obese individuals, brisk walking significantly reduced the postprandial TAG response 18% (EX: 381 ± 168 mg/dL 6h, NoEX: 454 ± 217 mg/dL 6h, P = 0.02) and attenuated the reduction in HDL-C (EX: -2 ± 6 mg/dL 6h, NoEX: -6 ± 6 mg/dL 6h, P = 0.02).

CONCLUSION: Performing 1 h of brisk walking lowers postprandial TAG and attenuates the drop in HDL-C after a fructose rich mixed meal in obese individuals. Furthermore, brisk walking lowers the postprandial TC concentration and LDL-C response in normal-weight individuals. Collectively, brisk walking prior to ingestion of a fructose rich mixed meal differentially, but beneficially, alters postprandial lipemia in normal-weight and obese individuals.

3154 Board #119

June 1  2:00 PM - 3:30 PM

Long Chain Fatty Acid Transport Limitation After Endurance Training Is Improved By Ppar-å Agonist

Alexandra Malgoyre, Julia Tonini, Alexandre Prola, Nadine Simler, Thomas Chailou, Bernard Serrurier, Xavier A. Bigard, Hervé Sanchez. IRBB CRSSA, LA TRONCHE cedex, France. (Sponsor: Major Robert Carter III, FACSM)

No relationships reported

Fatty acid oxidation is increased by aerobic exercise, but long chain fatty acids (LCFA) utilization is a well-known limiting factor of sub-maximal exercise duration. Although endurance performance is improved by PPAR-å agonist, the effects of endurance training associated with a PPAR-å agonist on fatty acids utilization remain unclear.

PURPOSE: To clarify the limiting steps of fatty acid utilization after endurance training, we studied PPAR-å agonist effect on LCFA transport in skeletal muscle mitochondria.

METHODS: Four groups of female rats were constituted: sedentary (S) and trained (T), treated by vehicle (V) or GW9742 (GW). The training program consisted in 5 running sessions/week for 5 weeks on a treadmill. Treatment was administered during the last 3 weeks. Endurance performances were determined through both a maximal aerobic velocity test (MAY) and time to exhaustion at 65% of individual MAY (T65). Maximal mitochondrial oxidative capacity (Vmax) for palmitoyl-carnitine (PC) and palmitoylCoA (PCoA) were measured in plantaris skinned fibers. Mitochondrial sensitivity (I/Km) was calculated with a Michaelis-Menten model.

RESULTS: Endurance training increased aerobic performance in both V (MAY: +53%, p<0.001 / T65: +53%, ns) and GW groups (MAY: +47%, p<0.001 / T65: +65%, p<0.05). Despite an increase of 3-HAD activity (+59% ; p<0.001) after training, both Vmax for PC and PCoA were not altered. Normalized to maximal oxidative capacities, Vmax PC decreased to 13% in TV (p<0.05) compared to 19% in SV. Nevertheless, compared to TV rats, Vmax PC increased in TGW (+37%, p<0.05) and PC relative utilization level is corrected at 18%. A lesser modification was observed for Vmax PCoA in TGW (+15%, ns). In addition, sensitivity to PCoA was decreased after training (<100%, p<0.05), but treatment by GW compensated this effect.

CONCLUSIONS: Endurance performance is slightly improved by a PPAR-å agonist treatment associated with aerobic training. Both CPT-1 and CPT-2 steps could explain the limitation of LCFA oxidation after endurance training. A PPAR-å agonist could correct CPT-2 limitation and partially CPT-1 one. Moreover alteration of PCoA sensitivity with endurance training could be one of the molecular basis underlying the cross over concept since fatty oxidation would be shifted to higher LCFA concentration.
Sedentary lifestyle and unhealthy diets lead to obesity and associated cardiovascular diseases. Lipotoxicity effects in cardiac cells are poorly known.

**PURPOSE:** As training optimizes fatty acid oxidation in skeletal muscle cells even with excess of fats, we studied the effect of exercise of saturated fatty acid palmitate on ventricular myocytes isolated from distinct models of metabolic disease (db/db and apolipoprotein E knockout, ApoE KO mice) and mice submitted (TR) or not (CT) to physical training.

**METHODS:** Cardiomyocytes were incubated with palmitate, we studied its effects on Ca2+ signaling, action potential and reactive oxygen species (ROS) levels. Exposure of cardiac cells from CT mice to palmitate led to Ca2+ signaling dysfunction characterized by a reduced (∆F0/F0= 4.80±0.2 vs. 3.6±0.2 ∆F0/F0, p<0.01) and slowed (decay time= 230.3±5 vs. 255.5±5.1 ms, p<0.01) Ca2+ transient. Interestingly, palmitate had not worsened the behavior of cardiomyocytes from db/db and ApoE KO mice. To understand Ca2+ signaling dysfunction induced by palmitate in cardiac cells from CT mice, we measured action potential and reactive oxygen species (ROS) levels.

**RESULTS:** There were no changes in action potential duration, but cells from CT mice exposed to palmitate increased ROS levels (DHE Fluorescence levels 98.4±16.16 vs. 197.8±22.79 a.u., p<0.01). We investigated whether cells from TR mice were protected from palmitate induced Ca2+ signaling dysfunction. Ca2+ transient amplitude and kinetics in cardiomyocytes from TR mice were enhanced (vs. CT) and not altered by palmitate exposure (∆F0/F0= 5.7±0.3 vs. 5.2±0.2, ns and decay time= 234±5.1 vs. 233±7.3±5 ms). Cardiomyocytes from TR mice presented significantly reduced basal ROS levels, still palmitate was able to induce ROS increase (DHE = 16.1±3.30 vs. 72.1±12.85 a.u., p<0.01).

**CONCLUSION:** Excessively increased fatty acid levels do not aggravate Ca2+ signaling dysfunction in cardiac cells from db/db and ApoE KO mice, but are related to Ca2+ signaling dysfunction in ventricular myocytes from CT mice. Moreover, physical training confers the ability to cardiomyocytes to deal with fatty acid excess, as seen by the lack of effect of palmitate in the Ca2+ transient, probably due to reduced basal production of superoxides by mitochondria in these cells. Supported by: NTNU and CAPES.

**Sao Paulo State University, Rio Claro, Brazil.**

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**Board #123 June 1 2:00 PM - 3:30 PM**

**Effects of Normobaric Hypoxic Training on Changes in Whole Body Adiposity and Regional Lipid Accumulation**

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(No relationships reported)

Previous studies demonstrated that muscular lipid content was correlated with total body fat and abdominal adipose tissue in obese men. Some studies indicated that 6 weeks of moderate intensity physical activity for obese men reduced visceral adipose tissue (VAT) but did not elicit any change in intramyocellular lipid (IMCL) content (Gan et al. 2003). However, the other study showed that moderate intensity training of 16 weeks for obese people increased IMCL despite decreased fat mass of the body (Dubé et al. 2008).

**PURPOSE:** To examine the effects of a short-term endurance training in normobaric hypoxic circumstances for sedentary young men on IMCL and extramyocellular lipid (EMCL) accompanied with whole body and regional adiposity including the VAT, subcutaneous abdominal adipose tissue (SAT), and intrahepatic lipid (IHL).
METHODS: Twenty-one sedentary healthy men participated in this study (Age 24.3 ± 5.5 yrs, BMI 25.5±3.0 kg/m²). Subjects conducted 12 time training sessions during a 2 or 4 week period. Each training session was lasting 60 min with a cycle ergometer at 65% of maximal oxygen uptake (VO2max) under normobaric hypoxic condition (FiO2 = 0.15). Before and after the training period, cross-sectional areas of VAT and SAT were determined by magnetic resonance imaging (MRI), and IMCL and EMCL of the right vastus lateralis muscle and IHL were evaluated by 1H-magnetic resonance spectroscopy. Body composition was measured by dual energy X-ray absorptiometry (DXA).

RESULTS: After the training period, body mass and body fat mass did not change significantly. IMCL was significantly increased from 11.1 ±2.0 mmol/kg to 14.5 ± 5.6 mmol/kg (P < 0.05). EMCL was not significantly changed from 25.8 ± 19.5 mmol/kg to 19.8 ± 10.3 mmol/kg (P = 0.11). IHL was significantly decreased from 59.8 ± 14.9 % to 50.0 ± 21.1 % (P < 0.01). VAT and SAT were not significantly changed (VAT: 53.4 ±39.0 cm² →50.6 ± 39.7 cm², P = 0.06, SAT: 185.4 ±43.9 cm² →183.1 ± 43.2 cm², P = 0.89).

CONCLUSIONS: These results indicated that the short-term endurance training in hypoxic condition increased the IMCL contents with no changes in EMCL, abdominal adipose tissue and whole body fat, but with decreasing IHL. This study was partly supported by the Nakami Foundation.

3159 Board #124  June 1  2:00 PM - 3:30 PM
The Effect of Conjugated Linoleic Acid on Fat Oxidation Following Short Term Aerobic Exercise.
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(No relationships reported)

There is evidential research supporting the use of conjugated linoleic acid (CLA) as an ergogenic nutriceutical to enhance fatty acid oxidation and improve total fat: lean muscle ratios. However, the potential benefit of CLA in normal weight females undertaking light aerobic exercise requires investigation.

PURPOSE: To determine the effect of CLA supplementation during a controlled 4 week aerobic exercise intervention on fat oxidation and body composition compared to a matched placebo (PL).

METHODS: Following familiarisation, 21 untrained female subjects (Age: 20.9±1.77 years; Height: 163.25±5.80 cm; Weight: 64.06±4.53 kg) undertook baseline laboratory assessments for maximal oxygen uptake (VO2max = 1.23±0.265 L.min⁻¹), peak fat oxidation (FAmax = 0.128±0.037 g.min⁻¹) and body composition. Subjects were then randomly assigned to one of three conditions: 1) 3g.d⁻¹ gelatin capsule CLA; 2) 3g.d⁻¹ gelatin capsule PL (olive oil) or 3) control only, no supplementation/exercise (CON). Supplements were administered weekly in a double-blind manner. For the CLA/PL groups, participants undertook 3x30 minutes exercise weekly at individual FAmax over a 4 week intervention period. Fat oxidation was assessed via stoichiometric calculations utilising expired air sampling at week 2 and 4. Fat mass (FM) and fat free mass (FFM) were also measured at these time points.

RESULTS: Baseline FAmax was not significantly different between conditions at week 0 (P=0.207). However, by week 4, FAmax was significantly greater with CLA compared to CON only (0.204±0.022 g.min⁻¹ and 0.115±0.043 g.min⁻¹; P=0.02). Baseline FM and FFM was not significantly different between conditions at week 0 (P=0.87 and P=0.78 respectively). Additionally, no significant differences were found for either FM (CLA: 20.3±1.39 kg; PL: 20.3±0.88 kg; CON: 20.2±0.83 kg; P=0.99) or FFM (CLA: 43.47±1.9 kg; PL: 44.57±1.06 kg; CON: 44.65±1.71 kg; P=0.79) between conditions at week 4.

CONCLUSION: Acute CLA supplementation may enhance maximal fat oxidation rates. It is possible that the trans-10, cis-12 isomer found in CLA may augment the activity of carnitine palmitoyltransferase responsible for mitochondrial beta-oxidation. CLA supplementation did not improve body composition over a four week exercise intervention in untrained female subjects.

3160 Board #125  June 1  2:00 PM - 3:30 PM
Niacin Supplementation Limits Fat Utilization During Short-Term Cycling Exercise
Gregory R. Davis, Candyl Trionfante, Arnold G. Nelson, FACSM. Louisiana State University, BATON ROUGE, LA.
(No relationships reported)

The hydrolysis of fatty acids (FA) from triglyceride (TG) molecules in adipose tissue may be a limiting factor in aerobic exercise performance and impaired hydrolysis may be linked to the development of insulin resistance. Niacin, also known as nicotinic acid or vitamin B3, decreases TG breakdown and FA mobilization in adipose tissue while caffeine enhances FA mobilization from adipose tissue.

PURPOSE: To determine how time to exhaustion and substrate utilization are affected by caffeine versus niacin supplementation during a progressive-intensity aerobic exercise bout lasting less than 30 min.

METHODS: 17 young, healthy, active, untrained males completed three identical progressive-intensity aerobic exercise trials. Utilizing a balanced, randomized double blind crossover design, participants were administered one of three supplements, caffeine (C) (5mg/kg of body weight), niacin (N) (1000 mg), or placebo (P) (30 minutes prior to each trial). Substrate utilization was determined through gas analysis and time to exhaustion was recorded for each trial. Each trial was separated by a one week wash-out period.

RESULTS: N treatment had significantly higher (p<0.05) respiratory quotient (RQ) compared to P and C (N=0.98±0.05 vs. P= 0.88±0.05 vs. C=0.88±0.06) (mean± std. dev.) and consequently, percentage of carbohydrate (CHO) utilization was higher for N compared to P and C (N=80%±13 vs. P=61%±17 vs. C=62%±20). Time to exhaustion was significantly different for all three trials (N=24.4±3.8 vs. P=25.5±3.1 vs. C=27±3.4).

CONCLUSIONS: In untrained individuals, progressive-intensity aerobic exercise lasting less than 30 min is highly dependent on the body’s ability to utilize CHO for fuel, however the ability to mobilize FA’s from adipose is also critically important for this type of performance.

3161 Board #126  June 1  2:00 PM - 3:30 PM
Effects Of Ovariectomy And Resistance Training On Lipid Metabolism And Oxidative Stress In Rats Liver
Mateus M. Domingos, Maria Fernanda Cury Rodrigues, Uliana Sbeguen Stotzer, Danilo Rodrigues Bertucci, Markus Vinicius Campos Souza, Camila do Valle Gatto, Yone Sato, Heloisa Sobreiro Selistre de Araújo, Sérgio Eduardo de Andrade Perez. Federal University of São Carlos, São Carlos, Brazil.
(No relationships reported)

Estrogen deficiency is associated with hepatic steatosis (HS), through changes in gene expression of molecules related to fat oxidation and lipogenesis and increased oxidative stress (OS). Resistance training (RT) may reduce the HS in ovariectomized (Ovx) rats.

PURPOSE: To assess the effects of RT on the gene expression of molecules related to lipid metabolism and OS markers in the liver of ovariectomized rats (Ovx).

METHODS: Adult Sprague-Dawley rats were divided into four groups (n = 8 per group): sham sedentary (Sham-Sed), Ovx sedentary (Ovx-Sed), Sham-Rt and Ovx-Rt. A 10-week RT period during which the animals climb a 1.1 m vertical ladder with weights attached to their tails. The sessions were performed three times a week, with 4-9 climbs. Gene expression was analyzed by RT-PCR by the ΔΔCt method. The EO was measured by levels of reduced glutathione (GSH) and oxidized glutathione (GSSH), lipid peroxidation (LP), concentration of vitamin E. A two-way analysis of variance (ANOVA) test was used to compare the variables RT with Ovx.

RESULTS: The Ovx decreased the gene expression of molecules related to fat oxidation, carnitine palmitoyltransferase I (53%, p<0.05) and β-hydroxyacyl-CoA dehydrogenase (27%, p<0.05), increased of molecules related to lipogenesis, sterol regulatory element-binding protein-1c (106%, p<0.05), and stearoyl CoA desaturase-1 (109%, p<0.05), decreased in the (GSH/GSSH) ratio (28%, p<0.05), vitamin E concentration (45%, p<0.05) and no significant change was detected in the LP. The ovariectomy-induced changes in expression of molecules related to lipid metabolism were restored by RT. However, the OS markers were not reversed by the RT.

CONCLUSION: The present results indicate that the RT has important effects on the prevention of HS in Ovx animals, through changes of molecules related to hepatic lipid metabolism. Nevertheless, the RT program adopted did not reverse the effects of Ovx in hepatic OS markers.
During the aging process, there is a reduced capacity for physical exertion that impairs functionality. Both aerobic exercise capacity (VO\textsubscript{peak}) and strength are reduced with age, and lifestyle choices may impact the severity of the decline. Specifically the types of dietary fats consumed may moderate the relative decline in physical function.

**PURPOSE:** Using the senescence-accelerated SAMP8 mouse model, a model for sarcopenia and other age-related disabilities, we studied the effect of dietary trans-fatty acids upon body composition, aerobic exercise capacity, and strength.

**METHODS:** From weaning, male SAMP8 mice were assigned either to control diet (Con) containing no partially hydrogenated oils or a diet from which 2 percent of energy was from trans-fatty acids (TFA diet). At 25 weeks of age (young, Y) and at 60 weeks of age (old, O), body composition was measured by magnetic resonance, VO\textsubscript{peak} with an enclosed treadmill and metabolic measurement system, and strength with a grip strength meter. Strength and VO\textsubscript{peak} were normalized for fat-free mass (FFM). Results were analyzed by analysis of variance and planned comparisons.

**RESULTS:** There was an age related increase in body fat mass (P < 0.05), but this increase was blunted on the TFA diet such that O-TFA was significantly different (P < 0.05) from O-Con (Y-Con, 3.2 +/- 0.6; Y-TFA, 3.3 +/- 0.7; O-Con, 7.5 +/- 1.8; O-TFA, 3.9 +/- 0.4 g body fat). There was an age related decrease in VO\textsubscript{peak} and grip strength on the Con diet (P < 0.05). The TFA diet caused an additional reduction in VO\textsubscript{peak} at young age (P < 0.05) (Y-Con, 11.148 +/- 345; Y-TFA, 10.185 +/- 181; O-Con, 10.139 +/- 199; O-TFA, 10.284 +/- 211 mL/gFFM/hr).

As well, in comparison to Con, the TFA diet led to a trend for further reduction of grip strength at old age (Y-Con, 6.0 +/- 0.6; Y-TFA, 5.9 +/- 0.5; O-Con, 5.5 +/- 0.2; O-TFA, 4.7 +/- 0.4 grams force / g FFM) (O-Con vs O-TFA, P = 0.056).

**CONCLUSIONS:** The SAMP8 mouse model exhibits age-related declines in physical function. Furthermore, consumption of a diet containing even a modest amount of trans-fatty acids leads to further impairment in exercise capacity. This may be related to dysregulation of lipid metabolism and deposition. The results have implications for effects of dietary fatty acid composition upon incidence of sarcopenia and loss of functionality across the lifespan.

**Board #128**
June 1 2:00 PM - 3:30 PM
Effect Of Post-exercise Dietary Intervention On The Markers Of Energy Metabolism And Lipid Synthesis

Wen-Hsin Chang\textsuperscript{1}, Yi-Ting Pan\textsuperscript{2}, Mei-chih Hsu\textsuperscript{2}, Shene-Pin Hu\textsuperscript{3}, Jen-Fang Lai\textsuperscript{4}, \textsuperscript{1}Kaohsiung Medical University, Kaohsiung, Taiwan. \textsuperscript{2}National Taiwan Sport University, Taoyuan, Taiwan. \textsuperscript{3}Taipei Medical University, Taipei, Taiwan. \textsuperscript{4}University, Taoyuan, Taiwan.

**(No relationships reported)**

Intense or prolonged physical exercise causes the loss of body water, the depletion and exhaustion of fuel stores, imbalances in the status of nutrients and various homeostatic disturbances of hormones. In the process of recovery after exercise, nutrition intervention is a central consideration for rehydrating and refueling the body.

**PURPOSE:** The study was to investigate the effects of different dietary composition after exercise on energy metabolic markers and the protein expression of lipid synthesis-related genes in healthy men.

**METHODS:** Twelve healthy male subjects (21.3 ± 0.4 yr, 52.8 ± 1.2 VO\textsubscript{2max}) participated in a randomized, crossover-design diet intervention, where they consumed either water (300 mL, Control diet, CON), 15% glucose drink (300 mL, 300 Kcal, Glucose diet, GD), or an isocaloric balanced diet (300 Kcal, 60% carbohydrate, 26% fat, and 14% protein, Normal diet, ND) after a medium-intensity exercise test (65 VO\textsubscript{2max}, 30 min), with 2 weeks rest period in between. Blood samples were taken before exercise and at 0 (Eat-0), 1 (Eat-1), 2 (Eat-2), and 3 (Eat-3) hours after eating.

**RESULTS:** Compared with the CON, the GD and ND consumption significantly elevated glucose (116 ± 5.8 vs. 104 ± 4.3 vs. 84.4 ± 1.7 mg/dL for GD, ND, and CON, respectively, p < 0.05) and insulin (28.0 ± 2.9 vs. 21.6 ± 2.5 vs. 4.24 ± 0.4 mU/L, p < 0.05) concentrations and decreased free fatty acid (0.17 ± 0.06 vs. 0.24 ± 0.05 vs. 0.54 ± 0.06 mmol/L, p < 0.05) level at 1 hour after eating. Serum TG concentration was greater for ND than GD and CON (69.7 ± 3.9 vs. 57.7 ± 3.2 vs. 54.8 ± 3.3 mg/dL, p < 0.05). However, the protein expression of ChREBP (carbohydrate responsive element binding protein), ACC (acyl-coenzyme A carboxylase), and FAS (fatty acid synthase), the markers of lipid synthesis, did not differ between diets.

**CONCLUSIONS:** From this study shows that a balanced diet consumption after exercise may have a greater influence on energy utilization, but not on the protein expression of lipid synthesis-related genes.

**Board #129**
June 1 2:00 PM - 3:30 PM
Effect Of Lifelong trans-Fatty Acid Intake On Exercise Capacity In Senescence-accelerated Mice

Wen-Hsin Chang\textsuperscript{1}, Yi-Ting Pan\textsuperscript{2}, Mei-chih Hsu\textsuperscript{2}, Shene-Pin Hu\textsuperscript{3}, Jen-Fang Lai\textsuperscript{4}, \textsuperscript{1}Kaohsiung Medical University, Kaohsiung, Taiwan. \textsuperscript{2}National Taiwan Sport University, Taoyuan, Taiwan. \textsuperscript{3}Taipei Medical University, Taipei, Taiwan. \textsuperscript{4}University, Taoyuan, Taiwan.

**(No relationships reported)**

During the aging process, there is a reduced capacity for physical exertion that impairs functionality. Both aerobic exercise capacity (VO\textsubscript{peak}) and strength are reduced with age, and lifestyle choices may impact the severity of the decline. Specifically the types of dietary fats consumed may moderate the relative decline in physical function.

**PURPOSE:** Using the senescence-accelerated SAMP8 mouse model, a model for sarcopenia and other age-related disabilities, we studied the effect of dietary trans-fatty acids upon body composition, aerobic exercise capacity, and strength.

**METHODS:** From weaning, male SAMP8 mice were assigned either to control diet (Con) containing no partially hydrogenated oils or a diet from which 2 percent of energy was from trans-fatty acids (TFA diet). At 25 weeks of age (young, Y) and at 60 weeks of age (old, O), body composition was measured by magnetic resonance, VO\textsubscript{peak} with an enclosed treadmill and metabolic measurement system, and strength with a grip strength meter. Strength and VO\textsubscript{peak} were normalized for fat-free mass (FFM). Results were analyzed by analysis of variance and planned comparisons.

**RESULTS:** There was an age related increase in body fat mass (P < 0.05), but this increase was blunted on the TFA diet such that O-TFA was significantly different (P < 0.05) from O-Con (Y-Con, 3.2 +/- 0.6; Y-TFA, 3.3 +/- 0.7; O-Con, 7.5 +/- 1.8; O-TFA, 3.9 +/- 0.4 g body fat). There was an age related decrease in VO\textsubscript{peak} and grip strength on the Con diet (P < 0.05). The TFA diet caused an additional reduction in VO\textsubscript{peak} at young age (P < 0.05) (Y-Con, 11.148 +/- 345; Y-TFA, 10.185 +/- 181; O-Con, 10.139 +/- 199; O-TFA, 10.284 +/- 211 mL/gFFM/hr).

As well, in comparison to Con, the TFA diet led to a trend for further reduction of grip strength at old age (Y-Con, 6.0 +/- 0.6; Y-TFA, 5.9 +/- 0.5; O-Con, 5.5 +/- 0.2; O-TFA, 4.7 +/- 0.4 grams force / g FFM) (O-Con vs O-TFA, P = 0.056).

**CONCLUSIONS:** The SAMP8 mouse model exhibits age-related declines in physical function. Furthermore, consumption of a diet containing even a modest amount of trans-fatty acids leads to further impairment in exercise capacity. This may be related to dysregulation of lipid metabolism and deposition. The results have implications for effects of dietary fatty acid composition upon incidence of sarcopenia and loss of functionality across the lifespan.

**Board #130**
June 1 2:00 PM - 3:30 PM
The Effects Of Short And Long Term Watercress Ingestion On Exercise-induced DNA Damage And Lipid Peroxidation

Gareth W. Davison, FACSM\textsuperscript{1}, Fogarty Mark\textsuperscript{2}, George Burke\textsuperscript{3}, John Brown\textsuperscript{1}, Ciara Hughes\textsuperscript{1}, \textsuperscript{1}University of Ulster, Belfast, United Kingdom. \textsuperscript{2}Napier University, Edinburgh, United Kingdom.

**(No relationships reported)**

Pharmacological antioxidant vitamins are routinely used for a prophylactic effect against exercise-induced oxidative stress. However, large doses are often required and may lead to a state of pro-oxidation and oxidative damage. Watercress contains compounds beyond their nutritional value which may increase protection against exercise-induced oxidative stress.

**PURPOSE:** This randomised controlled investigation was designed to test the hypothesis that acute (consumption 2 hours prior to exercise) and chronic (eight weeks consumption) watercress supplementation can attenuate exercise-induced oxidative stress.
PURPOSE: Ten (n=10) apparently healthy male subjects (age 23 ± 4yrs, stature 179 ± 10cm and body mass 74 ± 15kg), randomly assigned to either a control (no supplementation) or watercress supplementation group, volunteered to give blood at baseline (pre-supplementation), at rest (pre-exercise) and following exercise. Each subject completed an incremental exercise test to volitional exhaustion following acute and chronic watercress supplementation or control.

RESULTS: The main findings show an exercise-induced increase in DNA damage and lipid peroxidation over both acute and chronic control supplementation phases (P<0.05 vs. supplementation), while acute and chronic watercress attenuated DNA damage and lipid peroxidation and decreased hydrogen peroxide accumulation following exhaustive exercise (P<0.05 vs. control). A marked increase in the main lipid soluble antioxidants (α-tocopherol, γ-tocopherol and xanthophyll) was observed following watercress supplementation (P<0.05 vs. control) in both experimental phases.

CONCLUSION: These findings suggest that short and long term watercress ingestion has potential antioxidant effects against exercise-induced DNA damage and lipid peroxidation.

3166  Board #131  June 1  2:00 PM - 3:30 PM
The Effects of Fish Oil Supplementation on Markers of Inflammation in Chronic Kidney Disease Patients
Erika Deike¹, Rodney Bowden², Jen Moreillon³, Jackson Griggs³, Ronald Wilson³, Matt Cooke³, Brian Shelmadine³, Alexander Beaumien⁵, ¹Wayland Baptist University, Plainview, TX. ²Baylor University, Waco, TX. ³Family Health Center, Waco, TX. ⁵Victoria University, Victoria, Australia.

PURPOSE: A characteristic of chronic kidney disease (CKD) is excessive production of pro-inflammatory cytokines. The benefits of fish oil (FO) for an extensive range of populations and health concerns are apparent, yet the anti-inflammatory benefits for non-dialysis CKD patients are equivocal. Therefore, the purpose of this study was to investigate the effects of daily consumption of FO on IL-1β, IL-6, and TNF-α for 8 weeks in non-dialysis CKD patients.

METHODS: The study was conducted using a double blind, randomized, placebo-controlled experimental design. Thirty-one non-dialysis CKD patients were followed prospectively for 8 weeks while supplementing FO (2.4g/day (1400 mg EPA + 1000 mg DHA) or placebo (safflower oil) in their diet. MAIN OUTCOME MEASURES: IL-1β, IL-6, and TNF-α were all measured as markers of inflammation at pretest and at 8-weeks.

RESULTS: One-way ANOVA revealed no significant differences in IL-6 (p=.06), IL-1β (p=.18), and TNF-α (p=.20) between groups at baseline. Additionally, no pretest differences existed between groups for age (p=.549), weight (p=.524), waist circumference (p=.086), gender (p=.591) and ethnicity (p=.875). ANCOVA was calculated using compliance, age, gender, ethnicity, body weight, and waist circumference as covariates. No significant differences were discovered between groups after FO supplementation for IL-6 (p=.453), and TNF-α (p=.242). A significant difference was discovered for IL-1β (p=.050) with lower levels in the FO group.

CONCLUSIONS: The results of this study is in agreement with some previous studies that suggest that FO supplementation has no effect on plasma pro-inflammatory cytokines TNF-α or IL-6, but does have an effect on IL-1β in non-dialysis CKD patients. The protective effects in this study and others are due primarily to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) found in FO. Inflammation plays a significant role in cardiovascular disease in CKD patients with novel approaches needed to reduce the risk of cardiovascular disease.

3167  Board #132  June 1  2:00 PM - 3:30 PM
Maximizing Fat Utilization Postexercise with a Novel Low Glycemic Carbohydrate Meal
Ryan J. Lubbe¹, Nicholas T. Kruse¹, Marcus W. Barr¹, Bruce R. Hamaker¹, Michael R. Kushnick¹, ¹Ohio University, Athens, OH. ²Purdue University, West Lafayette, IN.

PURPOSE: To evaluate metabolic cost (VO₂max) and substrate utilization (RER) after consumption of a low GI CHO, high GI CHO, and control (500mL H₂O) during the recovery from a previous bout of exercise.

METHODS: A repeated-measures ANOVA model was used with LSD post hoc analyses where applicable. Means ± standard deviations are presented. Ten healthy, non-smoking, college-aged men (21 ± 2yrs) with average body composition (14.00 ± 1.82 % fat) and above average aerobic fitness (53.20 ± 2.87 mL/kg/min) were recruited. Participants completed three trials each in random order. Each trial began with a treadmill walk at 60% of their predetermined VO₂max until 300kcal were expended, followed by consumption of 300kcal of a low GI CHO, high GI CHO, or a control. Then measurements of ventilatory gases were made during a two hour recovery period.

RESULTS: There were no significant differences in VO₂ among trials. However, RER was significantly different among trials and across time - presented in the table below.

CONCLUSION: In this sample, consuming a low GI CHO after a bout of exercise helped to maintain fat oxidation during the first hour of a two hour recovery.

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Low GI CHO</th>
<th>High GI CHO</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (pre)</td>
<td>RER</td>
<td>RER</td>
<td>RER</td>
</tr>
<tr>
<td>1 (10-15)</td>
<td>0.79±0.08</td>
<td>0.78±0.10</td>
<td>0.81±0.06</td>
</tr>
<tr>
<td>2 (25-30)</td>
<td>0.79±0.05</td>
<td>0.82±0.09</td>
<td>0.79±0.05</td>
</tr>
<tr>
<td>3 (40-45)</td>
<td>0.82±0.05</td>
<td>0.85±0.06</td>
<td>0.81±0.05H</td>
</tr>
<tr>
<td>4 (55-60)</td>
<td>0.83±0.03</td>
<td>0.88±0.05C</td>
<td>0.83±0.05H</td>
</tr>
<tr>
<td>5 (70-75)</td>
<td>0.82±0.06</td>
<td>0.93±0.10C</td>
<td>0.81±0.05</td>
</tr>
<tr>
<td>6 (85-90)</td>
<td>0.84±0.03G</td>
<td>0.91±0.05C</td>
<td>0.82±0.03H</td>
</tr>
<tr>
<td>7 (100-105)</td>
<td>0.87±0.07F</td>
<td>0.92±0.11C</td>
<td>0.80±0.03</td>
</tr>
<tr>
<td>8 (115-120)</td>
<td>0.87±0.03E</td>
<td>0.95±0.11C,D</td>
<td>0.81±0.08</td>
</tr>
</tbody>
</table>

*Last 5 minutes of a 10 minute measurement period; ¹High>Low;Control; ²Low>Control; across High: ³4.8±1, ⁴8±6, ⁵7±1, ²>1, ²>2, ³>6; across Control: ⁴3,4,6,2; ²>5
Funded: Provost’s Research Fund-Ohio University
FREE COMMUNICATION/POSTER - INJURY

3168 Board #133 June 1 3:30 PM - 5:00 PM

**Treatment Of Acute Lateral Ankle Sprain With Tape Or Brace: A Randomized Controlled Trial**

Ellen Klemier, Ingrid P. van de Port, Amo Hoes, Frank J.G. Backx. University Medical Centre Utrecht, Utrecht, Netherlands. (No relationships reported)

**PURPOSE:** Ankle sprains are the most common sports injuries often leading to pain and other impairments including physical limitations and recurrences of an ankle sprain. The risk of re-spraining within a period of 3 years after the initial ankle sprain ranged from 3 to 34%. Since the nineties functional treatment of ankle sprains is recommended. Nowadays, the regular treatment of an acute lateral ankle sprain includes ankle taping, the use of an ankle brace is conventional to prevent re-injuries. The purpose of this randomized controlled clinical trial is to investigate the effect of a 4-week treatment with an ankle brace (soft brace) compared to the treatment with ankle tape on recurrent strain and residual symptoms within one year in patients with an acute lateral ankle sprain.

**METHODS:** Patients (aged > 18 yrs) with an acute lateral ankle sprain caused by an inversion trauma were included after visiting the emergency departments of two participating hospitals, their GP practitioner or physiotherapist. All participants were sequentially randomized to the treatment group (ankle brace) or control group (ankle tape). A sports physician conducted an anamnesis and a physical exam during which the ankle was examined for swelling, discoloration by hematoma, limited dorsoflexion and tenderness at baseline. Tests were performed to measure passive and active ankle stability. After baseline measurements, a 4-week treatment with brace or tape started. At week 5, 9, 13, 26 and 39 post-trauma, patients had to fill in online questionnaires asking about re-injuries and residual symptoms. After 52 weeks a final assessment with a physical exam by a sports physician took place.

**RESULTS:** In total 157 patients with an acute lateral ankle sprain participated in the study. Within 52 weeks after the initial injury 11 patients in the tape group and 13 in the brace group re-injured their ankle (HR 1.1, 95% CI 0.5 to 2.5). Of the residual symptoms, only the anterior drawer sign test showed a significant difference detrimental to the brace group (OR 3.3, 95% CI 1.3-8.1).

**CONCLUSIONS:** The ankle brace is not more effective in the treatment of acute lateral ankle sprains. However, results suggest equal effectiveness which might lead to the conclusion that both ankle tape and ankle brace can be used to treat lateral ankle sprains.

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3169 Board #134 June 1 3:30 PM - 5:00 PM

**Risk Factors Associated with Running Injuries in the United States Army**

Tyson Grier, Michelle Canham-Chervak, Vancil McNulty, Bruce H. Jones, FACSM. Army Institute of Public Health, Aberdeen Proving Ground, MD. (No relationships reported)

Running injuries result from the interaction of a number of extrinsic and intrinsic risk factors. **PURPOSE:** To identify risk factors associated with injuries attributed to running in U.S. Army Soldiers.

**METHODS:** Participants were male soldiers in a deploying U.S. Army unit (n=1320). Injury data, limited duty days, physical fitness, tobacco use, and previous Army physical fitness test (APFT) scores were obtained by survey. APFT variables (push-ups, sit-ups and 2 mile run) were converted into quartiles (Q), where Q1 = lowest performance and Q4 = highest performance. Odds ratios (OR) and 95% confidence intervals (95% CI) were obtained from multivariable logistic regression.

**RESULTS:** Overall injury incidence for the prior 12 months was 49% (n=652), with 28% of injured Soldiers (n=180) attributing their injuries specifically to running. Limited duty profiles were given to 76% of the Soldiers (n=137) injured while running, with 62% (n=80) of the profiles limiting duty from 1-30 days. Higher risk of injury was independently associated with higher BMI (OR=1BMI 26-29/BMI29=1.08, 95%CI 1.07-3.65), (OR=1BMI 30+BMI29=2.27, 95%CI 1.10-4.71), miles road marched per month (OR =5.1-10 miles/5 miles = 1.86, 95%CI 1.03-3.34), (OR=20.1miles/≤5miles = 1.98, 95%CI 1.06-3.68), and poor aerobic endurance as measured by 2 mile run performance (OR Q2/Q4 = 1.99, 95%CI 1.07-3.72), (OR Q1/Q4 = 2.25, 95%CI 1.18-4.29). A lower risk of injury was independently associated with resistance training 1-2 times a week compared to no resistance training (OR =1-2 times per week/no) = 0.50, 95%CI 0.29-0.85).

**CONCLUSION:** Running-related injuries accounted for over a quarter of all reported injuries. Countermeasures to prevent such injuries might entail enhancing aerobic endurance, decreasing excess body fat, reducing the number of miles road marched per month, and resistance training 1-2 times per week.

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3170 Board #135 June 1 3:30 PM - 5:00 PM

**Air Evacuated Non-Battle Injuries Diagnosed As Sport-Related Musculoskeletal Conditions, Us Army 2001-2010**

Morgan Clemenin, Bonnie J. Taylor, Keith G. Hauret, FACSM, Bruce H. Jones, FACSM. Army Institute of Public Health, Aberdeen Proving Ground, MD. (No relationships reported)

Sports and exercise are leading causes (23%) of non-battle injuries (NBI) requiring medical air evacuation from ongoing military operations in Iraq and Afghanistan. Epidemiologic reports of sport-related injuries often capture traumatic injuries (ICD-9 codes 800-959) but not injury-related musculoskeletal (MSK) conditions (ICD-9 codes 716-739) which include overuse and recurrent injuries. Since injury-related MSK conditions are not routinely monitored it is difficult to ascertain their impact on lost duty days, operational readiness, and Soldier quality of life. **PURPOSE:** To examine the incidence, rates, and causes of MSK injuries requiring air evacuation of deployed Army soldiers from Iraq or Afghanistan (2001-2010).

**METHODS:** Air evacuation records were used to identify Soldiers air evacuated from Iraq or Afghanistan between Oct 2001 and Dec 2010 for MSK NBI (ICD-9 codes 716-739). Cause of injury was determined by experienced coders based on incident narratives. Analyses used descriptive statistics to report incidence, rates and cause.

**RESULTS:** Of the 7,304 MSK NBI air evacuations, 998 were sports-related. Physical training was the leading cause (25%), followed by weightlifting (24%) and basketball (23%). The rate of sports-related MSK conditions was nearly double for Soldiers in the 30+ year age group (9.0 per 10,000 deployed Soldiers) compared to the <30 year age group (4.8 per 10,000 deployed Soldiers). Soldiers in the 30+ year age group had a significantly greater rate of basketball (p<0.01), physical training (p<0.01), football (p<0.05), and weightlifting (p<0.01) MSK injuries. Overall, knee (25%), back (14%), shoulder (14%), and ankle (13%) were the body parts associated with the majority of these injuries. On average, 81% of Soldiers air evacuated with sports-related MSK injuries are not returned to theater.

**CONCLUSIONS:** As a leading contributor to potentially preventable injuries, strategies to mitigate sports-related MSK NBI should be implemented into existing injury safety programs. Injury prevention programs for sports-related MSK injuries must receive adequate resources to provide Soldiers with protective gear and useful additional tools.

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3171 Board #136 June 1 3:30 PM - 5:00 PM

**Life-threatening Injuries Attributable To Sports Activity**

William P. Meehan, III, Rebekah Mannix. Children's Hospital Boston, Boston, MA. (No relationships reported)

**PURPOSE:** Determine the proportion of life-threatening injuries (LTIs) attributable to sports activity.

**METHODS:** We examined the National Hospital Ambulatory Care Survey database for emergency department visits between the years 1999 and 2008. LTIs were defined as International Classification of Diseases, Ninth Revision, Clinical Modification codes T80.0-T89.9.
Classification of Diseases, 9th Revision codes for skull fracture [800.xx-802.xx, 803.x-804.xx], cervical spine fractures [805.xx-806.05], liver lacerations [864.xx], and/or spleen lacerations [865.xx], traumatic aortic aneurysm or rupture [901.0; 902.0] and gastric/duodenal rupture [537.89]. We defined sport-related as having an external cause of injury code that was exclusively sport-related or when a text search of the visit confirmed the injury was sport-related.

**RESULTS:** Of the 300,394 observed ED visits, 0.5% (95% CI 0.5, 0.5) were for LTIs. Overall, 14% (95% CI 12, 17) of LTIs were sport-related, representing 890,000 ED visits in the 10 year sample. Of all visits for LTIs in children, 31% were sport-related (95% CI 25, 37); including 39% of all LTIs in children ages 6-18 years. In adults, 9% of LTIs (95% CI 7, 11) were sport-related. For adults aged 19-44 years, 12% (95% CI 9, 15) of LTIs of the head and neck were sport-related.

Of all pediatric cervical spine fractures, 23% (95% CI 6.5, 55) were sport-related. Seven percent (95% CI 4, 11) of cervical spine injuries in adults were due to sports injuries, representing 110,000 cervical spine injuries in the 10 year sample. Sports injuries accounted for 10% (95% CI 5, 20) of intracranial hemorrhages in adults, 4% (95% CI 1, 15) in children.

**CONCLUSION:** An estimated 89,000 LTIs secondary to sports activity occur annually. Nearly 40% of all life threatening injuries sustained by children between the ages of 6 and 18 years are sport-related. This represents a unique opportunity for prevention. Rule changes, protective equipment, and focused training have proven effective in decreasing sports injuries in the past. Given the proportion of all life-threatening injuries attributable to sports, and the ability to control the circumstances surrounding athletic injuries, further study of life threatening injuries in athletics is warranted.

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**Table 1:**

<table>
<thead>
<tr>
<th>Category</th>
<th>Events</th>
<th>Percent (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical spine fractures in children</td>
<td>23% (95% CI 6.5, 55)</td>
<td></td>
</tr>
<tr>
<td>Cervical spine injuries in adults</td>
<td>7% (95% CI 4, 11)</td>
<td></td>
</tr>
<tr>
<td>Intracranial hemorrhages in children</td>
<td>10% (95% CI 5, 20)</td>
<td></td>
</tr>
<tr>
<td>Intracranial hemorrhages in adults</td>
<td>4% (95% CI 1, 15)</td>
<td></td>
</tr>
</tbody>
</table>

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**Impact of Injuries from Sports, Exercise, and Recreational Activity among Active Duty Military Personnel**

Keith G. Hauer, Seryl A. Bedno, Tze-Cheg Kao, Bruce H. Jones, FACSM, Army Institute of Public Health, Aberdeen Proving Ground, MD.

(No relationships reported)

Injuries during Army Basic Combat Training (BCT) have been previously found to be higher in the summer than in the fall season and correlated with daily high temperatures (Knapik, Ann Occup Hyg 46:15, 2002).

**PURPOSE:** To compare the injury risks (cumulative incidence %) across all four seasons during BCT.

**METHODS:** Army Training and Doctrine Command provided electronic rosters for all BCT recruits arriving at Fort Jackson, South Carolina, for one year (October 2009 through September 2010). Rosters were linked to injury data from the Defense Medical Surveillance System. Injuries were identified based on specific International Classification of Diseases (ICD-9) codes. Seasons were defined as BCT classes (10 weeks long) beginning in particular months as follows: Summer (SU): July; Fall (F): October; Winter (W): January; Spring (SP): April. The injury incidence for each season was calculated as: recruits ≥ 2/1 total recruits X 100. Risk ratios (RR) with 95% confidence intervals (95%CI) were determined using W as the reference time period.

**RESULTS:** Participants were 9,262 men and 4,363 women. Injury risks in W, SP, SU, and F were respectively 20.1%, 24.6%, 25.1%, and 21.6% for men, and 45.8%, 53.8%, 51.7%, and 47.3% for women. For men, injury risks in the SU and SP were higher than in the W (RR[SU/W]=1.25, 95% CI=1.13-1.38; RR[SP/W]=1.22, 95% CI=1.10-1.35, respectively) and tended to be the same in F (RR[FW]=1.08, 95% CI=0.96-1.21). For women, injury risks in the SU and SP were higher than the W (RR[SU/W]=1.13, 95% CI=1.04-1.23; RR[SP/W]=1.18, 95% CI=1.08-1.28, respectively), but not in the F (RR[FW]=1.03, 95% CI=0.95-1.13). The correlation between average high daily temperature and injury incidence was 0.94 for men and 0.79 for women. Average daily high temperature ranged from 97.2°F (SU) to 55.9°F (W).

**CONCLUSION:** Compared to the winter, injury rates in BCT were higher in the SU and SP, and about the same in the F. Rate daily highs are predictively higher in the SU.

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**Table 2:**

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>Events (W)</th>
<th>Percent (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprain</td>
<td>110,000</td>
<td>25.3% (SE=0.6)</td>
</tr>
<tr>
<td>Strain</td>
<td>110,000</td>
<td>26.1% (SE=1.6)</td>
</tr>
<tr>
<td>Tendonitis/Bursitis</td>
<td>54.9% (SE=4.5)</td>
<td></td>
</tr>
<tr>
<td>Fracture</td>
<td>110,000</td>
<td>28.7% (SE=4.0)</td>
</tr>
</tbody>
</table>

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**Impact of Injuries from Sports, Exercise, and Recreational Activity among Active Duty Military Personnel**

Keith G. Hauer, Seryl A. Bedno, Eisenhower Army Medical Center, Fort Gordon, GA.

(No relationships reported)

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**CONCLUSION:** Compared to the winter, injury rates in BCT were higher in the SU and SP, and about the same in the F. Rate daily highs are predictively higher in the SU.
Association Between Anatomical Alignment And Musculoskeletal Injuries In Recreational Runners: Cohort Prospective Study.

Aline C.A. Carvalho, Ms, Luiz Carlos Mr Hespanhol Junior, Leonardo O.P. Costa, Mr, Alexandre D. Lopes, Mr., University São Paulo City, São Paulo - SP, Brazil. (No relationships reported)

BACKGROUND: Much has been said about the influence of factors such as the alignment of the lower limbs and the development of musculoskeletal injuries in runners, but little evidence supports this hypothesis.

OBJECTIVE: To describe the anatomical alignment of the lower limbs, to measure the prevalence and incidence of musculoskeletal injuries related to running, to examine the associations between the characteristics of these injuries and anatomical alignment, and describe the major injuries among runners and the anatomical regions most affected.

METHOD: A prospective cohort study composed of 89 recreational runners who underwent measures of bilateral Q angle, subtalar angle, medial longitudinal arch and length discrepancy of lower limb and were followed for a period of 12 weeks. We performed descriptive analysis and verification of the association between the characteristics of anatomical alignment of the runners and injuries. The incidence of injuries was calculated using survival analysis and the association between potential risk factors and time of injury was determined by Cox regression models.

RESULTS: Participants of the study were on average 44 years-old (SD = 10), without major changes in the alignment of lower limbs and presented an association between changes in Q angle and the discrepancy of Q angle with musculoskeletal injuries. The prevalence of musculoskeletal injuries related to running was 61.8%, the incidence over 12 weeks was 27%, being tendinopathies and muscle injuries the most common injuries and the knee and the leg as the most affected regions.

CONCLUSIONS: It was possible to identify the association of the discrepancy between the Q angles and the angles Q changes with injuries in runners. We also identified tendinopathies and muscle injuries as major injuries and the knee as the most affected region.

Epidemiology and Outcomes of Concussions in Major League Baseball

Vincent Moretti, Leslie Schwindel, Jonathon Watson, Mark Hutchinson, FACSM. University of Illinois at Chicago, Chicago, IL. (No relationships reported)

PURPOSE: All contact sports carry the risk for concussions, but limited data exists on such injuries in baseball, particularly at the professional level. The purpose of this study is to document the epidemiology of concussions in Major League Baseball (MLB) and to quantify the impact of these injuries upon player performance.

METHODS: Data on MLB concussions occurring between 2001 and 2010 was gathered from MLB disabled list records. For each player identified, additional data was gathered from online game summaries and player profiles. Recorded variables included player position, date of injury, age at injury, injury situation, source of trauma, and date of return to play. Performance statistics were compiled for each player for the 15- and 30-day periods immediately after they returned to play. Identical statistics from the 30-days immediately pre-injury served as a control. Statistical analysis was performed using two-sided z-test for proportions with a significance level of 0.05.

RESULTS: 33 concussions were identified, 8 from 2001-2005 (per game incidence=0.03%) and 25 from 2006-2010 (per game incidence=0.10%). Average age at injury was 29 years. 9 players were concussed by batted balls (27.3%), 8 by pitched balls (24.2%), 7 by fielder-runner collisions (21.2%), 6 by fielder collisions (18.1%), and 3 by swing bats (9.1%). Nearly a third (30.3%) of injuries were to catchers. On average, players were unable to play for 67 days (range 1-349) or 38 games (range 1-152) after a concussion. 4 players (12.1%) never returned to MLB. Batting average through the first 15 days (0.237, p=0.423) and the first 30 days (0.252, p=0.970) after returning from injury were insignificantly decreased from the pre-concussion average (0.253). On-base percentage through 15 days (0.302, p=0.237) and 30 days (0.326, p=0.996) was insignificantly decreased from pre-injury (0.326). Slugging percentage through the first 15 days back (0.358, p=0.013) was significantly decreased from pre-injury (0.412), but not through the first 30 days back (0.393, p=0.290).

CONCLUSIONS: The recognition and reporting of concussions in MLB is increasing, with a near 3-fold increase in just the past 5 years. The impact of this injury can be significant, resulting in lengthy time on the injured list, temporary performance decreases, and even the end of careers.

Risk Factors for Stress Fractures in United States Army Basic Combat Training: A Retrospective Analysis of 632,440 Recruits

Joseph J. Knapik, FACSM1, Scott J. Montain, FACSM2, Susan M. McGraw3, Tyson Grier1, Matthew R. Ely2, Bruce H. Jones, FACSM4. 1US Army Institute of Public Health, Aberdeen Proving Ground, MD. 2US Army Research Institute of Environmental Medicine, Natick, MA. (No relationships reported)

Stress fractures (SF) are a common and debilitating problem in United States (US) Army Basic Combat Training (BCT). Previous studies indicate that the medically diagnosed incidences of SF range from 0.8 to 5.1% of all male recruits.

PURPOSE: To examine demographic and physical risk factors for SF that are significant contributors to SF in basic trainees.

METHODS: This retrospective cohort study utilized databases at the Armed Forces Health Surveillance Center. All male US recruits participating in US Army BCT from January 1997 to January 2007 were identified based on date of entry into the US Army. Birth year and race/ethnicity were obtained from the Defense Manpower Data Center Master Personnel File and physical characteristics (height and weight) were obtained from the Military Entrance Processing Station database. Body mass index (BMI) was calculated as weight/height2. Cases were recruits medically diagnosed with inpatient or outpatient SF in the Defense Medical Surveillance System. Data were analyzed using logistic regression; odds ratios (OR) and 95% confidence intervals (95%CI) were calculated. Age, height, weight and BMI were categorized into strata and baseline strata (RR=1.00) selected as the youngest age group (<19 years), average height (175-180 cm), and weight (71-78 kg), and normal BMI (18.5-24.9 kg/m2).

RESULTS: There were 475,745 male recruits in the survey period and they had an overall SF incidence of 19.3 cases/1,000 recruits. Factors that increased SF risk included older age (OR=30 yrs/17-19 yrs=3.4, 95%CI=3-3.7), greater stature (OR=185 cm/175-180 cm=1.2, 95%CI=1.1-1.3), higher body weight (OR=71 kg/71-78 kg =1.2, 95%CI=1.1-1.3), lower BMI (OR>18.5 kg/m2/18.5-24.9 kg/m2=1.7, 95%CI=1.5-1.9), higher BMI (OR>30 kg/m2/18.5-24.9 kg/m2=1.1, 95%CI=1.1-1.2), and white race/ethnicity (OR=white/black=1.7, 95%CI=1.6-1.9; OR=white/Asian=1.2, 95%CI=1-1.5).

CONCLUSIONS: This was the largest sample of military male recruits ever examined for SF since it included virtually the entire US Army male recruit population over a 10-year period. SF risk was elevated among male BCT recruits who were older, taller, weighed more, had lower or higher BMI, and/or were of white race/ethnicity.


Shuva Dawadi, Keith G. Haurer, Bonnie J. Taylor, Morgan N. Clemen, Bruce H. Jones, FACSM. Army Institute of Public Health, Aberdeen Proving Ground, MD. (No relationships reported)

Participation in sports and athletics is a major part of a Soldier’s life and a major cause of serious, nonfatal injuries in the military. These injuries result in outpatient visits, inpatient hospitalizations, and medical air evacuations as well as substantial lost duty days and decreased military readiness.

PURPOSE: Determine the incidence and rate of sports and exercise-related (SER) injuries requiring medical air evacuation of US Soldiers deployed for Operations Freedom (Iraq) and Enduring Freedom (Afghanistan) from 2001 to 2010 and describe the injury type and anatomical location of injury.

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METHODS: Air evacuation records were reviewed for Soldiers medically evacuated from Iraq or Afghanistan for SER injuries (October 2001-December 2010). Narrative case history and diagnosis codes were used to determine incidence and rates of SER injuries and incidence of injury type, and anatomical location of injury.

RESULTS: Overall, 19,595 Soldiers were air evacuated for non-battle injuries (NBIs) from 2001 to 2010. For injuries with an identifiable cause (n=13,372), sports and exercise were the leading cause comprising 23% of NBIs (n=3,075; rate: 3/1,000 person-years). Sixty-one percent of SER injuries were caused by three activities: basketball (25%), physical training (19%), and American football (17%). The rest of the activities involved weightlifting (15%), wrestling/combative (7%), volleyball (4%), soccer (3%), softball (3%), and other specified sport activities (6%). This latter category included activities such as boxing, baseball, frisbee, swimming and diving, track and field, mountaineering, boating, hockey, and rugger. The leading injury types were sprains/strains/ruptures (27%), fractures (25%), and dislocations (18%). Knee (26%), ankle/foot (15%), wrist/hand (14%), and shoulder (14%) were the leading anatomical locations of injury.

CONCLUSIONS: Even in a dangerous combat environment, sports and exercise are an important cause of non-fatal injuries. These injuries, many of which are preventable, negatively impact soldier work performance and unit readiness during deployments. Identifying or developing and evaluating prevention strategies targeted to prevent these SER injuries is recommended to lessen this impact.

3179  Board #144  June 1  3:30 PM - 5:00 PM  The Feasibility Of Examining Psychological States As Risk Factors For Injury: A Pilot Study  Ian Shrier, FACSM, John S. Raglin, FACSM, Janette Powell, Emily B. Levitan, Murray A. Mittlenzer, Russell J. Steele, *McGill University, Montreal, QC, Canada, 2Indiana University, Indianapolis, IN, 3Cirque du Soleil “O”, Las Vegas, NV,* University of Alabama at Birmingham, Birmingham, AL, 4Harvard University, Boston, MA. 5McGill University, McGill University, QC, Canada.  (No relationships reported)

PURPOSE: To test the feasibility of a prospective study designed to examine the role of psychological states on the risk of injury.

METHODS: We measured psychological traits at baseline (mode, ways of coping with anxiety), and psychological states every day (1-item questions on anxiety, sleep, fatigue, soreness, self-confidence) before performances in Cirque du Soleil artists of the show “O”. Additional questions were added once per week to better assess anxiety (20-item) and mood. Questionnaires were provided in English, French, Russian and Japanese, representing the first or second language for all participating artists. Injury and exposure data were extracted from electronic records that are kept as part of routine business practices.

RESULTS: The 43.9% (36/82) recruitment rate was more than expected. Most artists completed the baseline questionnaires in 15min, a weekly questionnaire in <2min and a daily questionnaire in <1min. We improved the formatting of some questions during the study, and adapted the wording of other questions to improve clarity. There were no dropouts during the entire study, suggesting the questionnaires were appropriate in content and length.

CONCLUSIONS: A prospective study collecting psychological state data every day from subjects who train and work regularly together is feasible.

3180  Board #145  June 1  3:30 PM - 5:00 PM  Overuse Injuries Associated With Mountain Biking: Is Single Speed Riding A Predisposing Factor?  Michael T. Lebec, Korrny Cook, Drew Baumgartel. Northern Arizona University, Flagstaff, AZ.  (No relationships reported)

Pedaling a mountain bike with a single gear option is thought to require greater physical effort than riding a bike with multiple gears through which the rider may shift. For this reason, it has been proposed that riding a single geared mountain bike is associated with greater risk for overuse injury. This hypothesis, however, has not been investigated.

PURPOSE: The study’s purpose was to compare the incidence of self-reported overuse injuries in individuals who ride mountain bikes with single and multiple gear systems.

METHODS: Data were collected from 402 Arizona mountain bikers responding to an online survey. Respondents were asked to report personal demographics, characteristics of their mountain bikes, riding volume and style, as well as mountain bike related overuse injuries sustained in the past year. Based on previous literature on cycling overuse syndromes, a logistic regression model was constructed to determine associations between explanatory variables and reported overuse injuries. Independent variables incorporated into the final model included gender, type of bike ridden (single gear, multiple-geared, or both), and average number of hours ridden per week.

RESULTS: Statistical analyses suggest no differences in self-reported overuse injuries among riders of single or multiple geared mountain bikes. However, individuals who reported spending considerable time riding both single AND multiple geared bikes were significantly more likely to report an overuse injury than those only riding a single or multiple geared bike (p=0.036). A follow-up analysis of injury by anatomical region revealed a significant difference in the odds of a knee injury for those who did not ride both types of bikes as compared to those who did (p=0.042). Significance for other anatomical regions was not found.

CONCLUSIONS: Findings suggest individuals riding both single and multiple geared mountain bikes are significantly more likely to report an overuse injury than those only participating in one type of riding. It is hypothesized that single and multiple geared mountain biking are associated with different biomechanical demands. Bikers participating in both styles of riding may develop inefficient motor patterns and subject their tissues to greater stress levels.

3181  Board #146  June 1  3:30 PM - 5:00 PM  Epidemiology Of Meniscal Injuries In US High School Boys’ Football, Ice Hockey, and Lacrosse  David M. Swenson1, R. Dawn Comstock2, David C. Flanigan1, Thomas M. Best, FACSM3. 1The Ohio State University, Columbus, OH, 2Nationwide Children’s Hospital, Columbus, OH.  (No relationships reported)

High school athletes sustain millions of injuries each year, many of which are knee injuries. Knee injuries, specifically meniscal injuries, are relatively common in high-impact sports such as boys’ football, ice hockey, and lacrosse which involve frequent and rapid pivots and player-to-player contact. Meniscal injuries often require surgery or prolonged rehabilitation, and can result in long-term sequelae such as knee pain and osteoarthritis.

PURPOSE: To describe the epidemiology of meniscal injuries in US high school boys’ football, ice hockey, and lacrosse.

METHODS: High school sports-related injury data was collected from 2008/09-2010/11 for boys’ football, ice hockey, and lacrosse. We calculated overall injury rates, meniscal injury rates, and rate ratios.

RESULTS: From 2008/09-2010/11, certified athletic trainers reported a total of 7902 football, 528 ice hockey, and 758 lacrosse injuries during 2,065,536 football athlete exposures [AEs], 220,974 ice hockey AEs, and 339,971 lacrosse AEs. Overall injury rates were 3.83 per 1000 AEs in football, 2.39 in ice hockey, and 2.23 in lacrosse. Competition injury rates were significantly higher than practice for football (12.3 vs. 2.12 per 1000 AEs; RR 5.79, 95% CI 5.54-6.05), ice hockey (5.84 vs. 0.75 per 1000 AEs; RR 7.81, 95% CI 6.34-9.62), and lacrosse (4.40 vs. 1.27 per 1000 AEs; RR 3.47, 95% CI 3.00-4.01). Knee injuries accounted for 15.4% of all injuries in these sports, and 8.3% of all knee injuries involved the meniscus. Meniscal injury rates were 0.051 per 1000 AEs in football, 0.032 in ice hockey, and 0.015 in lacrosse. Overall meniscal injury rates were higher during competition than practice (RR 5.58, 95% CI 3.87-8.06). Over half (58.1%) were treated with surgery. Most were new (87.9%) as opposed to recurrences of previous meniscal injuries, and person-to-person contact (47.3%) was the most common mechanism.

CONCLUSIONS: Full-contact sports have high rates of injury, including knee injuries. Meniscal injuries are serious and frequently require surgery and expensive diagnostic evaluations. Targeted interventions should aim to reduce the incidence of meniscal injuries in US high school boys’ football, ice hockey, and lacrosse to prevent long-term sequelae such as knee pain and osteoarthritis.

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3182 Board #147 June 1 3:30 PM - 5:00 PM
Risk Factors for Closed Head Injuries in Military Parachuting
Bria S. Graham1, Joseph J. Knapi5, FACSM8, Kyle Hoodebecks5, Shawn Runkin5, Kevin Klug5, Stanley Proctor5, Ryan Steelman5, Tyson Grier5, Bruce Jones5, FACSM8, 1US Army Public Health Command, Aberdeen Proving Ground, MD; 2Womack Army Hospital, Ft Bragg, NC; 3Concurrent Technologies Corporation, Fayetteville, NC.
(No relationships reported)
Closed head injuries appear to have become an increasing problem in military parachuting. A recent study of an operational airborne unit found that injuries of this type accounted for 31% of all injuries (Knapi, Aviat Space Environ Med 82:797, 2011). However, few studies have specifically examined factors that might be related to head injuries in military parachuting.

PURPOSE: The purpose of this investigation was to examine factors associated with closed head injuries during military parachuting.

METHODS: Participants were soldiers in the 82nd Airborne Division at Fort Bragg, NC who performed parachute training jumps between June 2010 and September 2011. Injury data was collected directly on the parachute drop zone and verified by a physician using clinical records. Soldiers jumped with either the T-10 parachute or the newer T-11 parachute. Wind speed data was collected using an anemometer on the drop zone. Data on jump types (combat load or no combat load) and time of day (night or day) and were obtained from routine 82nd Airborne Division reports. Chi-square statistics, risk ratios (RR) and 95% confidence intervals (95%CI) were calculated.

RESULTS: There were 57,606 total parachute descents and 611 total injuries (10.61/1000 jumps), with 210 of the 611 injuries (34%) classified as closed head injuries (3.6/1000 jumps). A higher risk of closed head injury was associated with use of the T-10 parachute (RR [T10/T11]=3.2, 95%CI=1.3-7.6)), high wind speeds (RR[high/low]=2.2, 95%CI=1.0-4.9), combat loads (RR[load/no load]=3.0, 95%CI=2.2-4.0), and night jumps (RR [night/day]=1.8 95%CI=1.4-2.4).

CONCLUSIONS: The data indicate that the T-10 parachute, higher wind speeds, combat loads, and night jumps increase the risk of closed head injuries during military parachuting in an operational military unit.

3183 Board #148 June 1 3:30 PM - 5:00 PM
Prevalence, Severity And Mechanism Of Acute Injuries In Male Elite African Youth Soccer Players
Suzanne Jacobs, Tshwane University of Technology, Pretoria, South Africa.
(No relationships reported)
A survey of injury rate for children in community sport reported the highest rate of injuries among soccer, when compared to other sport.

PURPOSE: The purpose of this study was to investigate the prevalence, severity and mechanisms of injury in male elite African youth soccer players.

METHODS: The study was conducted on hundred and sixty nine (N=169) male elite African youth soccer players aged 14 to 18 years from eleven countries in the African Continent. Data was collected retrospectively and included prevalence of injuries over a two-season period. A self-administered questionnaire was used to collect the data for this study. Descriptive statistics, Chi-Square Analysis and Independent t-tests were used for statistical analysis.

RESULTS: A total of 132 players sustained 544 injuries with a prevalence rate of 78%. More injuries were recorded during training (55%) than during competition (45%). Injuries during training showed statistical significant differences regarding playing position (p<0.05), with midfielders showing significantly higher injury rates. The injuries during training were most prevalent in the ankle (21%), groin (11%), finger (10%), shoulder (10%) and knee (9%). Body sites most commonly injured during competition showed similarities with the body parts injured during the training. The distribution of injuries according to body part was unrelated to playing position. Most injuries were of minor severity accounting for 50% and 52% of injuries in training and competition respectively. The major mechanisms of injury in both training and competition were running, tackled, tackling and shooting.

CONCLUSION: The male elite youth soccer players in the present study had a higher injury rate compared to those studies in the literature. The injuries were mostly of minor severity and the most frequent body part injured was the ankle joint. Since the ankle joint comprised a large proportion of the injuries, future studies aimed at preventive strategies for injuries in the ankle joint are recommended, especially at school level. Prevention programmes, fair play, and the continuing improvement of skills may reduce the incidence of injuries in the long term.

3184 Board #149 June 1 3:30 PM - 5:00 PM
Risk Factors Associated With Lower Leg Injuries in the United States Army
Morgan K. Anderson, Tyson Grier, Michelle Canham-Chervak, Timothy T. Bushman, Malikah Waajid, Bruce H. Jones, FACSM, Army Institute of Public Health, Aberdeen Proving Ground, MD.
(No relationships reported)
Lower leg injuries (region of the knee to foot) are a leading injury type among U.S. Army basic trainees, however this has yet to be investigated in Army operational units.

PURPOSE: To examine risk factors for lower leg injuries in a deploying Army unit.

METHODS: Male soldiers (N=708) ages 18-30 were administered a survey querying unit physical training, personal fitness training, Army physical fitness test (APFT) scores, tobacco use, and injury. The APFT consists of a 2 mile run, push-ups and sit-ups. APFT scores were converted into quartiles (Q) where Q4 = lowest performance and Q1 = highest performance. Odds ratios (OR) and 95% confidence intervals (95% CI) from a multivariable analysis were calculated.

RESULTS: Of the 972 soldiers that reported an injury within the last 12 months, 418 (43%) reported a lower leg injury. Of these lower leg injuries, 245 (59%) Soldiers were placed on limited duty profiles with 53% being placed on limited duty for ≥30 days. Individuals with the slowest run times had an increased risk of lower leg injury compared to individuals with faster run times (Q2/Q1 (OR = 1.61, 95% CI 1.11 to 2.33), (Q3/Q1 (OR = 1.71, 95% CI 1.18 to 2.48), (Q4/Q1 (OR = 2.57, 95% CI 1.76 to 3.75). Cross-training ≥4 times a week increased the risk of lower leg injury compared to those that did not participate in cross-training (OR ≥4 times per week/No cross-training = 1.64, 95% CI 1.02 to 2.65. A marginal association found for tobacco use (OR [Smoker/Nonsmoker] = 1.27, 95% CI 0.98 to 1.65).

CONCLUSION: Lower leg injuries are a leading injury type in deploying Army units. There is a need for further evaluation and a plan to increase aerobic endurance, decrease tobacco use, and determine the appropriate amount of cross-training needed per week in an effort to reduce limited duty days attributed to injuries.

3185 Board #150 June 1 3:30 PM - 5:00 PM
Running Related Injury, Mileage And Q-angle: A Prospective Follow-up Study.
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(No relationships reported)
The Q-angle (Q-angle) may be associated with the development of Running Related Injuries (RRI). Only a few studies have investigated the association between Q-angle, and the likelihood of RRI. These studies have not led to any firm conclusions, on the link between Q-angle and development of RRI. To our knowledge, none of these studies have taken mileage into account, which may be an import part of the causal pathways leading to injury development.

PURPOSE: To investigate if mileage to RRI differs between novice runners with different Q-angles.

METHODS: Participants were recruited via an online questionnaire. Inclusion criteria’s were, age 18-65, running must not have exceeded 10km in total the past year, healthy individuals, consent to run at least two times pt. week over a 10 week period. Q-angle was measured at baseline, using a standard goniometer, the participant lying supine and the quadriceps relaxed. Participants were divided into three groups (Q-low ≤15°, Q-normal 10°-14°, Q-high ≥15°). All training data was collected via GPS watch, handout based at baseline. The data was uploaded to an online training journal, accessible to the researchers. No guidelines were given to running intensity, time or distance. The Kaplan-Meier method was used to estimate survival mileage until RRI in each group. If a participant reported an injury, their survival mileage was eliminated, they underwent examination and the RRI was diagnosed. To evaluate the outcome, cox-regression model was used to calculate the Hazard Ratio (HR) between groups, with Q-normal as the reference group.
RESULTS: N = 60 included, 3 participants excluded due to missing training data. N = 114 legs was analyzed, divided between 57 participants (n = 30 male, n = 27 female). 14 injured legs was reported, divided between 9 participants (Q-low ≤10° RRI = 7, Q-normal 10°-14° RRI = 5, Q-high ≥15° RRI = 2). HR for the Q-low ≤10° was (1.3, CI 95% 0.4 - 4.4, pvals 0.609), HR for the Q-high ≥15° was (0.6, CI 95% 0.1 - 3.2, pvals 0.558).

CONCLUSION: Novice runners with Q-angles lower or higher than 10°-14°, don’t have a statistical significant higher hazard rate of sustaining RRI, while running at least, two times per week, over a 10 week period.

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3186 Board #151 June 1 3:30 PM - 5:00 PM

**Gender Comparisons of Sports/Recreation- and Training-Related Injuries Among U.S. Service Members in Operation Iraqi Freedom**

Mitchell J. Rauch, FACSM, Hilary J. Aralis, Caroline A. Macena, FACSM, Jamie Bartlett, Andrew J. MacGregor, Peggy P. Han, Michael R. Galarneau. Naval Health Research Center, San Diego, CA.

(Please note: No relationships reported)

PURPOSE: The aim of this cross-sectional study was to determine the distribution of sports/recreation- and training-related (SRT) injuries among service members deployed in OIF.

METHODS: We studied 1,372 U.S. military personnel (110 females, 1,262 males) who sustained at least one SRT-related injury while deployed in Iraq. Data included all nonbattle injuries that resulted from participation in an SRT-related activity. An injury was defined as any complaint that required the attention of a military health care provider, regardless of time lost from duty. Injury distributions were calculated for body location, injury type, and injury severity. Chi-square analyses were used to compare these injury distributions by sex.

RESULTS: Overall, 1,518 injuries were reported with similar injury rate ratios (IRR) for females (120 injuries, IRR = 1.09) and males (1,398 injuries, IRR = 1.11) during SRT-related activities. Most injuries (80.0%) were mild in nature (Injury Severity Score < 3). No significant differences were found between sexes for injury severity (p = 0.47). Overall, a slightly higher percentage of lower extremity injuries were sustained by females (45.8% vs. 39.4% [males]) and upper extremity injuries incurred by males (34.3% vs. 30.8% [females]). The most common lower extremity body region affected was the lower leg/ankle (40.1%), and the most common upper extremity body region affected was the shoulder/upper arm (47.6%). Sprains/strains (74.5%), contusions (8.8%), and fractures (8.6%) were the most common injury types, with similar distributions between females and males (p = 0.26). Sprain/strain injuries were most frequent at the lower leg/ankle and shoulder/upper arm regions, with significant differences between injuries incurred by males and females (foot/toes more frequent among females, shoulder/upper arm more common among males) (p = 0.001). Foot/toe fractures were more common among females (p = 0.001). While fractures were most frequent at the hand/wrist/fingers, dislocations were most common at the shoulder/upper arm.

CONCLUSIONS: Results suggest that deployed service members sustaining injuries during SRT-related activities were likely to incur an extremity injury, especially strains/fractures. Most injuries were not likely to cause significant time lost from duty.

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3187 Board #152 June 1 3:30 PM - 5:00 PM

**A Hospital-Based Study of Pediatric Sport and Recreational Injuries**

Thomas Schuch1, Carma Hanson2, Brett J. Goodwin1, Mark Romanick1, Dennis J. Caine1. 1University of North Dakota, Grand Forks, ND. 2Altru Health System and Safe Kids Grand Forks, Grand Forks, ND. (Sponsor: James Whitehead, FACSM)

(Please note: No relationships reported)

Nearly 30 million children and adolescents participate in organized sports annually in the United States. It is estimated that 3.7 million of these participants report to hospital emergency rooms (ER) each year with injury.

PURPOSE: To describe the frequency and distribution of pediatric sports and recreational injuries treated at a regional hospital over a 10-year period.

METHODS: The study used a retrospective case series design. Institutional Review Board approval was obtained from the University of North Dakota and Altru Health System. The hospital’s ER database was searched for sports and recreational injuries affecting children ages 1-19 years using ICD-9 “E” codes.

RESULTS: During 2000-2009, 2,855 pediatric sports and recreational injuries were treated at the hospital ER. Although injuries were distributed throughout all months, September was marked by a relative high percentage of injuries (18%). The majority of injuries were sustained by males (74.2%). The peak frequency of injuries occurred at ages 11-13 for girls and 13-15 years for boys. The forearm was injured most often (18.3%), followed by head/neck (17.3%), and hand (16.8%) injuries. Bicycle-related injuries were most common (20.5%), especially among children ≥ 14 years of age, followed by football (19.7%) and hockey (16.2%), which were more common among older children and youth. Soft tissue injuries were the most common injury type (28.8%), followed by fractures (25.5%). Acute epiphyseal injuries accounted for 8.6% of all fractures. Two hundred and three concussions were treated, with most (79%) affecting youth 10-19 years. Concussions were commonly associated with football (24.6%), hockey (21.7%), and bicycling (21.7%). The vast majority of injuries were treated and released on the same day (99.7%). There were no fatalities.

CONCLUSIONS: Although denominator, and therefore injury rate data are lacking, this case series provides an estimate of the relative frequency of sport and recreational injury in a region, and gives an estimate of the morbidity load on a hospital ER. It is evident that some age groups, and some sports and recreational activities, should be targeted for further prevention and research efforts.

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3188 Board #153 June 1 3:30 PM - 5:00 PM

**Epidemiology of Volleyball Injuries in Young Females**

Gerardo E. Miranda, Deric Lopez, Manuel Mas, William Micheo, FACSM. University of Puerto Rico School of Medicine, San Juan, PR.

(Please note: No relationships reported)

Volleyball is currently among the most common club sports in the United States and Puerto Rico. Although, adolescent girls make up the largest number of athletes associated with this organization, epidemiological studies in this population are limited.

PURPOSE: To describe volleyball related injuries in young females in Puerto Rico; identify injury patterns, and risk factors.

METHODS: A retrospective descriptive study was done. One hundred and five (105) young females (avg age 13.6 years) from local volleyball club leagues participated in the study. Each participant filled a written questionnaire. It included demographic, and current or previous injury information. For those with volleyball related injury, localization, mechanism, type, game versus practice situation, time elapsed since symptoms started, intervention/s, and severity of injury were included. The primary outcome measure is the frequency of volleyball related injury, evaluated by anatomic area, type, mechanism, and etiology. Secondary outcome measures include association of injury to position played, other sport participation, time of exposure, and game versus practice situation.

RESULTS: Ninety two percent (92%) of girls had more than 2 years of club volleyball experience, and sixty one percent (61%) reported history of at least one volleyball related injury and one hundred and two (102) injuries were reported. The lower extremities accounted for most acute injuries (51%); the ankle was the most commonly injured body part (35%). In the upper extremities acute injuries involved mostly the wrist and hand. Meanwhile, overuse injuries were evenly distributed in the shoulder, back/trunk, and knee. The most common mechanism of acute injuries was contact with floor and contact with another player, whereas overuse injuries occurred without contact, and occurred more frequently during practice (54%). Additionally, the front row positions were injured more often than the back row players.

CONCLUSION: Young female front row players are at high risk for acute volleyball injuries involving the ankle. Further research needs to be done in this population and other age groups, gender, and competition levels, in order to better understand if these elements alter injury mechanism, risk factors, and to plan preventive measures.
Injury Risk Associated with Functional Movement Screening in the United States Army.

Timothy T. Bushman, Tyson Grier, Michelle Canham-Chervak, Morgan K. Anderson, Malikah Wsaajd, Bruce H. Jones, FACSM. Army Institute of Public Health, Aberdeen Proving Ground, MD.

(No relationships reported)

Functional Movement Screening (FMS) is a measurement tool that aims to predict risk of injury in physically-active populations.

PURPOSE: To investigate injury risk associated with FMS in a deploying U.S. Army unit.

METHODS: Male Soldiers (n=807) ages 18-49 completed FMS which involved seven exercises: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability pushup, and rotary stability. Each test had a range of 0-3 points with a maximum possible score of 21 if the individual demonstrated sound biomechanics throughout each movement and experienced no pain. If pain was present, the individual automatically scored a zero for that particular test. FMS scores were categorized into four categories, ≤14, 15-16, 17-18, 19-21. Injury occurrence within the last 12 months was collected by survey. Injury risk ratios (RR) and 95% confidence intervals (95% CI) comparing FMS categories are presented.

RESULTS: Overall injury incidence for the prior 12 months was 41% (n=340). We found that a higher risk of injury was associated with lower FMS scores (RR ≤14/19-21) = 1.95, 95% CI 1.57-2.41. However, intermediate FMS scores were not significantly different (RR 15-16/19-21) = 1.15, 95% CI 0.88-1.51 and (RR 17-18/19-21) = 1.16, 95% CI 0.91-1.47. During FMS, 57% (n=462) of the Soldiers experienced pain on at least one of the seven tests. Individuals who experienced pain and scored a zero or a one out of a possible three points (p=0.040 to 0.0001) had a higher risk of injury than their counterparts for the deep squat (RR 0pts/3pts)= 1.59, 95% CI 1.28-1.97, hurdle step (RR 0pts/3pts) = 1.81, 95% CI 1.47-2.23, in-line lunge (RR 0pts/3pts)=1.82, 95% CI 1.51-2.20, shoulder mobility (RR 0pts/3pts)= 1.84, 95% CI 1.49-2.27, shoulder mobility (RR 1pt/3pts)= 1.52, 95% CI 1.08-2.13, trunk stability push-up (RR 0pts/3pts)= 1.42, 95% CI 1.14-1.77, and rotary stability (RR 0pts/3pts)=1.42, 95% CI 1.06-1.92.

CONCLUSION: Consistent with previous literature, a FMS score of ≤14 suggested higher risk of injury. Based on this study, experiencing pain on one of six specific tests indicated an elevated risk for injury. These findings suggest further research may be needed to be paid to these particular tests in order to accurately quantify a Soldier’s risk for injury with FMS.
3193  Board #158  June 1  3:30 PM - 5:00 PM
Intrinsic And Extrinsic Risk Factors For Tennis Injuries
Janine Stubbe1, Rebecca Kuiper1, Jasper Stega1, Ariëtte van Hespen1, Babette Pluim1. 1TNO, Leiden, Netherlands. 2Royal Netherlands Lawn Tennis Association, Amersfoort, Netherlands.
(No relationships reported)

In addition to the well-documented beneficial effects, sport can have a negative side effect in the form of sports injuries. The total number of sports injuries in the Netherlands is about 3.6 million per year. Two-thirds of all medically treated sports injuries are associated with nine sports, including tennis.

PURPOSE: The objective of this study was to investigate the incidence, nature, and severity of tennis injuries, and to examine risk factors for tennis injuries. Method: In April 2010, baseline information on recreational tennis players aged 16 years and older was collected. Self-reported surveys containing items about personal characteristics, tennis-specific information and injury history were handed out by tennis trainers during practice sessions at three tennis academies in Amsterdam. After three (July 2010) and six months (October 2010) tennis players received a survey sent by e-mail containing items about sustaining an injury and match and training exposure. Injury incidences were calculated (e.g. the number of injuries per 1,000 hours tennis). Furthermore, logistic regression analyses were conducted to assess the risk factors for sustaining a tennis injury. The main outcome measure of the logistic regression analyses was whether the person sustained an injury during the data collection period or not. Injury was defined as physical complaints caused by playing tennis and resulting in a time loss from tennis of at least one day.

RESULTS: A total of 151 injuries were reported: 58% of the injuries were classified as acute and 36% as recurrent. The most common locations were: elbow, shoulder, lower back, calf, and ankle. Most injuries affected the players’ tennis participation: 42% was classified as severe, 25% as moderate, and 13% as minor. The overall incidence rate was 3.55 injuries per 1,000 hours of tennis. Injury risk in tennis gradually increased with exposure (OR = 1.004).

CONCLUSION: Tennis has a high injury rate and injury rate gradually increases with exposure (OR = 1.004). More research is needed to examine the risk factors associated with tennis injuries.

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3194  Board #159  June 1  3:30 PM - 5:00 PM
Video Incident Analysis of Concussion Mechanisms in Boys’ High School Lacrosse
Shane V. Caswell1, Andrew E. Lincoln2, Reginald E. Dunn3, Jon L. Almquist. 1George Mason University, Manassas, VA. 2Union Memorial Hospital, Baltimore, MD. 3Fairfax County Public Schools, Falls Church, VA.
(No relationships reported)

PURPOSE: To describe common game play scenarios and mechanisms of injury associated with concussion in boys’ high school lacrosse using game video.

METHODS: Video of 518 boy’s high school lacrosse games were captured by trained videographers during the 2008 and 2009 seasons. When an injury occurred, a log entry was recorded to include the time of injury, the body part injured, and the player number. Videotapes were analyzed using StudioCode (Sportstec USA, Camarillo, CA) software to identify event characteristics. Video data were linked to the injury reported by the athletic trainer (AT) for further detail and verification.

RESULTS: 44 incidents (20 in 2008 and 24 in 2009) were determined to be a concussion, 34 (77%) of which had sufficient image quality for analysis. Most 22 (65%) head injuries involved varsity level athletes compared with 12 (35%) at junior varsity. 23 (67%) concussions occurred in the attacking zone compared with 10 (34%) in the midfield zone. All (100%) concussions resulted from intentional player-to-player bodily contact. Players were most often injured while playing the midfield (18, 53%) and defense (n=9, 27%) positions and attempting to pick up a loose ball (n=16, 47%) or when ball handling (n=14, 41%). Most frequently the striking player’s head (27, 79%) was used in the collision and in 59% (n=20) the struck player’s head was the initial point of impact. In 24 (71%) of cases a subsequent impact with the playing surface was suffered immediately following the initial impact. In 9 (26%) collisions a penalty was called.

CONCLUSION: This study identified intentional bodily collisions in which the striking player used his head to initiate contact as the most frequent cause of concussion. Concussions most often occurred during the acts of competing for a loose ball and ball handling. Since the time this study was conducted, rule changes have been enacted that prohibits deliberately initiating contact to an opponent’s head or neck with a stick, or any part of the body. Further investigation of preventive measures such as the education of coaches and officials, enforcement of new rules designed to prevent head-to-head contact is warranted to reduce the incidence of concussion injuries in boys’ lacrosse. Supported by the National Operating Committee on Standards for Athletic Equipment and US Lacrosse.

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3195  Board #160  June 1  3:30 PM - 5:00 PM
Injury Rates For Collegiate And High School Rugby Players
Maggie McGinty1, Donald C. LeMay2. 1The Ohio State University Medical Center, Columbus, OH. 2Ohio Heath, Columbus, OH. (Sponsor: James R. Borchers, FACSM)
(No relationships reported)

PURPOSE: There have been many studies done in reference to professional rugby world wide. However, there are few studies that evaluate the injury rates of tournaments that involve amateur High School and College athletes. Furthermore, there are minimal studies looking at male and female rugby players.

METHODS: The objective of this study was to investigate the incidence, nature, and severity of rugby injuries that were reported to the medical tent during a two day rugby tournament from 2008 to 2010. In 2008 there were 167 people completed the questionnaire. 63 respondents were male and 104 were female. 23 people (13%) reported injuries. 41% of injuries were to the lower extremities, 27% were upper extremity, 23% involved the trunk, and 9% affected multiple areas. The most common type of injury was repetitive/overuse muscle strains (32%, n=7), 5 were acute muscle strains, and 8 were ligament sprains. Over-exertion/strenuous movements were the most common cause of injury (n=9), followed by 6 overuse/repeated strains and 5 falls. Walking accounted for half

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3196  Board #161  June 1  3:30 PM - 5:00 PM
12-Month Incidence of Exercise Injuries in Community-dwelling Older Adults Following an Exercise Intervention
Rob Little, Liza Stathokostas, Dave Humphreys, Don H. Paterson, FACSM. University of Western Ontario, London, ON, Canada.
(No relationships reported)

Fear of injury is reported as a barrier to exercise by older adults. However the literature is limited in describing exercise injuries in older adults.

PURPOSE: To evaluate the 12 month incidence of, and describe injuries to, previously sedentary community dwelling older adults (≥60y) following an 8-week supervised exercise program.

METHODS: Data were collected from the “Get Fit for Active Living” 8-week exercise. A self-reported questionnaire was used to document the injuries incurred in the 12 months post-exercise intervention. Linear regression analysis was conducted to identify co-variants related to injury outcome.

RESULTS:167 people completed the questionnaire. 63 respondents were male and 104 were female. 23 people (13%) reported injuries. 41% of injuries were to the lower extremities, 27% were upper extremity, 23% involved the trunk, and 9% affected multiple areas. The most common type of injury was repetitive/overuse muscle strains (32%, n=7), 5 were acute muscle strains, and 8 were ligament sprains. Over-exertion/strenuous movements were the most common cause of injury (n=9), followed by 6 overuse/repeated strains and 5 falls. Walking accounted for half
of the activities during which injury occurred. Following that were stretching and swimming (both 9%, i.e. 2 injuries in each of these activities). 70% of injuries reported required medical treatment, with 75% being visits to a physician, 12% to a physical therapist, one walk-in clinic and one emergency room visit. 44% were not able to continue exercising immediately. Return-to-activity time varied from 1 to 182 days. Univariable regression analysis was performed using sex, age, and exercise volume as correlates, but none were significantly associated with injury occurrence.

CONCLUSIONS: These results showed similar or lower exercise-related injury rates as compared with previous reports on younger and middle-aged adults, however the definition of, and criteria for “injury” reporting varies in the literature. This study indicates that older adults taking up exercise are not at an increased risk of injury, and participation in an intervention - where the instruction of safe participation is taught - might confer some “protective” effect. Supported by CIHR.

**3197 Board #162 June 1 3:30 PM - 5:00 PM**
Mechanism Of Injury Trends For Shoulder Injuries In Interscholastic Sports: 2007-2009

**METHODS:** Epidemiological data were collected by certified athletic trainers for injured high school athletes at 7 high schools during the 2007-08 and 2008-09 academic years. Shoulder injury relative incidence rates (RIR) and 95% confidence intervals (CI) were calculated per 10,000 athlete-exposures (AE). The variable MOI, was separated into the following categories: contact with person (Person), contact with surface (Surface), contact with apparatus (Apparatus), Noncontact, Overuse, and Other. For MOI, shoulder injury frequency was converted into a percentage of the total number of shoulder injuries reported per sport.

**RESULTS:** A total of 135 shoulder injuries occurred during 188,925 AEIs. Results are reported for the 4 sports with the highest incidence rates of shoulder injury (Wrestling, Football, Softball, Baseball). For wrestling RIR = 53.5 [30.0,76.9]; football, RIR = 14.6 [10.9, 18.2]; softball, RIR = 10.0 [4.8,15.2]; and baseball, RIR = 8.6 [4.6, 12.6]. For MOI, contact injuries accounted for a considerable percentage of shoulder injuries in football (Person = 80.0%; Surface = 20.0%) and wrestling (Person = 57.9%; Surface = 19.0%), with few reported in baseball (Person = 0%; Surface = 11.0%) and softball (Person = 9%; Surface = 71%). In contrast, noncontact injuries accounted for a distinct percentage of shoulder injuries in baseball (Noncontact = 16.7%; Overuse = 66.7%) and softball (Noncontact = 28.6%; Overuse = 64.3%), with relatively few injuries reported in wrestling (Noncontact = 0%; Overuse = 0%) and football (Noncontact = 5.2%; Overuse = 5.2%).

**CONCLUSIONS:** While shoulder injury prevention programs tend to focus on preventing overuse injuries, a considerable number of shoulder injuries occur during football and wrestling, and tended to be contact in nature. Further exploration of these contact injuries, including research associated with the development shoulder injury prevention programs for contact-related injuries may be warranted.

**3198 Board #163 June 1 3:30 PM - 5:00 PM**
Incidence And Risk Factors Of Running-Related Injuries: A Prospective Cohort Study

**METHODS:** Beside the positive effects of running, this activity may cause musculoskeletal injuries. An understanding of the incidence of injury and the risk factors associated with injuries in runners can assist in the implementation of preventive strategies in this population.

**PURPOSE:** To determine the incidence of running-related injuries in a cohort of amateur runners and to identify the aspects of training that are associated with running-related injury.

**RESULTS:** In this prospective cohort study, 200 amateur runners answered a fortnightly online survey containing questions about their running training routine. These runners were followed-up for a period of 12 weeks. The incidence of injuries was calculated using survival analysis and the association between potential risk factors and time of injury was determined by Cox regression models.

**RESULTS:** A total of 191 runners completed all follow-up surveys (i.e. completeness of follow up=95.5%). A new RRI was observed in 34.6% (n = 66) of our sample, which is equivalent to 8 injuries per 1000 hours of exposure to running. The mean pain intensity was 1.4 (SD = 1.3) evaluated by a 10-point (1-10) pain numerical rating scale (NRS). The main types of RRI reported were muscle injuries (18.2%, n=12 each one), followed by plantar fascitis (10.6%, n=7), and tendinopathies (9.1%, n=6). The anatomical areas most commonly affected were the thigh and the leg (18.2%, n=12 each one), followed by knee (16.7%, n=11), and foot (16.7%, n=11). The variables related to training characteristics that had a value of p<0.05 at least in the log rank test (univariate analysis) were included in the multivariate Cox regression model. The variables associated with RRI in the Cox regression analysis were duration of training greater than 60 minutes (hazard ratio (HR)=1.9; 95% confidence interval (CI)=1.0 to 3.4); training on mixed terrains (HR=1.9; 95% CI=1.1 to 3.3).

**CONCLUSION:** The incidence of RRI was 34.6% or 8 injuries per 1000 hours of exposure to running. The RRI risk factors observed in this population were performing endurance exercise (running) for over 60 minutes, training on mixed terrain (uphill and downhill), and perform interval training.

**3199 Board #164 June 1 3:30 PM - 5:00 PM**
Ability Of Previous Exercise Frequency To Predict Injuries In Officer Candidates And Its Association To FMS
Selasi Attipoe1, Peter Lisman1, Francis G. O’Connor, FACSMD1, Patricia A. Deuster, FACSMD1, Chris G. Pappas, FACSMD1, Joseph J. Knupik, FACSMD1, 1Uniformed Services University, Bethesda, MD. 2Womack Army Community Hospital, Fort Bragg, NC. 3Public Health Command, Aberdeen Proving Grounds, MD.

**METHODS:** Participants included 874 male (22.4±2.7 yrs) candidates enrolled in either six (n = 447) or ten (n = 427) weeks of OCS. Prior to beginning OCS, candidates completed a questionnaire and underwent FMS. Questions included self-reported frequencies for running, walking, and exercising. FMS consisted of deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise (SLR), push-up, and rotary stability tests. Injury incidence data were gathered throughout training and grouped as “any”, “overuse”, or “traumatic”. WT frequency was grouped as ≤ 1, 2-4, or ≥ 5x/wk, whereas running and GES were grouped as < 5 or ≥ 5x/wk. FMS test scores were grouped as “high” (score of 3) vs. “low” (score of 1 or 2). χ2 statistics were used to evaluate group differences in injury risk and determine associations between SETF and FMS tests.

**RESULTS:** Candidates were 1.6 times more likely to suffer an overuse injury if they reported a GES frequency < 5x/wk (p = 0.028). 14.1% of persons who reported a GES frequency < 5x/wk suffered an injury compared with 9.3% with frequencies ≥ 5x/wk. In contrast, both running and WT frequencies were independent of injury. Increased WT frequency was associated with high FMS scores for SLR (p = 0.007), whereas running frequency was associated with low FMS scores in shoulder mobility (p = 0.03). GES frequency ≥ 5x/wk was associated with low FMS scores for squat (p = 0.013) and rotary stability (p = 0.017) tests.

**CONCLUSION:** GES frequency < 5x/wk was associated with increased overuse injury risk. Although weak associations were found between SETF and high FMS test scores, the implications of these findings remain to be determined.
There is no consensus in the literature about what are the incidence and prevalence of main musculoskeletal injuries in runners.

**PURPOSE:** The objective of this study was to systematically review the data available on incidence and prevalence of main running-related musculoskeletal injuries (RRMI).

**METHODS:** Searches were conducted on EMBASE, MEDLINE, SPORTDISCUS, LILACS and SICILO databases, with no limits of date and language of publication, being the searches conducted in March 2011. We considered eligible articles related with RRMI that describe the incidence or prevalence rates of RRMI. We excluded studies that reported only the type of injury or anatomical region, studies conducted with injured runners only, and studies with incomplete data or some other reason that precluded interpretation of which would be the incidence and prevalence rates of the main RRMI in runners. The extracted data were: first author, publication year, study design, description of the population of runners, RRMI definition and the name of each RRMI with their rates of incidence or prevalence.

**RESULTS:** Among the 2781 titles, eight of them were considered eligible for the review. Most articles had moderate risk of bias and just one fulfilled less than a half of the risk of bias criteria. The main RRMI were: patellar tendinopathy (incidence ranged from 5.5% to 22.7%; prevalence ranged from 6.3% to 18.5%), medial tibial stress syndrome (incidence ranged from 13.6% to 20.0%; prevalence ranged from 7.8% to 11.1%), Achilles tendinopathy (incidence ranged from 9.1% to 10.9%; prevalence ranged from 6.2% to 18.5%), plantar fasciitis (incidence ranged from 4.5% to 10.0%; prevalence ranged from 5.2% to 17.5%), patellofemoral syndrome (incidence ranged from 5.5% to 6.9%; prevalence ranged from 5.5% to 15.6%) and iliotibial band syndrome (incidence ranged from 1.8% to 9.1%; prevalence ranged from 4.7% to 10.5%).

**CONCLUSION:** The main RRMI found in this systematic review were: (1) patellar tendinopathy, (2) medial tibia stress syndrome, (3) Achilles tendinopathy, (4) plantar fasciitis, (5) patellofemoral syndrome, and (6) iliotibial band syndrome.

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**Board #165**

**June 1**

3:30 PM - 5:00 PM

**Incidence And Prevalence Of Main Running-Related Injuries: A Systematic Review**

Alexandre Dias Lopes1, Luiz Carlos Hespanhol Junior1, Leonardo Oliveira Pena Costa1, Simon Yeung2. 1São Paulo Running Injury Group (SPRanIG) of Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil. 2Hong Kong Polytechnic University, Hong Kong, China.

(No relationships reported)

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**Board #166**

**Comparison of Neutral Spine and Hamstring Stretch for Relief of Hyperlordotic Lumbar Pain**


(No relationships reported)

**PURPOSE:** Widespread prescription for lower back pain (LBP) is hamstring stretching. Some patients report relief, others, worsening. A pilot study of 167 subjects found no relation between hamstring flexibility and LBP. Subsequent independent studies confirm no relation between hamstring flexibility and LBP. Sufferers of disc injury and spinal stenosis often worsen with flexion, contradicting hamstring stretching during active pain. Previous work determined that hyperlordosis (swayback) results in one form of LBP by compression of facets and soft tissue, and shortening lumbar height. Neutral spine (NS) lengths and unloads, directly stopping LBP. Momentary incidental lumbar lengthening during hamstring stretching briefly stops symptoms. It is proposed that temporally reversing swayback with hamstring stretching became confused with the separate entity of flexibility. The purpose of this study is to compare a neutral spine method, Ab Revolution (AR) with conventional hamstring stretching (HS) for LBP from hyperlordosis.

**METHODS:** Pilot study of 167 subjects measured degrees hamstring flexibility using straight leg raise test, compared to nominal measures of active LBP, previous LBP, or never LBP. Of initial 167 N, 113 had active LBP. Of these 113, 92 reported wanting to bend forward, lift one leg, sit, or bring knees to chest to relieve symptoms. 4 were lost to follow up. Remaining 88 were divided into two groups: AR N=43, Daily conventional hamstring stretching HS=43. Outcome measures of neutral spine NS, flexibility, and LBP were assessed at day 1, 6 weeks, and 6 mos, analyzed using Chi-Square.

**RESULTS:** AR showed sig reduction of LBP during daily activities (40 of 43) using NS. HS group showed no significant reduction in LBP: 41 of 44 increased hamstring flexibility, 43 had brief symptom relief during stretch but return to pain with upright stance and activities of daily living, 43 were measured no NS. 18 of 44 had increase in LBP.

**CONCLUSIONS:** Incidental lumbar flexion from hamstring stretch, not hamstring flexibility, briefly reduces LBP by reversing swayback. Hamstring stretch is stopgap, indirect, not curative, may aggravate symptoms, and over time create new ones. Lumbar lengthening to neutral through AR is functional, and gives sustainable pain relief by directly stopping causes of LBP from hyperlordosis.

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**Board #167**

**June 1**

3:30 PM - 5:00 PM

**Costs of Physical Activity-Related Musculoskeletal Injury In Community-Dwelling Women**

Alison K. Herrmann1, James R. Morrow, Jr.2, James T. Morrison1, Madeleina Ng1, Laura F. DeFina2, Robert M. Kaplan1. 1UCLA School of Public Health, Los Angeles, CA. 2University of North Texas, Denton, TX. 3UCLA Health System Patient Safety Institute (PSI), Los Angeles, CA. 4The Cooper Institute, Dallas, TX.

(No relationships reported)

**PURPOSE:** Despite a substantial literature documenting benefits of physical activity (PA), regular exercise is also associated with some risks. For example, the risk of musculoskeletal injury (MSI) increases with greater exercise frequency. MSI is associated with financial costs including the costs of medical care and time lost from work. The purpose of this study was to evaluate the economic costs associated with PA-related MSI in community-dwelling women.

**METHODS:** Participants included 918 women in the WIN Study. Participants reported weekly on their PA behaviors and MSI incidence via the Internet for up to 3 years. Costs were estimated by review of medical records and through self-reports of medical care use. Participants reported MSI and provided consent to obtain health records. Components of costs included time missed from work, physician visits, medical facility contacts, and prescription medications. Frequencies of each item were tabulated and then weighted by estimated costs using prevailing costs associated with PA-related MSI in community-dwelling women.

**RESULTS:** Among the 918 participants, MSI data were available for 245 women reporting MSI associated with PA. Within this group of women, there were 2325 episodes of expenditure or contact with the health care system. Total costs of the episodes ranged from $0.00-$18,934. The modal cost was $0.00 with a mean of $433 (SD=$1670). The distribution of injury costs was positively skewed with nearly all participants reporting no or very low costs.

**CONCLUSION:** About one in four community-dwelling women who are physically active experience a MSI. The great majority of these injuries are minor. Large expenses associated with these MSI are quite rare. Our analysis does not consider the potential costs associated with improved physical fitness. However, it is likely that the long-term costs savings resulting from PA outweigh the minor costs associated with a physically active lifestyle.

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**Board #168**

**June 1**

3:30 PM - 5:00 PM

**Systematic Review of Methodology in Ski Injury Research**

Kristen A. Scopaci, John Hatzenbuehler1, Tyler Bernaiche2, Christina Holt1, Kaksi Threlkeld1, William Dexter, FACSMD1. 1Tufts University School of Medicine, Boston, MA. 2Tufts University School of Medicine, Boston, MA.

(No relationships reported)

**PURPOSE:** To perform a systematic review of ski injury literature focusing on methodology for data collection.

**METHODS:** Medline and SPORTDiscus databases were searched using key words “ski* injur*” and “snowboard* injur*”, limited to human studies in English in the past 20 years. Inclusion criteria were original studies that looked specifically at injuries to skiers or snowboarders and described data collection methods. Two reviewers screened the articles for inclusion. For any discrepancies, discussion with a third reviewer was conducted to reach consensus. For each included article, the methods section was reviewed and categorized according to method type.

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**Board #169**

**June 1**

3:30 PM - 5:00 PM
RESULTS: 185 studies met inclusion and exclusion criteria. Almost all (179, 97%) were observational. Only 5 were experimental including 3 randomized controlled trials. There was one methodological study. Of the 179 observational studies, 8 (5%) were cohort, 29 (16%) case-control, 117 (65%) cross-sectional, 22 (12%) case series, and 3 (2%) were prospective case studies. Overall, 10 (5%) studies were fully prospective, 74 (40%) reported prospective collection of data with a retrospective analysis, and 101 (55%) were retrospective or not clearly defined. 72 studies included data collected at a ski mountain including from ski clinics, ski patrol and surveys. 91 studies used data collected at hospitals or medical clinics. Other sources of data included mailed or self-completed surveys, injury surveillance databases, and death certificates. 61 studies utilized more than one data collection method.

CONCLUSIONS: Multiple methods of variable quality exist for collecting ski injury research data. A standardized data collection tool would improve the quality and implications of such research. Subsequently our aim is to create a ski injury data collection tool that provides consistent data.

F-29  Free Communication/Poster - Interventions to Increase Physical Activity in Adults

JUNE 1, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

3204  Board #169  June 1  2:00 PM - 3:30 PM
Project VIA BRAZIL: Active Living, Finding Healthy Ways
Tania Bertoldo Benedetti¹, Andriana C. Schwingle², Wojtek Chodzko-Zajko, FACSM³, Giovana Zarrellon Mazo⁴, Eleonora d’Orsi⁵, Marcia Ory⁶, ¹Universidade Federal de Santa Catarina, Florianópolis, Brazil. ²University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, ³University do Estado de Santa Catarina, Florianópolis, Brazil. ⁴School of Rural Public Health, TAMU, TX.

(Purpose) In recent years several Federal initiatives in Brazil have focused on physical activity promotion. Most programs offer only traditional group-based exercise classes. Although exercise classes have shown to be very effective in improving health of participants, they tend to be relatively high cost and are able to reach only a small percentage of the eligible population.

(Purpose) Project VIA Brazil is an ongoing research project that compares advantages and disadvantages of traditional group-based exercise programs with an evidence-based behavioral change program designed to promote physically active lifestyles among older Brazilians.

(Methods) Project VIA Brazil enrolled 100 community dwelling older adults aged 60 years and older living in Florianópolis, Southern Brazil. They were divided among two intervention groups: traditional exercise class (GE) and a behavioral change program (GB); and a control group (GC). GE group consisted of a 3-month aerobics class, 3 times per week, 60 min each; whereas GB group had a 12-session ‘Active Living Every Day’ program. The programs were offered in public health centers through the city.

(Results) In this presentation we describe the outcome of the qualitative component of the analyses that used the RE-AIM public health evaluation model, explored the reach, adoption, implementation, and sustainability of the two interventions. Key staff members at participating health centers were interviewed as well as selected older adult participants. Our data suggest that both traditional exercise programs and behavioral change programs have merit and that public health centers should consider offering a combination of classes to maximize the reach of physical activity promotion efforts.

Conclusions: Traditional exercise programs and more modern behavioral change programs each have merit and both should be considered as important elements of physical activity promotion.

3205  Board #170  June 1  2:00 PM - 3:30 PM
Effects of Seated Pedaling on Calorie Expenditure and Perceived Productivity
Peggy A. Plato, Heather A. McDowell. San Jose State University, San Jose, CA. (Sponsor: Craig Cisar, FACSM)

(Purpose) Obesity is a major problem in the US population, and a sedentary lifestyle contributes to this problem. Despite public health efforts promoting the importance of physical activity, the majority of U.S. adults do not meet the minimal activity recommendations. Because adults are increasingly spending time seated, often in front of a computer monitor, interventions that fit into this lifestyle and increase energy expenditure have potential to positively impact health and well-being.

(Purpose) To evaluate the efficacy of a seated leg pedaling device for increasing calorie expenditure and perceived productivity.

(Methods) Participants were recruited from a university lecture class that met 2 days per week. One day each week participants used the device, pedaling at their own pace, and recorded the number of revolutions completed during the 50 min class. On both pedaling (P) and non-pedaling (NP) days, participants completed a survey at the end of class rating perceived productivity (1=low, 5=high). Following the 4 week intervention, calorie expenditure was measured during seated rest and while pedaling.

(Results) Pedaling significantly increased calorie expenditure compared to seated rest (1.7 ± 0.1 vs. 1.1 ± 0.1 Kcal/min respectively, p<0.001). Although Kcal expenditure increased by only 0.6 Kcal/min, using the pedaling device 4 hr/day, 5 days/week would increase energy expenditure by 37,440 Kcal/year, equivalent to a 4.8 kg weight loss if calorie intake remained constant. Participants reported that the pedaling device was comfortable and easy to use. Perceived energy level (3.5 ± 0.3 P vs. 3.0 ± 0.3 NP, p<0.05), motivation (3.4 ± 0.2 P vs. 3.0 ± 0.3 NP, p<0.05), and alertness (3.5 ± 0.2 P vs. 3.1 ± 0.3, p<0.05) were higher when pedaling during class. There were no significant differences in perceived ability to focus and participation in class between pedaling and non-pedaling days.

(Conclusions) A leg pedaling device can be used at work or school to increase energy expenditure during seated activities. Although the additional energy expenditure is small, over time it can impact energy balance and help individuals reach or maintain healthier body weights. Additionally, this low level physical activity may increase energy, motivation, and alertness while working.

3206  Board #171  June 1  2:00 PM - 3:30 PM
Do User Intentions and Health Feedback Influence Exergame Duration of Use and Measured Exertion?
Eric B. Helker¹, Frank X. Chen², Abby C. King, FACSM³. ¹Arizona State University, Phoenix, AZ, ²Stanford University, Stanford, CA.

(Purpose) Determine if a person’s intentions when using an exergame (i.e., as a game or as “exercise”) and presence of health feedback (i.e., calorie counter displayed or not) result in greater perceived and actual exertion and time spent using Kinect Dance Central.

(Methods) A randomized 2x2 (exercise vs. game intention; calorie counter vs. not) experiment was conducted among university students and staff. Participants (N=42, Mage=26.5±7.2, 59.5% men; 61.9% reported regular exercise) were recruited via local advertisements and listservs and invited to participate in a 90-minute “stress relief” study. Participants were excluded if they owned and/or regularly used the Xbox Kinect. All participants received a 5-minute Kinect and supervised dance tutorial and then were left alone to use the program for as long as they desired. The “intention” manipulation was accomplished via [a] an oral instruction with references to the action as either “exercise” or “game” and [b] setting-based contextual cues (e.g., “Exercise time. Have a great workout!” was written below the monitor for the Exercise condition). Participants either had the program’s “workout mode” (i.e., a calorie counter and duration of use of the system) turned on or off. Manipulations were tested and refined prior to the experiment. Perceived exertion was measured via the Borg Scale. Actual exertion (i.e., average METs across the time using the program) was measured via the Zephyr BioHarness. Time spent using the program was measured via stop watch.

(Results) ANOVA analysis revealed a significant main effect of intention on duration of use (F=5.2, p<0.05, Mean=39.7±14.4) but not feedback or feedbackXintention (p>0.25). There were no significant predictors of perceived or actual exertion (p>0.54, sample Mrpe=12.8±1.7, Mmet=4.5±1.1).

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CONCLUSIONS: Results suggest that this sample of young adults, when using an exergame framed as “exercise”, used it for a longer time than those for whom the program was framed as a “game.”

3207  Board #172  June 1  2:00 PM - 3:30 PM  Changes in Preservice Classroom Teachers’ Activity Levels through Participation in a Physical Education Infusion Program  Tan Leng Goh, James C. Hannon. University of Utah, Salt Lake City, UT. (Sponsor: Janet M. Shaw, FACSM)  (No relationships reported)

Preservice classroom teachers (PCTs) have an influence on the health and wellbeing of school children.

PURPOSE: To examine changes in the physical activity (PA) levels of PCTs at the end of a 12-week intervention program, Physical Education Programming Infusion (PEPI).

METHODS: Participants were 19 female PCTs (Age = 28.4±7.2yrs). The 30-minute weekly PEPI was infused into a required semester-long science methods course. The objective of PEPI was to provide PCTs the skills to integrate movement and healthy lifestyle knowledge into classroom subjects. Activities were also structured to help PCTs to become aware of their personal PA behaviors. To assess the participants’ PA levels, they wore pedometers (New Lifestyle NL-1000) over 6 consecutive days at the start and end of the PEPI. Difference in baseline and post PA levels was assessed by paired-sample t-test. Participants also completed open-ended questionnaires to examine their experiences using the pedometers. Thematic analysis was used to analyze the questionnaires.

RESULTS: There was a significant difference in average daily step counts (p<0.05) between baseline (7553±3365) and post-intervention (8421±4476). There was also a significant difference in weekend step counts (p<0.05) between baseline (5841±3201) and post-intervention (7942±4786). Results from the open-ended questionnaires revealed that: 1) participants became more aware of their PA levels through the pedometer activity, 2) wearing the pedometer motivated them to exercise more, 3) they set goals to increase their PA levels, and 4) they find that a similar pedometer activity is feasible to be implemented with their school children.

CONCLUSIONS: Pedometers were used as an assessment of the PCTs’ PA levels and a tool to motivate them to be active. Post-intervention step counts of PCTs increased as they became more aware of their PA levels. In designing and implementing courses to become future physical educators, it is important to help them become aware of their personal PA behaviors, identify benefits of an active lifestyle and encourage them to pursue activities that they enjoy. Consequently, this will strengthen their beliefs in their positions as PA role models. Future research should address barriers and facilitators among PCTs to meet the recommended 10,000 steps per day.

3208  Board #173  June 1  2:00 PM - 3:30 PM  Cost-effectiveness Of A Pedometer-based Versus Time-based Physical Activity Prescription Program: The Healthy Steps Study  Gregory S. Kohl1, William Leung2, Toni Ashion3, Grant M. Schofield, III1, Nicholas Garrett1, Ngaire Kerse4, Asmita Patel4. 1University of Western Sydney, Sydney, Australia. 2University of Auckland, Auckland, New Zealand. 3Auckland University of Technology, Auckland, New Zealand. (Sponsor: Karen Croteau, FACSM)  (No relationships reported)

Physical activity (PA) promotion interventions based in primary care settings have demonstrated effectiveness. As older adults are at particular risk of several non-communicable diseases, and particularly those related to physical inactivity, examining methods of engaging them in cost-effective programs is important.

PURPOSE: To investigate the cost-effectiveness of a pedometer-based versus time-based PA prescription program (the New Zealand Green Prescription) in improving PA and health-related quality of life in low-active older adults.

METHODS: Participants in the Healthy Steps study were 330 low-active adults aged 65 years and older (mean age 74.1±6.1 years) recruited through primary care physicians. Participants were randomized into either a pedometer-based or a standard-time based Green Prescription where they received 3 telephone counselling sessions over 12 weeks based on increasing PA.

Outcomes were measured at baseline, 3 months (end of intervention) and at 12 months (follow-up). PA was assessed with the Auckland Heart Study Physical Activity Questionnaire, health-related quality of life was measured with the EQ-5D, with utility scores based on the New Zealand tariff 2 for cost-effectiveness analysis. Quality-adjusted life years (QALY) were calculated using these utility scores. Costs included public and private healthcare costs and exercise/PA-related personal expenditure. The 259 participants who completed the 12-month follow-up who submitted full cost and healthcare utilization data were included in the analysis.

RESULTS: There were no significant between-group differences in costs. Cost-effectiveness acceptability curves showed that, compared to the standard-time based Green Prescription, the pedometer-based Green Prescription was statistically cost-effective for the 3 cost categories (community care costs, exercise and community care costs, and all costs), as well as for all QALY thresholds. At a New Zealand cited threshold of $20,000 per QALY the pedometer Green Prescription had a probability of being between 93% and 96% cost-effective for the 3 cost categories.

CONCLUSIONS: Outcomes indicate that pedometer-based Green Prescriptions may be cost-effective in increasing PA and health-related quality of life over 12 months in previously low-active older adults.

3209  Board #174  June 1  2:00 PM - 3:30 PM  Use and Tailoring of an Evidence-Based Physical Activity Behavior Change Program in a Worksite Population  Bhihba M. Dasi1, Steven J. Petruzzello, FACSM2. 1University of Georgia, Athens, GA. 2University of Illinois at Urbana-Champaign, Urbana, IL.  (No relationships reported)

As the overweight and obesity rates rise, so do health care costs in the US. Employers often bear the brunt of these rising costs along with the side effects of overweight and obesity, such as increased presenteeism and absenteeism. An excellent intervention for the growing overweight and obesity epidemic is worksite wellness programs, a recent trend in the field of health education.

PURPOSE: To assess the effects of an evidence-based physical activity (PA) behavior change program on mass transit employees.

METHODS: Active Living Every Day (ALED), originally designed as a 20-wk program, was condensed into a 6-wk format for this study and delivered in 2 phases. Phase 1 (P1) presented the 6-wk version in its original format, without any tailoring. Phase 2 (P2) received a 6-wk version, tailored for the mass transit population. Tailoring was done with focus groups at the end of P1, using the Nominal Group Technique.

RESULTS: In P1 (age = 47.6 ± 9 yrs, BMI = 32.5 ± 8.9 kg/m2), significant changes were seen in “caring about consequences to others” (P = 0.05), “increasing healthy opportunities” (P = 0.007), “committing oneself” (P = 0.005), and “reminding oneself” (P = 0.04). These factors were all part of the processes of change. For P2 (age = 46.6 ± 11.7 yrs, BMI = 32.1±1.9 kg/m2), significant changes were seen in decisional balance (P = 0.029), “increasing healthy opportunities” (P = 0.008), “substituting alternatives” (P = 0.017), “rewarding oneself” (P = 0.041), “reminding oneself” (P = 0.034), sleep quality (P = 0.004), PA affect (P = 0.001), PA enjoyment (P = 0.001), perceived stress (P = 0.004), reduced motivation (P = 0.024), and overall physical and mental health (P = 0.02). Comparing the non-tailored to the tailored version of ALED, statistically significant changes were exhibited in two measures: “increasing healthy opportunities” (P = 0.013) and physical fatigue (P = 0.002).

CONCLUSIONS: It is inconclusive to determine whether tailoring the ALED intervention had any significant impacts on the outcome measures. The ALED intervention is a relatively inexpensive and easy to implement worksite wellness program and did demonstrate significant changes in participants’ processes of change, sleep quality, perceived stress, fatigue, physical activity enjoyment, and overall physical and mental health status.

3210  Board #175  June 1  2:00 PM - 3:30 PM  Effectiveness of an Exercise Program in Improving Balance in Adults Diagnosed With HIV  Francesca Mojica1, Glorimar Garcia2, Martin Rosario3, Alexis Ortiz4. 1University of Puerto Rico-Medical Sciences Campus, San Juan, Puerto Rico. 2La Perla de Gran Precio, San Juan, Puerto Rico.  (No relationships reported)

Balance impairments are common in adults diagnosed with HIV as a consequence of infection and from secondary effects of medications. Such impairments could predispose this population to falls and decreased mobility.
PURPOSE: To assess balance with eyes open and closed after a three-month physical fitness exercise program.

METHODS: Participants (n = 23) were assessed previous to participating in a community-based physical fitness exercise program and three months after program initiation. Balance was measured with a MatScan™ (Tekscan, Boston, MA) as the displacement of the center of pressure in cube centimeters in two conditions; eyes open and eyes closed. Eyes open represented visual, vestibular, and proprioceptive systems integration whilst eyes closed represented only vestibular and proprioceptive systems. Paired t-tests were used to compare pre and post balance values for both conditions.

RESULTS: Balance values with the eyes open improve significantly (p = 0.04) from baseline (3.78 ± 1.4 cm2) to three months (0.84 ± 0.14 cm2) post exercise participation. Although, balance with eyes closed improved over time (2.26 ± 0.56 cm2 - 1.42 ± 0.37 cm2), such improvement was not statistically significant (p = 0.15).

CONCLUSIONS: Participation in a fitness program appears to improve balance with opened eyes suggesting improvement throughout the visual, vestibular, and proprioceptive systems. Balance with closed eyes appears to improve with a smaller magnitude suggesting most improvements occur first through the visual system. ACKNOWLEDGEMENTS: Thanks to the support of La Perla de Gran Precio.

3211 Board #176 June 1 2:00 PM - 3:30 PM

Effect Of A 45-minute Exercise Session On Total Activity In Normal-weight And Obese Women

Tyler Clark, Bliss Hanlon, Bruce W. Bailey, Michael Larson, James D. LeChemininant, FACSM. Brigham Young University, Provo, UT.

(No relationships reported)

PURPOSE: The purpose of this study was to compare total physical activity level in normal-weight and obese women under two separate conditions (an acute bout of exercise; non-exercise).

This study used a matched subject design (except for BMI) with treatment conditions randomized and counter-balanced.

METHODS: Seventeen normal-weight (31.4±9.2 y, 22.8±1.3 kg/m2) and 17 obese (32.9±9.0 y, 34.0±4.9 kg/m2) women completed testing for both conditions. During the exercise condition, participants completed an early morning (8-9am) exercise session on a motor-driven treadmill at 3.8 mph and 0% grade for 45 continuous minutes. Each participant was fitted with an accelerometer immediately prior to the exercise session and wore it continuously for the following 24-hours. There were no instructions or limitations on subsequent activities. During the non-exercise session participants wore an accelerometer on the same day of the week (1 week later), for the same 24-hour period, but did not complete a supervised exercise session and received no instructions or limitations on physical activities.

RESULTS: For both the normal-weight and obese women, the exercise condition resulted in significantly more total physical activity (accelerometer counts), moderate-intensity activity (min), vigorous-intensity activity (min), moderate-to-vigorous intensity activity (MVPA) min, and less sedentary time (min) than the non-exercise condition (P<0.05). Physical activity counts were 73% and 57% higher during the exercise condition than the non-exercise condition for the non-obese and obese group, respectively. There was a significant group*condition interaction for MVPA (F=4.48; P=0.043) with the obese women showing less MVPA on the exercise day (20 min less) than the normal-weight group.

CONCLUSIONS: A supervised and planned exercise bout dramatically increases total physical activity in normal-weight and obese women compared to a day without planned exercise. The normal-weight women spontaneously obtained more MVPA on the exercise day than the obese women.

3212 Board #177 June 1 2:00 PM - 3:30 PM

Are Changes In Sedentary Behavior And Steps Maintainable After A 3-month Intervention?

Amanda Libertine, Sarah Kozyez-Keadle, Patty S. Freedson, FACSM. University of Massachusetts, Amherst, MA.

(No relationships reported)

Exercise training studies have been conducted to increase physical activity (PA) in overweight, sedentary individuals. More recently, sedentary time reduction (STR) interventions have targeted decreases in sedentary behavior (SB). Short-term changes in these behaviors may occur; however, follow-up evaluations are not commonly done.

PURPOSE: To determine if maintenance in PA and SB 3-months following a training study is better in a STR, exercise only (EX), or exercise and STR (EX-STR) group.

METHODS: Overweight/obese (n=47) individuals completed a 3-month training study. Participants were randomized into 1 of 3 groups: 1) STR: met weekly with a researcher who gave recommendations to reduce SB and increase PA, 2) EX: exercised 5 days/week, and 3) EX-STR: combination of EX and STR. The interventions were effective in eliciting behavioral change from baseline to 3-months. Thirty-one participants (BMI= 33.6±8.7 kg/m2; age=45.2±10.19 years) agreed to the follow-up. Participants wore an activPAL/AP monitor at end of study (M3) and 3-months post-study (M6). The AP recorded time spent sitting/lying, standing, and stepping. Percent sedentary (%SED) was calculated as sitting time/monitor wear time. Steps/day (surrogate for PA) were also determined. Linear mixed effects models were used to test for differences in %SED and steps within and between groups.

RESULTS: EX and STR maintained %SED and EX-STR did not. %SED was significantly higher in EX than STR at M6. The % change from M3 to M6 in steps/day for STR, EX, and EX-STR was 22.8, 26, and 43.3%, respectively.

<table>
<thead>
<tr>
<th>%Sed (mean)</th>
<th>Steps (mean)</th>
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<tr>
<td>STR</td>
<td>EX</td>
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<tr>
<td>STR</td>
<td>EX</td>
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<tr>
<td>M3</td>
<td>64.2</td>
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<tr>
<td>M6</td>
<td>62.0c</td>
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**Note:** different from M3 to M6 (p<0.05 for all)

CONCLUSION: These data suggest it may be more feasible to sustain reductions in %SED following an STR than maintaining an increase in PA following exercise training. Funded by RC HL099557

3213 Board #178 June 1 2:00 PM - 3:30 PM

Community Walking Program Promotes Physical Activity in Adults and Youth for 10 years

Nobuko Hongu, Shuang Huang, Linda M. Block, Cathy L. Martinez, Barron J. Orr, Sharon Holscher Day, Nicholas B. Knutson, Yuta T. Torrey, Robin B. Harris. The University of Arizona, Tucson, AZ. (Sponsor: Linda Houtkooper, FACSM)

(No relationships reported)

PURPOSE: Cooperative Extension professionals strive to educate community members about healthy lifestyles, including physical activity and nutrition. The University of Arizona Cooperative Extension developed the Walk Across Arizona (WAAZ), state-wide, community team-based walking promotion program and has implemented it for 10 years (2001-2011). The program goals are to encourage individuals and families to increase their physical activity by joining a walking team and to increase satisfaction with being in a community and to decrease social isolation of people within communities.

METHODS: WAAZ participants were recruited by word of mouth, program fliers, and community newspapers. Participants enrolled in the program by completing an on-line registration form and brief survey including demographic characteristics of the participants, their usual physical activity behaviors, fruits and vegetable intakes, and community involvement. During the program the participants reported the steps or miles they walked weekly. The total miles walked by the teams were posted on the WAAZ Web site (http://calab.arizona.edu/walkacrossaz/). Following completion of each 8-week program, participants were provided incentives and asked to complete program assessments.

RESULTS: The WAAZ program started with 329 participants (34 teams). Over the past 10 years 1,328 teams with 11,589 participants walked over 2.4 million miles during the program. The community planning Task Force and collaborations with community organization partners helped extend outreach of WAAZ statewide with inclusion of youth and people with limited resources.

848

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The changes in fruits and vegetable intakes during the program were associated with reported average walking miles per week. The program also promoted a sense of belonging among participants in a community. In 2011, 791 participants, 6 to 99 years old recorded walking an average of 21 miles per week, and 170 miles per person during 8-week program. Currently, 2 schools (n=58) are participating in the WAAZ program as a part of their PE classes.

CONCLUSION: A community team-based walking program effectively promotes physical activity. The WAAZ program is a model that can provide research based physical activity, and nutrition education resources to promote healthy lifestyles within a community.

3214 Board #179 June 1 2:00 PM - 3:30 PM
**Effect Of Physical Activity On Primary Care Total Number Of Visits In Inactive Patients**

Carme Martín-Borras¹, María Giné-Garriga², Anna Puig-Ribera², Carlos Martín-Cantera², Antonio Cuesta³, Mercé Solá³, PPAF Group⁴. FPCEE Blanquerna, Universitat Ramon Llull, Barcelona, Spain. ²Universitat de Vic, Vic, Spain. ³IDIAP Jordi Gol, Barcelona, Spain. ⁴Universidad de Málaga, Málaga, Spain. ²Institut Català de la Salut, Sant Joan Despí, Spain. ³Institut Català de la Salut, Catalonia, Spain. (Sponsor: Viswanath Unnithan, FACSM)

(No relationships reported)

Inactive people with multiple morbidities are associated with increased health costs. Previous reviews of physical activity programs have assessed their effects on health and functional outcomes. None, to our knowledge, have examined their effects on primary care utilization in terms of number of visits.

**PURPOSE:** To assess the effectiveness of a primary care based physical activity program on altering the total number of visits to the healthcare centre among inactive population seen in primary care, over 27-month period.

**METHODS:** 362 primary healthcare patients (283 women, 79 men) (66.52 ± 12.33 years old) not undertaking 30 minutes of moderate intensity physical activity on at least five days of the week were randomly allocated into two groups (Control Group, CG=172; Intervention Group, IG=190). IG went through a 3-month standardized physical activity program linked to community resources. CG met once a month for educational and social meetings. Total numbers of consultations to the healthcare centre, registering the total number of visits during the twelve months prior and after the program, were assessed. Consultations included face-to-face and home visits by GPs or nurses, and also out-of-hours visits to the healthcare centre. Secondary outcomes for IG and CG were self-reported health status documented via the SF-12 survey, and assessed at baseline (month 12), at the end of the intervention (month 15), and at 6 and 12 months follow-up after the end of the intervention (month 21 and 27, respectively). An analysis of covariance (ANCOVA) was performed for all outcome measures.

**RESULTS:** Consultations of the IG participants showed a significant decline relative to those in the CG (p < 0.05) (mean score ± SD in number of visits of participants in the IG and CG were 9.32 (3.25) and 15.79 (4.82), respectively in month 27).

**CONCLUSIONS:** In summary, our findings indicate that our intervention reduces the number of consultations, which is a direct measure of health economic costs.

F-30 Free Communication/Poster - Medical Issues

JUNE 1, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

3215 Board #180 June 1 3:30 PM - 5:00 PM
**Intensive Lifestyle Modifications Reduce Lp-PLA2 Mass In Patients With HIV Lipodystrophy**

Kevin S. Chapman¹, Joshua S. Wooten¹, Preethi Nambi¹, Baiba K. Gillard², Vijay Nambi², Henry J. Pownall², Lynne W. Scott², Christie M. Ballantyne², Ivonne Coraza², Ashok Balasubramanyam². ¹Southern Illinois University Edwardsville, Edwardsville, IL. ²Baylor College of Medicine, Houston, TX.

(No relationships reported)

Patients with HIV-associated dyslipidemia have exhibited Lp-PLA2 levels above what is observed in patients with coronary heart disease (CHD), which may indicate accelerated development of CHD.

**PURPOSE:** To assess if an intensive diet and exercise (D/E) program independently and combined with fenofibrate and niacin provided added benefits to usual medical care at reducing circulating Lp-PLA2 mass and CCL5/RANTES in patients with HIV dyslipidemia.

**METHODS:** Participants (n=107) were randomized to five study groups: 1) Usual care; 2) D/E; 3) D/E with fenofibrate (160 mg/d); 4) D/E with niacin (2 g/d); and 5) D/E with fenofibrate and niacin for 24 weeks. General linear models (SPSS 18.0) was used to compare the five randomized groups with respect to Lp-PLA2 mass and CCL5/RANTES while controlling for age, baseline BMI, baseline CD4+ T-cell count, baseline viral load, duration of HIV, and duration of antiretroviral drug therapy, as well as the baseline outcome value. Statistical significance was set at P<0.05.

**RESULTS:** Following the 24-week intervention, Lp-PLA2 concentration (Table 1) was significantly lower in patients who participated in D/E only, D/E plus fenofibrate, and D/E plus niacin than patients receiving usual medical care. Interestingly, there was no significant difference in Lp-PLA2 mass between patients who received D/E only, D/E plus fenofibrate and D/E plus niacin. No significant differences were observed between groups for CCL5/RANTES concentrations following the 24-week intervention.

**CONCLUSIONS:** This study is first to demonstrate that when compared to standard medical care, plasma Lp-PLA2 mass can be reduced by an intensive D/E program in patients with HIV dyslipidemia.

Supported by NIH Grant R01 HL73696 (A.B.).

<table>
<thead>
<tr>
<th>Group</th>
<th>Lp-PLA2 (mg/mL)</th>
<th>Baseline</th>
<th>Post-treatment</th>
<th>Lp-PLA2 (mg/mL)</th>
<th>Baseline</th>
<th>Post-treatment</th>
<th>RANTES (pg/mL)</th>
<th>Baseline</th>
<th>Post-treatment</th>
<th>RANTES (pg/mL)</th>
<th>Baseline</th>
<th>Post-treatment</th>
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<tbody>
<tr>
<td>1</td>
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<td>436.0 ± 88.8</td>
<td>42.4 ± 25.8</td>
<td>47.4 ± 30.5</td>
<td>2</td>
<td>367.2 ± 83.8</td>
<td>370.2 ± 102.6</td>
<td>40.0 ± 14.9</td>
<td>52.4 ± 28.8</td>
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<td>403.3 ± 156.8</td>
<td>368.8 ± 70.0</td>
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<tr>
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<td>371.0 ± 97.1</td>
<td>352.0 ± 84.11</td>
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<td>380.2 ± 100.3</td>
<td>41.3 ± 22.2</td>
<td>41.4 ± 23.0</td>
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</tbody>
</table>

Data are presented as Mean ± SD. Group 1 is usual care + 2 placebos; Group 2 is intensive diet/exercise program + 2 placebos; Group 3 is intensive diet/exercise program + fenofibrate; Group 4 is intensive diet/exercise program + niacin. Group 5 is intensive diet/exercise program + fenofibrate + niacin. *P<0.05, †P<0.01, significantly different than Group 1 Post-treatment.
3216 Board #181 June 1 3:30 PM - 5:00 PM
Intense Training Improves Prognosis On An Ex-elite Athlete With Smoldering Multiple Myeloma
Daniel A. Boulloua,1 Laurinda Abreu,2 Anthony S. Leicht3. 1Universidade Católica de Brasília, Brasília, Brazil; 2Lavadores, Vigo, Spain; 3James Cook University, Townsville, Australia.
(No relationships reported)

PURPOSE: To evaluate the influence of a supervised training program on: changes in serum monoclonal protein level (i.e. IgG), percentage of bone marrow plasma cells (BMPCs), performance, and cardiac autonomic control (i.e. heart rate [HR] variability [HRV]) on a female diagnosed with smoldering multiple myeloma.

METHODS: A 38-year-old female patient with smoldering multiple myeloma and former elite youth athlete, was followed for four years while participating in a high intensity training regime designed for the development of various physical capacities. HRV was evaluated via time (root mean square of successive differences [RMSSD]) and frequency (low [LF] and high [HF]) domain parameters with analysis of two 24 hrs R-R recordings per week during a six week period at the middle and the end of the follow-up. Changes in muscular strength, muscular endurance, and aerobic capacity; IgG levels, and BMPCs were evaluated throughout the entire follow-up.

RESULTS: HRV parameters exhibited significant (p<0.01) increments (18-29%) in RMSSD, LF, HF with the LF/HF ratio being (2.28 ± 0.41 vs. 2.22 ± 0.43, p=0.595) unchanged. Exercise performance was significantly improved (e.g. 233 % increase in maximum number of pull-ups, and 22% increase in 1 repetition maximum bench press). Similarly, IgG levels exhibited a significant (p<0.001) reduction (44%, from 3,290 mg.dl-1 vs. 1,840 mg.dl-1) while BMPCs also decreased from 20% to 10%.

CONCLUSIONS: The current case report results indicated that an intense training program designed for the development of various physical capacities, and adapted to the patient’s former elite training background, significantly improved exercise performance, cardiac autonomic control, and hematologic function that may improve long-term prognosis for smoldering multiple myeloma. Examination of similar exercise training for other cancer populations may assist in the development of treatment regimes for improved prognosis.

3217 Board #182 June 1 3:30 PM - 5:00 PM
Three-Dimensional Global Area Tracking is a Valuable Quantitative Parameter for Left Ventricular Function in Athletes
Victor C. Wang1, Frank Mayer2, Marc Dorenkamp3, Klaus Bonaventura1. 1University Outpatient Clinic Potsdam, Potsdam, Germany; 2Charité - Universitätsmedizin Berlin, Berlin, Germany; 3Klinikum Ernst von Bergmann, Potsdam, Germany.
(No relationships reported)

The one- and two- dimensional echocardiography offers established methods for quantitative evaluation of left ventricle systolic function such as the measurements of the ejection fraction by Teichholz or Simpson. In recently developed three-dimensional (3D) speckle tracking, the region of interest is tracked in real time. Ejection fraction and area tracking values were calculated for Spearman’s rho correlation tests for nonparametric statistical comparisons.

RESULTS: Mean values of 3 measurements from both ejection fraction and area tracking were calculated for Spearman’s rho correlation tests for nonparametric statistical comparisons. Correlations were significant negative correlations between ejection fraction and area tracking. Correlations were found for athletes rho=-.776, for cardiovascular patients rho=-.929 and for combined group rho=-.855. All correlations were significant (p < 0.01) (2-tailed).

CONCLUSION: Significant negative correlations between ejection fraction and area tracking were found regardless of different physical fitness and cardiovascular conditions in athletes and cardiovascular patients.

3218 Board #183 June 1 3:30 PM - 5:00 PM
Regular Exercise As A Protective Factor Against Obesity Risk Among Extreme Sleep Phenotypes In Athletes
Christopher P. Herrera, Abdulaziz Farooq. ASPETAR-Qatar Orthopaedic & Sports Medicine Hospital, Doha, Qatar.
(No relationships reported)

Recent studies suggest a strong relationship between extreme sleep phenotypes (e.g. short and long sleepers) and higher obesity rates in the general population. Increased adiposity and a lack of physical activity are reported to mediate this relationship. Notably, sleep phenotype has not been explored in an athlete population but is of interest given the apparent differences in lifestyle patterns of physical activity compared to the general population which may attenuate the risk of obesity.

PURPOSE: To determine the influence of regular physical activity on factors underlying the relationship between sleep and obesity risk.

METHODS: Football players (n=111, 23.6±5 years, range 17-35) from the Qatar Stars League who were attending pre-competition screening assessments during August 2011 were queried using a standardized sleep questionnaire. The Arabic version of the Pittsburgh Sleep Quality Index (PSQI) was used to determine the quantity and quality of sleep. The reported total sleep time was used to establish sleep phenotype: short (<5 h), normal, and long (15.3%). Sleep quality was worse in short sleepers (PSQI 7.2±2) compared to regular sleepers (5.2±2) and long (PSQI 5.5±2) sleepers (p=0.05). Total cholesterol, HDL, LDL and triglycerides were similar between groups (p values range 0.39-0.91). TST was poorly associated with BMI (r=0.11; p=0.27) and BF (r=0.02; p=0.85).

CONCLUSIONS: The relationship between sleep phenotype and higher obesity risk was not present in this group of football players. Although the mechanisms remain unclear, regular sports participation likely plays a protective role against increased obesity risk in athletes with extreme sleep phenotype.

3219 Board #184 June 1 3:30 PM - 5:00 PM
Sleep Quality and Daytime Sleepiness in High-Performance Athletes
Andreas Miera, Kim Reuland, Julia Miera, Heiko K. Strueder. German Sport University, Cologne, Germany.
(No relationships reported)

There is strong scientific evidence that metabolic, neuroendocrine, immunologic, restorative physiologic, memory and psycho-motor functions are negatively affected by sleep restriction. Elite athletes are particularly exposed to factors that may impair sleep quality such as mental and physical stress and forced shifts of the individual circadian sleep/wake phase due to training and competition schedules. The quality of sleep among elite athletes, however, is not well documented.

PURPOSE: To determine sleep quality, daytime sleepiness and chronotype distribution in Luxembourgian elite athletes as well as to analyze the role of gender and time of season in this context.
METHODS: 23 (11 females: 21.4 ± 2.3 years; 171.2 ± 9.7 cm; 61.3 ± 6.1 kg and 12 males: 19.9 ± 1.9 years; 179.2 ± 8.3 cm; 72.8 ± 8.6 kg) Luxembourgian elite athletes from different sports completed three online questionnaires with regard to their sleep quality (Pittsburgh Sleep Quality Index: PSQI, the daytime sleepiness (Epworth Sleepiness Scale: ESS) and the individual chronotype (Athlete Morningness/Eveningness Scale: AMES). Respondents were also asked to specify their individual time of the season (preparation, competition, transition or rest period).

RESULTS: 39% of the athletes who participated in this survey were characterized as “normal” or “moderate morning type” and 22% as “moderate evening type” with no effect of gender. 40% of the athletes scored greater than or equal to 5 on the PSQI, indicating poor sleep quality. There was no effect of gender but a trend towards better sleep quality in the competition if compared to the period transition and in the transition if compared to the rest period. Furthermore, 17% of the athletes had ESS scores higher than 10 and 13% higher than 14 indicating abnormal and clinically relevant daytime sleepiness, respectively.

CONCLUSION: The current study suggests that there is a relatively high prevalence of poor sleep quality in elite athletes. Moreover, our results suggest that time of the season could be a crucial factor for sleep disturbances. In combination with our results on daytime sleepiness we conclude that individual sleep schedules including daytime naps could be helpful to improve sleep quality and to reduce daytime sleepiness in elite athletes.

3220 Board #185 June 1 3:30 PM - 5:00 PM
Exhaled Nitric Oxide Predicts Airway Inflammation Of The Rugby Players During Training Camp
Tomoko Imaz1, Shoji Takayanagi1, Masahiro Takemura1, Takao Furukawa1, Kazuhiko Shimizu1, Takeo Akama2, Shunpei Miyakawa1, Koichi Watanabe1. 1University of Tsukuba, Tsukuba, Japan. 2Waseda University, Tokorozawa, Japan. (No relationships reported)

A high prevalence of exercise induced respiratory symptoms, bronchial hyper responsiveness (BHR) and airway inflammation have been reported in athletes. The exhaled nitric oxide fraction (FeNO) has been proposed as a useful marker of airway inflammation. Previous studies reported changes in FeNO during and after exercise. Practice load and bout during training camp seemed to be higher than those of daily training. So airway inflammation may be higher during training camp than during daily training. However, there had been not investigated with FeNO during training camp.

PURPOSE: The purpose of the study is to investigate the airway inflammation of rugby players during training camp

METHODS: 69 rugby players participated in this study. We measured their FeNO before training camp (Pre), during middle of training camp (mid-camp) and at the end of training camp (end-camp). They were also asked about the history of respiratory symptoms. FeNO were measured by using a portable MINO (NINOX MINO).

RESULT: The rugby players average age, height and weight were 19.5±1yr, 176.4±6.2cm, 83.6±13.4kg. Twenty of 69 who reported respiratory symptoms had asthma or past history of asthma. And thirty-two of them had allergy such as allergic dermatitis, nasal inflammation, allergic rhinitis, and food allergy. FeNO of the Pre was 28.2±28.6ppb. 27 rugby players exceeded the normal limit of airway inflammation level (FeNO > 25). FeNO of the mid-camp and end-camp were 25.3±15.8ppb. 25.6±16.2ppb. 15 players whose Pre NO levels were under the limit exceeded airway inflammation level during camp. Players of less than FeNO<13ppb didn’t exceed the FeNO>25.

DISCUSSION: We found 42% of all players had airway inflammation without past history of asthma. 15 rugby players with Pre FeNO ≥13ppb exceeded normal airway inflammation level during camp. Strenuous training of camp may influence response to developing of their airway inflammation. Those whose Pre exceeded 50ppb showed the decline FeNO during the camp. It was suggested that training of the previous day might influence the FeNO level of next day.

CONCLUSION: Many rugby players who trained hard had airway inflammation. If the athletes FeNO levels are over 13 ppb before the training camp, airway condition of the athletes might change according to training load or training condition.

F-31 Free Communication/Poster - Mental Health
JUNE 1, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

3221 Board #186 June 1 2:00 PM - 3:30 PM
Stress Habitation and Alterations in Perceived Stress Predict BMI Percentile Changes Across a School Year.
April M. Seelbinder, Denise M. Feda, Joan Dorn, James N. Roemmich, FACSM. University at Buffalo, Buffalo, NY. (No relationships reported)

Adolescents experience stressful situations at a high rate during school. Indeed, school is the most common source of stress for teens. This high rate of stress may promote increases in adiposity during a developmental period important for establishing the adult physique. Adiposity gains may be the result of teens engaging in common stress coping behaviors; snacking on energy dense foods, television, and reduced physical activity. All of which may increase adiposity. Adolescents who experience repeated bouts of the same stressors during the school year and continue to react to them would be most at risk for gains in adiposity. However, teens who habituate faster, or reduce their responding to repeated presentations of the same stressor may seek out fewer obsesogenic coping mechanisms, which may be protective against gains in adiposity.

PURPOSE: To determine the relationship between alterations in perceived stress levels and BMI percentile changes across a school year, and to determine whether the rate of habituation to stress is associated with alterations in BMI percentile.

METHODS: 41 adolescents ages 13-16 y completed the Perceived Stress Survey-14 prior to the beginning and at the end of the academic year. Adolescents’ height and weight was also measured at both time points. The stress habituation protocol was completed once and consisted of 6 mentalial subraction trials and measured the rate of reduction of perceived stress across trials. 34 of the 41 adolescents completed the habituation protocol.

RESULTS: When controlling for gender, race, family position on the social ladder and change in physical activity, increases in perceived stress across the school year predicted (β =0.44, p <0.02) increases in BMI percentile. When using the same covariates, a rapid reduction in (quicker habituation) perceived stress to repeated presentations of the same stressor was associated (β =28.1, p <0.05) with smaller changes in BMI percentile.

CONCLUSIONS: Increases in adolescents’ perceived stress during a school year may promote increases in BMI percentile. A greater habituation to repeated presentations of the same stressor may be protective against increases in BMI percentile. Supported by a UB 2020 Interdisciplinary Research Development Fund.

3222 Board #187 June 1 2:00 PM - 3:30 PM
Body Fat Percentage Predicts HRQoL over Measures of Fitness and Activity in Postmenopausal Sedentary Women
Elizabeth S. Edwards, Layne E. Eidenmüller, Christopher J. Womack, FACSM, Judith A. Flohr. James Madison University, Harrisonburg, VA. (No relationships reported)

PURPOSE: The purpose of this study was to determine the association of Health-Related Quality of Life (HRQoL) with certain anthropological measures, cardiovascular fitness, muscular strength, and physical activity (PA) in sedentary postmenopausal women.

METHODS: Data was collected at baseline on thirty-four postmenopausal sedentary women (age 57.9 ± 4.7 yrs.) as part of a larger pilot study. Measurements included: waist circumference (WC), body fat % via DXA (BFI %), maximum relative oxygen consumption (VO2max), chest press, leg press, and physical activity via the IPAQ. Chest press and leg press 1RM were estimated from 5RM measurements, and then were converted to ratios by dividing the weight lifted by body weight. HRQoL was evaluated using the CDC 4-question Healthy Days module. Bivariate Pearson’s correlations were used to identify variables that were associated with HRQoL. Stepwise regression was then used to identify variables that significantly predicted HRQoL.
RESULTS: The average number of healthy days in the previous month was 23.5 ± 8.8. Both BF% (r = -0.47, p = .006) and VO2max (r = 0.40, p = .021) were significantly associated with HRQoL, but neither measure of muscular strength nor IPAQ were significantly correlated with HRQoL. In the regression model, only BF% significantly predicted HRQoL, b = -0.69, t(32) = -2.97, p = .006. BF% explained a significant proportion of the variance in HRQoL, R2 = 0.22, F(1,32) = 8.83, p = .006.

CONCLUSIONS: BF% explained a significant proportion of HRQoL, whereas measures of cardiovascular and muscular fitness, as well as physical activity, did not. This is contrary to what has been reported previously in the literature, which have consistently indicated a correlation between HRQoL and self-reported PA. However, previous studies have primarily used other forms of measuring HRQoL, such as portions of the Short Form-36, as well as various self-report methods for PA. Additionally, it should also be noted that HRQoL correlated highly with VO2max and IPAQ, which may indicate that BF% mediates the effect of cardiovascular fitness and PA on HRQoL.

3223 Board #188 June 1 2:00 PM - 3:30 PM
Assessment of VO2max and Body Composition Following a 3-Month Wellness Intervention for Severe Mental Illness
Jeremy A. Patterson, FACSM1, Rachel M. Drake1, Alisha Shonecker2, Judy A. Johnston3,4.Wichita State University, Wichita, KS. 3Breakthrough, Wichita, KS.

(no relationships reported)

Maximal aerobic capacity (VO2max) is a good indicator of overall health and is commonly measured in the general population, but often goes overlooked in individuals with severe and persistent mental illness (SMI).

PURPOSE: To assess the VO2max, weight, and BF% in individuals with SMI, before and after a wellness intervention.

METHODS: Weight, BF%, and VO2max were measured pre and post a 3-month wellness intervention that included exercise promotion, dietary education, and group activities. VO2max was assessed by the YMCA bike test and BF% by skinfolds. Baseline measures compared to endpoint were analyzed with all participants, separated by gender and disorder.

RESULTS: 49 individuals (43±12.20 yrs/27±22 m/f) were assessed. BMI classifications were schizoaffective (n=11), bipolar disorder (n=17), schizoaffective disorder (n=14), major depressive disorder (MDD) (n=7). No significant difference was observed between pre / post measurements of BF% in all diagnoses except MDD. Males with MDD benefited from a wellness intervention reporting a significantly lower BF% (p(0.036)<0.05). No significant change in VO2max was observed following the intervention (p(0.038)<0.05). Individuals with SMI continually rated in the very poor to poor classifications for VO2max.

CONCLUSION: Individuals with SMI tend to have low VO2max and high BF%. Individuals in the current study did not statistically benefit from a wellness intervention in terms of BF% and VO2max except males with MDD. Males with MDD significantly lowered their BF% following a wellness intervention. Although this study statistically found no significant increase in VO2max in this cohort following a wellness intervention, it is worth noting the variations in test results in this study. 14 of the participants showed significant improvements from pre to post (26.63 ± 6.93 to 35.00 ± 9.05 ml/kg/min respectively) and 9 of the participants that started with a higher VO2max showed equally significant decreases (35.56 ± 11.62 to 26.20 ± 10.16 ml/kg/min), suggesting how complicated this type of study is with this population. Many participants will experience set backs that rapidly affect their health and others that can remain stable and adapt to a routine will benefit greatly, as was observed in our study.

Supported by RWJ Foundation Grant.

3224 Board #189 June 1 2:00 PM - 3:30 PM
Objectively Measured Physical Activity Characteristics and Depressive Symptoms in Older Latino Adults
Eduardo E. Bustamante1, Alexis F. Manning2, Beth A. Staffileno2, Louis Fogg3, JoEllen Wilbur3, David X. Manquez, FACSM1. 1University of Illinois at Chicago, Chicago, IL. 2Rush University Medical Center, Chicago, IL.

(no relationships reported)

PURPOSE: Older Latinos have the highest rates of major depression among racial/ethnic groups in the US, a problem that is compounded by barriers to care, resulting in high unmet need. Latinos report the least leisure-time physical activity (LTPA) but participate in the most objectively-measured PA of any racial/ethnic group due to high levels of non-LTPA (i.e. household, occupational, and transportation PA). The influence of non-LTPA, best captured by accelerometer, on depressive symptoms in minority populations has been understudied. Thus, the purpose of this study is to examine the relationship between characteristics of objectively-measured PA (i.e., dose, intensity, and bout duration) and depressive symptoms in older Latinos.

METHODS: A total of 174 older Latinos (≥ 60 yrs) completed interview style questionnaires and wore a triaxial accelerometer for 7 days. Output was used to estimate time spent in light, moderate, and vigorous intensity PA categorized by Miller (2010) cutpoints. Multiple linear regression analyses were used to predict Center for Epidemiologic Studies Depression Scale (CES-D) score. Established correlates of depression in older Latinos (i.e., age, gender, income, disability, education, acculturation, marital status, chronic disease, perceived health, and perceived hardship) were entered first. Then PA variables (i.e., minutes of total PA/day [dose], light, moderate, and vigorous PA/day [intensity], and minutes of light and moderate PA in 10-min bouts/day [bout duration]) were entered separately as additional terms to test for increments in variance explained by the model.

RESULTS: Most participants were female (74%), Mexican (55%), and Latino-oriented (85%). Twenty percent met CES-D criteria for possible depression (≥ 16). Daily minutes of moderate PA (M = 30.3, SD = 28.4, β = -.18, ΔR² = .02, p < .05) and minutes of moderate PA in 10-min bouts (M = 12.1, SD = 17, β = -.22. ΔR² = .04, p < .01), but not daily minutes of total, light, or vigorous PA, emerged as significant independent predictors of depressive symptoms.

CONCLUSIONS: Results provide preliminary evidence that the relationship between depressive symptoms and PA in older Latinos is driven by moderate PA and PA in 10-min bouts, while light PA and PA in shorter bouts may have a smaller impact on depressive symptoms in this population.

3225 Board #190 June 1 2:00 PM - 3:30 PM
Association of Park Access with Usual Stress of Adolescents
Denise Feda, April Seelbinder, Samina Raja, Li Yin, James Roemmich, FACSM. University at Buffalo, Buffalo, NY.

(no relationships reported)

Chronic usual stress is associated with obesity, weight gain, disorders of growth, development, and metabolism, and is also a risk factor for chronic diseases, such as cardiovascular disease. Previous studies have found that the presence of subjective measures of green space in adolescents’ built environment may protect against daily psychological stress, but did not control for the potential stress reducing benefits of physical activity.

PURPOSE: To determine the association between objective measures of neighborhood park area and usual stress of adolescents, while controlling for physical activity.

METHODS: 32 boys and 36 girls, ages 12-15, completed one-week of accelerometer and activity recording. Adolescents completed the PSS-14 measure of perceived stress, and parents completed a demographic questionnaire. Neighborhood built environment and park access variables were calculated using a geographic information system (GIS) and ArcGIS 9 and Network Analyst software. A network 0.5 mile was used for distance calculations. Accelerometer data were screened for completeness by trained researchers and converted to METs. Multiple regression was used to test the association of park area and the interaction of park and gender with usual stress while controlling for socioeconomic status and physical activity.

RESULTS: Separate models of neighborhood total park area (β = -0.000007, p ≤ 0.05) and percentage of park area (β = -67.53, p ≤ 0.03) both predicted usual stress.

CONCLUSIONS: Access to neighborhood parks and green space may buffer usual stress of adolescents, even when controlling for socioeconomic status and the protective effects of exercise on stress. Supported by NIH Grant HD055270.

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### Board #191
**June 1 3:30 PM - 5:00 PM**

**The Relationship of Socio-Demographic Characteristics and Nutrition Knowledge in Triathletes**

Daniel Christopher Washuth, Celines Martinez, Valerie George, Florida International University, Miami, FL.


Previous studies have shown that as a person’s nutrition knowledge increases, nutritional content of consumed food improves. A number of socio-demographic factors can influence nutrition knowledge. The relationship of socio-demographic characteristics and nutrition knowledge in Triathlete is unknown even though nutrition plays a key role in performance and in overall health.

**PURPOSE:** To determine the relationship of socio-demographic characteristics (i.e., gender, age, education, income, and marital status) on the nutrition knowledge of triathletes.

**METHODS:** An online survey was conducted in the fall of 2011. Emails were sent to potential participants through triathlon clubs and organizations in the U.S. asking them to complete the four sections of the Nutrition Knowledge Questionnaire; Dietary Recommendations, Sources of Food/Nutrients, Choosing Everyday foods, and Diet-Disease Relationship (Wardle and Parameter, 2001).

**RESULTS:** A total of 104 triathletes (54 female, 50 male) completed the questionnaire. The mean percent correct score was; Dietary Recommendations (68 ±19, mean±S.D.), Sources of Food/Nutrients (70 ±21), Choosing Everyday Foods (60 ±2). Marital status influenced nutrition knowledge, with triathletes who reported being married having a significantly (p<0.05) higher Total Nutrition Knowledge (TNK) score (69%) compared to single (50%). The majority (45%) were college graduates, 40% had post graduate degrees. Eighty eight percent reported income > $50,000. There was a significant correlation (p<0.05) between TNK score and education and household income. The scores in the Choosing Everyday Foods were the lowest out of all the categories. The triathletes reported that they believed the recommendations for fruits and vegetables was 4 servings/day.

**CONCLUSIONS:** The high level of education and income of these Triathlete perhaps provided them with the opportunity to learn more about nutrition either through formal education or guidance of a nutritional professional. However, athletes with less education and lower income may be in need of assistance to increase nutrition knowledge. Since the score for the category, Choosing Everyday Foods was the lowest, Triathletes need more education to help them understand how they can apply nutrition knowledge in making healthy food choices.

### Board #192
**June 1 3:30 PM - 5:00 PM**

**Education to Empower Collegiate Athletes to Fuel for Better Health and Performance**

Kelly M. Ping, Nanna L. Meyer, University of Colorado, Colorado Springs, CO.


Subjects were tested prior to (PRE), midway (MID), and following the 8 week diet (POST). Wingate anaerobic cycle tests were performed to determine peak power (PP) and fatigue index (FI).

**RESULTS:** There was no difference in PP between LO (PRE: 628.8±42.0W; MID: 719.4±52.3W; POST: 679.7±47.9W) and OM (PRE: 645.9±67.4W; MID: 663.5±58.5W; POST: 640.2±53.8W) at any time point (p=0.5) or as a result of diet (p=0.8). There were no differences in LBM in either group (LO: 48.4±1.7kg (PRE); 47.7±1.7kg (POST); OM: 41.8±1.4kg (PRE); 40.6±2.3kg (MID); 46.9±2.4kg (POST)) at any time point (p=0.8) or as a result of diet (p=0.2).

**CONCLUSION:** The present study found that anaerobic performance and lean body mass is unaffected by an 8 week lacto-ovo vegetarian diet. Future studies should evaluate the effects of a vegetarian diet on anaerobic athletic performance.

### Board #193
**June 1 3:30 PM - 5:00 PM**

**Anaerobic Performance In Women Is Unaffected By An Eight-week Lacto-ovo Vegetarian Diet**

Emily J. Saurers, Jessica Knurick, Gavin Moir, Shala E. Davis, FACSM, East Stroudsburg University, East Stroudsburg, PA.

**PURPOSE:** The relationship of combining academics and athletics put college athletes under pressure to succeed, and in order to be successful, athletes must have an understanding of how to effectively fuel their bodies. Research shows that athletes with a higher level of sport nutrition knowledge make better choices related to the intake of food and fluids, which positively affects performance, health, and social interactions. The purpose of this study was to enhance athletes’ sport nutrition knowledge and dietary behavior through interactive educational approaches.

**METHODS:** Twenty-nine athletes were assigned to the experimental group (EXP; females=20; males=9; freshmen=10, sophomores=10, juniors=7, seniors=2) and 13 athletes to the control group (CON; females=6; males=7; freshmen=3, sophomores=6, juniors=3, seniors=1). EXP included cross-country (7), track (6), soccer (8), and softball (3) players with an average of 19 ± 1.2 y, height of 172 ± 9.8 cm, and weight of 66.4 ± 10.2 kg. CON consisted of cross-country (9), softball (2), and volleyball (2) players, who opted out of the intervention. Each participant completed a previously validated and reliable sport nutrition knowledge questionnaire at the beginning and the end of the 6-month intervention, which was comprised of 4 interactive workshops using experiential learning (i.e., fueling for performance, grocery shopping, cooking/eating together, and body image and acceptance). It was hypothesized that EXP would have improved sport nutrition knowledge and dietary behaviors compared to CON.

**RESULTS:** Paired t-tests showed that EXP increased nutrition knowledge, while CON did not (EXP: pre SNK: 43.7±9.1; post SNK: 50.6±4.8 [p<0.001]; CON pre SNK: 48.2±6.6 and post SNK: 49.0±10.1 [p=0.914]). Behaviorally, EXP showed a significant increase in daily vegetable consumption (pre: 2.0±1.6; post: 2.2±1.5; p=0.006) and a trend in weekly food preparation (pre: 2.1±2.2; post: 3.0±2.3; p=0.053) with no difference in CON from pre to post.

**CONCLUSION:** This study shows that providing interactive learning opportunities to college athletes improves sport nutrition knowledge and dietary behaviors, such as eating more vegetables and preparing meals more frequently at home or in the dorms.

### Board #194
**June 1 3:30 PM - 5:00 PM**

**The Effects of a Vegetarian Diet on Anaerobic Capacity and Body Composition**

Jessica R. Knurick, Shala E. Davis, FACSM, Emily J. Saurers, Gavin L. Moir, East Stroudsburg University, East Stroudsburg, PA.

**PURPOSE:** To evaluate the effects of an 8-week forced lacto-ovo vegetarian (LO) diet on anaerobic capacity and body composition in active females aged 19-24.

Vegetarian diets are associated with health benefits such as lower incidence of diabetes, obesity, and ischemic heart disease. Despite these benefits, the consequences of a vegetarian diet on athletic performance have been questioned. Specifically, the effects of vegetarianism on anaerobic performance are largely unexplored.

**PURPOSE:** The purpose of this study was to evaluate the effects of a vegetarian diet on anaerobic performance.

**METHODS:** Twenty-two recreationally active women (21.7 ± 1.6 years) were matched and assigned to either a lacto-ovo vegetarian (LO; n=11) or omnivorous (OM; n=11) diet for 8 weeks. Subjects were tested prior to (PRE), midway (MID), and following the 8 week diet (POST). Wingate anaerobic cycle tests were performed to determine peak power (PP) and fatigue index (FI). Lean body mass (LBM) was assessed using air displacement plethysmography. Repeated measures ANOVA were used to analyze LBM, FI, and PP.

**RESULTS:** There was no difference in PP between LO (PRE: 628.8±42.0W; MID: 719.4±52.3W; POST: 679.7±47.9W) and OM (PRE: 645.9±67.4W; MID: 663.5±58.5W; POST: 640.2±53.8W) at any time point (p=0.6) or as a result of diet (p=0.9). There was no difference in FI between LO (PRE: 68.7±5.1%; MID: 62.3±3.5%; POST: 66.5±4.7%) and OM (PRE: 62.3±3.3%; MID: 71.5±3.4%; POST: 69.3±3.5%) at any time point (p=0.5) or as a result of diet (p=0.8). There were no differences in LBM in either group (LO: 48.4±1.7kg (PRE); 47.7±1.7kg (MID); 43.0±4.6kg (POST); OM: 41.8±1.4kg (PRE); 40.6±2.3kg (MID); 46.9±2.4kg (POST)) at any time point (p=0.8) or as a result of diet (p=0.2).

**CONCLUSION:** The present study found that anaerobic performance and lean body mass is unaffected by an 8 week lacto-ovo vegetarian diet. Future studies should evaluate the effects of a vegetarian diet on athletes to assess anaerobic athletic performance.
METHODS: In an 8-week interventional design, 22 women (21.73 ± 1.61 years) were matched and assigned to either an LO (n=11) or omnivorous (OM; n=11) group. The LO group abstained from eating meat, fish, and poultry, while maintaining activity level during the 8 weeks. Mean power, 1RM squat strength, and body fat percentage were all assessed in both groups at pre, mid, and post testing periods.

RESULTS: There were no significant changes in mean power output from pre to post testing within or between dietary groups (Pre-OM: 375.20 ± 83.67, Post-OM: 375.32 ± 78.94, Pre-LO: 412.76 ± 60.00, Post-LO: 403.94; p > 0.05). 1RM squat performance significantly increased in both groups at each testing session (Pre-OM: 139.44 ± 27.66, Mid-OM: 160 ± 28.5, Post-OM: 171.11 ± 42.48, Post-LO: 198 ± 35.1; p < 0.05). No changes in body fat percentage were experienced from pre to post testing within or between dietary groups (Pre-OM: 26.02 ± 7.53, Post-OM: 26.75 ± 7.75, Pre-LO: 24.99 ± 4.67, Post-LO: 26.24 ± 3.24; p > 0.05).

CONCLUSION: Adherence to either an LO or OM diet over an eight-week period was shown to have no effects on anaerobic capacity or body composition measures.

3230 Board #195 June 1 3:30 PM - 5:00 PM
Nutritional Evaluation of Physical Active Individuals Assisted in Nutrition Clinic from a Brazilian Federal University
Aline G. Amorim, Fabiana B. Ferreira, Jessica Min Moraes, Maria Em Santos, Patricia P. Correa. Federal University of Maranhao, Sao Luis, Brazil. (No relationships reported)

BACKGROUND: Nutritional requirements of physically active individuals differ from sedentary individuals, and the nutritionist’s approach is important in this context.

PURPOSE: To evaluate, from a nutritional point of view, physical active subjects attending an sports nutrition clinic in a federal university from Brazil.

METHODS: Data regarding physical activity, anthropometry (Body Mass Index-BMI, waist circumference) and food (use of dietary supplements, food frequency according to Food Pyramid groups, 24-hour recall) were obtained from patients, assisted by a nutritionist, who practice regular physical activity (active for at least 3 months, 3 times/week). Data were analyzed using unpaired t-test between gender, where p≤0.05 was considered significant.

RESULTS: The group consisted of 22 patients, with mean age 36.8 ± 18.6 years. From these, 14 were male (63.6%), and 8 were female (36.4%). 50% of the male individuals and 35.7% of the female preferred weightlifting, while others 35.7% of the female tended to walking. According to BMI, both male (25.0 ± 4.8 kg/m2) and female (26.8 ± 4.6 kg/m2) were overweight. However, four women (26.8%) were obese, while only one man (12.5%) exhibited such diagnosis. Only 3 patients reported the use of nutritional supplements. A higher frequency was observed for bread, grains and other starches (81.8%), sugar (77.3%), dairy products (72.7%), fats (72.7%) and fruits (68.2%) intake. The energy intake was 3126.0 ± 571.1 Kcal/d for male and 1613.0 ± 371.3 Kcal/d for female (p <0.05). The protein intake reached 2.1 ± 1.5 and 1.1 ± 0.5 g protein/Kg body weight for male and female (p≤0.05), respectively. Carbohydrate intake did not differ between genders (5.9 ± 3.4 and 3.4 ± 2.9 g carbohydrate/Kg body weight for men and women, respectively).

CONCLUSION: The patients’ nutritional intake should meet their nutritional requirements in order to reverse or even prevent health outcomes that are incompatible to good life style, such as adequate energy consumption, low sugar and fat intake. ACKNOWLEDGEMENTS: FAPEMA for financial support

3231 Board #196 June 1 3:30 PM - 5:00 PM
Dietary Supplement Habits of Soldiers of 101st Airborne Division Air Assault
Kim Crawford1, Matthew E. Darnell1, Heidi Stapel1, Mita T. Lovalekar1, John P. Abt2, Timothy C. Sell1, Michael D. Wint2, Takashi Nagai2, Jennifer B. Deluzio1, Scott M. Lephart1. 1University of Pittsburgh, Pittsburgh, PA. 2101st Airborne Division (Air Assault), Fort Campbell, KY. (No relationships reported)

To achieve optimal military readiness, Soldiers are turning to dietary supplements (DS) to increase strength, endurance, alertness and overall health. Future efforts should focus on educating Soldiers to use foods, fluids and nutrient timing as a safer and more effective alternative to DS.

METHODS: A total of 390 Soldiers (Age 28.2 ± 6.6 years; BMI 26.5 ± 3.5 kg/m2) completed a diet history including a detailed DS questionnaire (Table 1). Fifty-one percent consume more than one DS. Purposes of use, usage, perceived benefits and adverse reactions are noted. Both 18% reported to improve joint health, while 29% increase muscle mass, strength, size and endurance (Table 1) and 24% improve physical performance. Both 18% reported to improve alertness and feel more energized. Fewer patients consume one DS. Both 25% improve joint health, while 24% improve muscle mass and strength. Alertness is improved by both 24%, while both 25% improve energy to workout. Decrease muscle soreness is reported by both 24%.

CONCLUSION: Soldiers are using DS to correct nutrient inadequacies and improve the quality of the daily diet, to optimize adaptations from training and expedite recovery and to improve health and physical readiness. Future efforts should focus on educating Soldiers to use foods, fluids and nutrient timing as a safer and more effective alternative to DS. Supported by the U.S. Army Medical Research and Materiel Command under Award No. W81XWH-06-2-0070/09-2-0095
It has been reported that athletes at different competition levels and of diverse countries look to enhance athletic performance through the use of dietary supplements (DS). However, research on the use of DS by Puerto Rican national athletes is very limited.

**PURPOSE:** To determine dietary supplementation practices of athletes representing Puerto Rico at the 2010 Central American and Caribbean Games.

**METHODS:** Three hundred and fifty athletes (194 men, 156 women) of 23 sports participated in the study. Mean age (± SD) was 23.8 ± 7.8 years, mean competitive years was 8.9 ± 5.4, and training time ranged between 11 to over 25 hours per week. Dietary supplement use was determined through a questionnaire that included: demographic profile, use of DS, reasons for use, sources of information, and places where DS are purchased. Analyses consisted of frequencies and percentages of the variables of interest.

**RESULTS:** Seventy percent (70%) of the athletes reported having used DS in the past 12 months (64.7% men, 78.4% women). Of these, sports drinks (89.3%), multivitamins (65.8%), B12 (32.9%), and protein powder (28.8%) were DS most used. The main reasons for using DS were to enhance athletic performance (49.4%), maintenance (47.3) and to increase energy levels (46.1%). The most frequently reported sources of information were the nutritionists/dietitians (35.8%), publications (34.6%), and physicians (32.5%). Supplements were mostly obtained in health food stores (44.9%).

**CONCLUSION:** Athletes representing Puerto Rico at the 2010 Central American and Caribbean Games demonstrated dietary supplementation practices similar to those reported by national athletes in other countries.

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**PURPOSE:** This research investigated the use of dietary supplements patterns and doping awareness among high-ranked Judoists in two countries.

**METHODS:** Korean (70 males and 31 females) and Japanese (37 males and 34 females) national Judo team members divided into two groups (high and low competitive performance levels) according to their international and national rankings.

**RESULTS:** Among Koreans, 59% consumed dietary supplements, whereas 61% of the Japanese consumed dietary supplements. Among Koreans, 88% at the high and 51% at the low competitive performance level consumed dietary supplements, while 68% of high and 57% of low competitive performance level Japanese consumed dietary supplements. The most commonly consumed dietary supplements among Koreans were oriental supplements (34%), vitamins (23%), and protein powder (12%). However, vitamins (45%), protein powder (33%), and minerals (15%) were most commonly consumed among Japanese. Surprisingly, 38% Judoists of both countries had not received any proper education about anti-doping, while 44% had not received about anti-doping list knowledge. In addition, there was a significant difference in education about anti-doping (p < 0.001) between high and low competitive performance levels of Korean Judoists. However, Korean Judoists received significantly less anti-doping education than Japanese Judoists (p < 0.001). The associations for anti-doping education and anti-doping list knowledge with the use of dietary supplements were 3.46 (95% CI = 1.31-9.12) and 1.63 (95% CI = 0.71-3.76), respectively.

**CONCLUSIONS:** Our findings showed similar trends as previous studies. However, interestingly, we found that Judoists’ use of dietary supplement was increased as they experienced anti-doping education.

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**PURPOSE:** To evaluate the use of nutritional supplements by triathletes, their source of information and purpose for using supplements.

**METHODS:** An online survey was conducted in the fall of 2011. Emails were sent to potential participants through triathlon training clubs and organizations in the U.S. The email invited triathletes to complete the Supplement Use Survey created by Froiland et al (2000).

**RESULTS:** One hundred and twenty six triathletes (63 male, 63 female) were surveyed, ranging in age from 18-75 years. The majority (87%) were between 25-54 years of age. Approximately, 60% of the participants reported using supplements≥ 5 times/wk and 28%, 2-4 times/wk. The most frequently used supplements were multivitamins (80%), whey protein (65%), meal/calorie replacement drinks (67%), and fish oils (66%). The most common sources of information for supplements were: fellow athletes (68%), magazines (57%), books (54), and the internet (48%). Only 32% of participants reported receiving nutritional supplement information from a Sports Nutritionist/Registered Dietitian. A large portion of the participants (56%) reported that the reason they used supplements was to prevent injury and illness.

**CONCLUSIONS:** The majority of triathletes in this study used a wide variety of supplements but only about of third of those athletes reported seeking information from nutrition professionals before engaging in a supplement regimen. Triathletes have special nutritional needs and would benefit from working with nutrition professionals to ensure they are using the appropriate supplements to achieve optimum nutrition.
RESULTS: 30 percent of the children showed risk of overweight and obesity, two thirds of these children are female. 47 percent reported adverse environment and 14 percent were found in the contemplation stage. In general, children with an attitude of action were of normal weight, with an average BMI of 20.6 &amp;#177; 2.8, with respect to adverse environment there was no difference between children in the contemplation stage and the action stage (p &amp;#8804; 0.05).

CONCLUSIONS: The greatest influence on the transition from the contemplation stage to action was given by family and social environment of the school.

3236  June 1  2:00 PM - 3:30 PM
Board #201  Physicians' Views and Experiences of Counseling for Physical Activity: The New Zealand Green Prescription Program
Asmita Patel1, Grant M. Schofield2, Gregory S. Kolt3, Justin W.L. Keogh4, 1AUT University, Auckland, New Zealand, 2University of Western Sydney, Sydney, Australia, 3Bond University, Gold Coast, Australia, 4Sponsor: Karen Croteau, FACSM

RESULTS: Physicians counseled for PA and administered GRxs for both primary preventive (e.g., weight control) and secondary management (e.g., diabetes management) purposes. Physicians reported that the benefits of the GRx program centered around two main themes: (i) a non-medication approach to a healthier lifestyle and (ii) the ongoing specialized support provided by the exercise counselor through the telephone counseling. The only main theme that emerged regarding physicians perceived barriers to GRx use related to time constraints around the consultation. PA in general and PA prescribed through the GRx program were viewed by physicians as beneficial for the management of depression.

CONCLUSION: GRxs are being administered to individuals who can benefit from physical activity (i.e., those with pre-existing conditions and/or weight problems). GRxs may also be used to promote PA in currently healthy, but low-active and sedentary individuals. Such individuals are at risk for future health-related problems because of their inactive lifestyle. More research is required into the role that the GRx can have in helping manage depression. Supported by Health Research Council of New Zealand Grant 05/279.

METHODS: Individual face-to-face interviews were conducted with 15 primary care physicians. Interviews were audio-taped and transcribed. Data were analyzed using an inductive thematic approach.

3237  June 1  2:00 PM - 3:30 PM
Board #202  Variation Of Knowledge Of ACSM Physical Activity Recommendations With The Use Of Different Information Sources
Luis Leite1, Paulo Gonçalves Pinheiro1, Dulce Leal Esteves1, Kelly O'Hara1, Ricardo Gouveia Rodrigues1, Rui Brás2,1Beira Interior University, Covilha, Portugal, 2Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal, 3Beira Interior University & CIDESD, Covilha, Portugal

Conclusions: Increasing efforts to disseminate ACSM Physical Activity (PA) recommendations have been made, and the use of both traditional forms and new technologies tools has increased. Nevertheless, little investigation on the effect of the use of different information sources and the extent to which knowledge has diffused through a population (knowledge retention). PURPOSE: This study aims to examine whether knowledge the American College of Sports Medicine (ACSM) PA recommendations for Health Promotion varies by the use of different information sources.

METHODS: The study included a randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 y. The awareness of ACSM PA Recommendations was assessed as indicated by Bennett et al., 2009. A survey was designed to (1) identify main information sources and (2) relate knowledge retention on adequate PA for health benefits and PA information sources.

RESULTS: All information sources investigated revealed low adherence. The main information sources identified were friends/family (2.90±1.173); sport professionals (2.81±1.408); Medical doctors (2.65±1.381) and school teachers (2.63±1.406). Recommendations knowledge was significantly higher (p&lt;0.05) when information source are sport professionals. Recommendation knowledge was significantly lower (p&lt;0.05) for Internet users (information source Internet or social networks). Increase of knowledge about the ACSM PA recommendations varies by age, gender and education level.


3238  June 1  2:00 PM - 3:30 PM
Board #203  Awareness Of ACSM Physical Activity Recommendations for Health Promotion Among Portuguese Population
Sergio Vieira1, Dulce Leal Esteves2, Paulo Gonçalves Pinheiro1, Kelly O’Hara1, Rui Brás2,1Beira Interior University, Covilha, Portugal, 2Beira Interior University & CIDESD, Covilha, Portugal

Conclusions: Regular moderate physical activity (PA) has an important influence on health and well-being, but is not clear if people know the adequate PA characteristics for health improvement.

RESULTS: The study included a stratified randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 y. divided in 4 age groups: young (Y): 210 subjects, 15-24 years; young adults (YA): 224, 25-39 years; adults (A): 206, 40-60 years; older (O): 208, > 60 years. The awareness of ACSM Physical Activity Recommendations for Health Promotion was assessed as indicated by Bennett et al., 2009.

RESULTS: Almost a quarter of respondents (26.3%) were accurately knowledgeable of the ACSM physical activity recommendations. Recommendations knowledge was slightly higher among women (27.5%) than men (25.5%) and increase with age: Y: 20.1%; YA: 23.2%; A: 27.7% and O: 29.0%. No significant differences were found on recommendations knowledge among the different educational levels investigated.


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3239  Board #204  June 1 2:00 PM - 3:30 PM  
Measuring Progress In The Implementation Of The U.S. National Physical Activity Plan  
Daniel B. Bornstein, Kelly E. Evenson, Sara B. Satinsky, Amy A. Eylter, Ross C. Brownson, Russell R. Pate, FACSM. University of South Carolina, Columbia, SC. University of North Carolina - Chapel Hill, Chapel Hill, NC. Washington University - St. Louis, MO.  
(No relationships reported)  
Evaluation of a national physical activity (PA) plan is critical to its overall success; yet, most national PA plans from around the world lack a formal evaluation process. Authors of the U.S. National Physical Activity Plan (NPAP), released in 2010, are committed to evaluation, seeking evidence of achievements and opportunities for improvement. To provide this evidence, change in population levels of PA is a logical outcome to measure; however, it likely will not be evident for years or decades and is influenced by a multitude of factors. Therefore, it is necessary to have more proximal indicators, such as implementation of the NPAP’s strategies, which target policy and environmental change.

PURPOSE: To identify progress and barriers encountered by six, sector-specific teams leading implementation of the NPAP.

METHODS: Quarterly reports were developed and disseminated to six sector-specific teams (Business and Industry; Education; Health Care; Parks, Recreation, Fitness, and Sports; Public Health; Transportation, Land Use, and Community Design) that lead implementation of the NPAP, and documented the following: work being done; progress toward goals; barriers to reaching goals; products or programs developed; practice/policy changes; lessons learned; contributions from external sources; and media coverage generated.

RESULTS: Across sector teams, overall efforts to advance the NPAP’s strategies occurred in four key areas: 1) generating federal policies, best practice guidelines, national standards, and surveys; 2) educating state-level staff on guidelines; 3) encouraging message promotion by high-level public officials; and 4) generating relevant media coverage. Within each sector team, activities specific to their prioritized strategies were documented, including: products developed; contributions received; lessons learned; and barriers encountered.

CONCLUSION: Teams responsible for implementing the NPAP have made demonstrable progress and have reported barriers to advancing the NPAP’s sector-specific strategies at national, state, and local levels. Results of these initial efforts may inform similar future attempts to advance physical activity policy at national, state, and local levels.

3240  Board #205  June 1 2:00 PM - 3:30 PM  
Partnership for Active Community Environments: Translating Research to Action  
Barbara S. McClanahan, Michelle B. Stockton, Sue E. Clark, Rick McClanahan. University of Memphis, Memphis, TN. City of Bartlett, Bartlett, TN. (Sponsor: Healthier Chambliss, FACSM)

(B.S. McClanahan: Contracted Research - Including Principle Investigator; PI on NIH grant.)

PURPOSE: PACE (Partnership for Active Community Environments) is an interdisciplinary collaborative working to increase understandings of supports and barriers to building active, vibrant neighborhoods. Using a community-based participatory research (CBPR) design a townhall meeting of diverse groups of built environment professionals (n=175) was held and action items were identified and prioritized. Encouraging the adoption and maintenance of healthy behaviors through support and nurturing of the local ‘greenline’ (rails-to-trails) emerged as a priority action.

METHODS: Through observation and key informant interviews perceptions of safety risks were identified as a significant barrier to physical activity in a low-income, urban neighborhood of high crime and poverty. Using a CBPR design an elementary school adjacent to the high risk area was identified as a target of intervention. PACE members worked with stakeholders (principal, board chair, teachers) and community leaders (neighborhood development corporation, neighborhood association leaders) to identify strategies to address safety concerns, enhance physical activity and encourage the adoption of healthy lifestyles.

RESULTS: School leaders and community stakeholders prioritized clearing land adjacent the greenline to address safety concerns and suggested developing a school garden on the land providing ‘garden to cafeteria’ opportunities for learning and healthy eating. PACE identified and facilitated partnerships to support the initiative. Students worked with PACE staff, community leaders and volunteers to clear ground, prepare soil (spread 2000+ pounds lime), plant and harvest the wide variety of produce. Harvested foods were incorporated into school meals and students were invited to take additional produce home. Observations and key informant interviews revealed that perceptions of safety and student use of the greenline (physical activity) were enhanced.

CONCLUSIONS: PACE’s collaborative efforts to encourage the adoption and maintenance of healthy behaviors through CBPR practices were successful and can serve as a model for other communities.

3241  Board #206  June 1 2:00 PM - 3:30 PM  
Should We Treat Workplace Inactivity like Occupational Hazards such as Chemical Exposure?  
Donald E. Watenpaugh. University of North Texas Health Science Center, Fort Worth, TX. (Sponsor: Peter B. Raven, FACSM)

(No relationships reported)  
PURPOSE: We need to redefine how workers, employers, and policymakers address workplace inactivity. People are increasingly inactive at their jobs as technological evolution reduces physical work. This chronic inactivity reduces fitness and creates risk of myriad diseases, such as obesity, sleep apnea, cardiovascular disease, diabetes, and osteoporosis. Risks of occupational inactivity rival risks of other more obvious hazards such as chemical exposure and noise. Furthermore, the culture of most workplaces fails to acknowledge risks of chronic inactivity, nor the value of sporadic weekday activity for improving alertness, cognition, and thus productivity. For example, employers often provide break time and specific areas for smoking, yet to do this for exercise may be considered distracting, counterproductive, and/or too expensive.

METHODS: Through observation and key informant interviews perceptions of safety risks were identified as a significant barrier to physical activity in a low-income, urban neighborhood of high crime and poverty. Using a CBPR design an elementary school adjacent to the high risk area was identified as a target of intervention. PACE members worked with stakeholders (principal, board chair, teachers) and community leaders (neighborhood development corporation, neighborhood association leaders) to identify strategies to address safety concerns, enhance physical activity and encourage the adoption of healthy lifestyles.

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CONCLUSIONS: PACE’s collaborative efforts to encourage the adoption and maintenance of healthy behaviors through CBPR practices were successful and can serve as a model for other communities.

3242  Board #207  June 1 2:00 PM - 3:30 PM  
Policy and Environmental Assessment to Improve Community Health in Physical Activity, Nutrition, and Chronic Disease  
Janet R. Wojcik, Hope Matthews, Thomas Bell, Susan Collier, Deborah Hayworth. Windthrop University, Rock Hill, SC. City of Rock Hill Parks, Recreation & Tourism, Rock Hill, SC. South Carolina Department of Health and Environmental Control, Rock Hill, SC. United Way of York County, Rock Hill, SC. (Sponsor: Melanie Poudevigne, FACSM)

(No relationships reported)  
South Carolina is considered one of the unhealthiest states. It ranks 1st in the nation for deaths due to stroke, 5th highest for adult obesity, 6th highest for diabetes, and 7th highest in childhood obesity (CDC, 2011; SC Budget & Control Board, 2007). In York County, 29.7% of adults are obese; 8.8% have Type 2 diabetes, and 24.4% are physically inactive (CDC, 2008). Recent BMI data collected at 13 schools on 3rd and 4th grade students revealed over 40% are either overweight or obese.

PURPOSE: To perform community-wide assessments across different sectors to guide the development of a three-year Community Action Plan (CAP).
METHODS: The CHANGE tool (CDC, 2010) was used to rate from 1-5 the existing written policies and supportive environments for physical activity (PA), nutrition, tobacco, chronic disease management, and leadership in the Community-At-Large (CAL) (n=1), K-12 schools (n=3), worksites (n=5), community institution/organizations (n=3), and health care organizations (n=5). CHANGE data were combined with current initiatives from a community coalition and recent data on health behaviors, obesity, bikeability, and food deserts.

RESULTS: Scores of 0-20% are considered low, 21-60% moderate, and 81-100% high. Some of the lower scores were in PA, especially K-12 policy (36% and 40% for 2 schools) with the CAL at 55% for environment but 75% for policy. Nutrition scores, in both policy and environment, were <40% in at least 5 sites, plus the CAL. Tobacco scores were good (10 sites >60%), mostly due to local and state smoking policies. In chronic disease management, only one worksite scored below 40% in both policy and environment, but overall worksites and health care agencies were higher-scoring >60%. In leadership across all sectors, environment scores (6 sectors >80%) exceed policy (6 sectors <80%), suggesting managers may be supportive of implementing new policy.

CONCLUSION: The initial goal for the CAP is to develop better wayfinding for bike routes and trails to increase PA. Additional goals will include increasing access to healthy food, chronic disease leadership, and tobacco-free spaces. Overall, to improve community health, there is a large need to develop sustainable written policies across all sectors.

Supported by ACHIEVE from CDC Healthy Communities and National Recreation and Park Association

F-34 Free Communication/Poster - Psychological Responses - Acute Exercise
JUNE 1, 2012 1:00 PM - 6:00 PM
ROOM: Exhibit Hall

3243 Board #208 June 1 2:00 PM - 3:30 PM
The Benefits Of Promotion Of Physical Activity For Companies
Vincent H. Hildebrandt1, J.H. Stubbe2, J.W. Velthuisen2, W. Van Mechelen, FACSM1. 1TNO, Leiden, Netherlands. 2PwC, Amsterdam, Netherlands. 3VU University Medical Center, Amsterdam, Amsterdam, Netherlands.

(NO relationships reported)

PURPOSE: To assess the benefits of promotion of physical activity for companies on macro-economic level.

METHODS: Data of the Dutch Monitor on Physical Activity (PA) and Health during 2006-2009 were analyzed (N=5020, total for 4 years). The monitor is a representative sample of the Dutch population, interviewed by telephone (average annual response rate: 54%). Questions were asked about demographic characteristics, PA, chronic illnesses, lifestyle factors and sickness absence. A logit model was used to estimate the probability of having a disease given the PA, socio-economic variables (gender, age, education, employment) and lifestyle variables (BMI, smoking and alcohol consumption). Furthermore, it was investigated whether these differences evolved into changes in the annual number of days of absenteeism from work. Next, the monetary value of different physical activity stimulation scenarios was quantified. One scenario used the PA public health guideline (at least 5 days per week at least 30 minutes at least moderate intensity PA), the other used the high intensity PA guideline (at least 3 times per week high intensity PA during at least 20 minutes). All scenarios were compared to the ‘as is’ situation in order to calculate the productivity benefits or losses of changes in thelevel of physical activity.

RESULTS: Promotion of PA resulted in lower costs of absenteeism from work related to sickness. If all Dutch workers would comply with the high intensity guideline who currently do not, annual savings would be maximal: $1280 million (moderate intensity guideline: $550 million savings). A more realistic scenario in which promotion of PA would result in an increase of the number of Dutch workers complying with the guidelines of approximately 20-25% would still give substantial savings ($520 million for high intensity PA and $330 million for moderate intensity PA).

CONCLUSIONS: Promotion of PA results in substantial savings for companies due to less absenteeism related to sickness, in particular when high intensity PA is promoted.
CONCLUSIONS: Previous literature suggests a significant improvement in creative potential induced by exercise. Results of this study suggest there are no statistically significant benefits to creative potential induced by an acute bout of aerobic exercise. It is possible that the exercise intensity and duration of the current study is not enough to yield benefits to creative potential. Future research may benefit from a within-groups experimental design which utilizes different measures of creative potential in order to ensure a minimal learning effect.

3246  Board #211  June 1  3:30 PM - 5:00 PM
Relationships between Mood and Salivary Immunoglobulin A Level in Tailored Exercises
Hisashi Mitsuishi, Takayuki Ishiwata, Hanyasu Kato, Shintaro Endo, Kininoshi Yasumatsu, Hidetoshi Kano, Takashi Nigorikawa, Tetsuya Matsuo, Makoto Matsuyama, Kazuo Oshi. Rikkyo University, Nii-ashi, Saitama, Japan.
(No relationships reported)

BACKGROUND: It is well known that exercise is effective to improve mental health and immune functions. In particular, studies have shown evidences of tailored exercises (intensity, frequency, type, etc.) being beneficial for people with mood disorders who are not in the habit of exercising, such that their mood and mucosal immunity improves. However, psychological indicators of mood, i.e., questionnaires, and physiological indicators of immune function, i.e., salivary activity of immunoglobulin A (sIgA level), are typically evaluated individually. Therefore, it is not clear if there is a relationship between the mood and sIgA levels associated with tailored exercise programs for people who do not have the habit of exercising.

PURPOSE: We investigated the relationships between the mood and sIgA levels in response to tailored short-term less intense or moderately intense exercises.

METHODS: We examined the effects of acute exercise on the mood and sIgA levels in 10 healthy male university students who did not have the habit of exercising. A mood scale was used to evaluate the psychological responses (positive engagement, tranquility, negative affect). The sIgA levels were measured by ELISA. Data were collected at 3 different stages (before, during, and after the exercise) for 2 different types of exercises, i.e., tailored (strength training and walking) and un-tailored (step exercise and indoor hockey).

RESULTS: According to the Spearman rank-correlation test, there were significant relationships between the mood and sIgA levels during and after tailored exercises. In particular, significant positive correlations were observed between "positive engagement" and sIgA levels (r=0.82, p<0.05) and between "tranquility" and sIgA levels (r=0.68, p<0.05). There were significant negative correlations between "negative affect" and sIgA levels (r=-0.64, p<0.05). However, there was no significant relationship between the mood and sIgA levels in the cases of un-tailored exercises.

CONCLUSIONS: These findings may help clarify the relationship between the mood and sIgA levels and show how tailored exercise is more effective than un-tailored exercise for evaluating stress in people who do not have the habit of exercising.

3247  Board #212  June 1  3:30 PM - 5:00 PM
Exercise-Induced Dehydration Has No Effect on Alcohol Pharmacokinetics but Influences Willingness to Drive
Chris Irwin, Alison Goodwin, Michael Leveritt, Andrew K. Davey, Ben Desbrow. Griffith University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSM)
(No relationships reported)

PURPOSE: This study investigated the influence of exercise-induced dehydration on alcohol pharmacokinetics and subjective ratings of impairment following an acute moderate dose of alcohol.

METHODS: Twelve male volunteers (22.6±4.2 yrs, 77.2±6.85 kg body weight, 180.5±5.0 cm; values are mean±SD) participated in 3 experimental trials completed in a randomised cross over design and separated by at least 7 days. In one trial, participants exercised to cause dehydration of ~2.5% body weight loss (DA trial). For the other trials, participants were required to be in a rested and euhydrated state (A1 and A2 trials). A set volume of alcohol was then consumed in each trial and participants were monitored over a 4 hr period. Blood (BrAC) and breath (BrAC) alcohol samples were collected throughout and analysed to calculate pharmacokinetic variables associated with the blood alcohol curve. Total urine production, estimates of BrAC, and subjective ratings of mood, intoxication and impairment were also recorded throughout each trial.

RESULTS: There was no difference in the pharmacokinetics of alcohol among any of the trial conditions. BrACs were higher than BACs for 2 hrs following alcohol consumption, but lower at measures taken 3 and 4 hrs post ingestion in all of the trials. Total urine production was greater in the euhydrated trials (1182±393 ml vs. 300±125 ml, p<0.05), with significantly more urine produced in the first 2 hrs after alcohol ingestion (1039±378 ml vs. 190±121 ml, p<0.05). Participants’ ratings of confusion and intoxication were significantly lower in the DA trial compared to the A2 trial, and they were also more willing to drive a car a short distance under these conditions.

CONCLUSIONS: These findings suggest that subtle changes in total body water as a result of exercise induced sweat loss, has no impact on alcohol pharmacokinetics. However, dehydration may influence the subjective effects of alcohol and increase the likelihood of risk-taking behaviours such as drink-driving. This may have direct implications for individuals who consume alcohol following physical activity and then consider driving a motor vehicle.

3248  Board #213  June 1  3:30 PM - 5:00 PM
Optimal Categorization Of A Facial Scale For Assessing Real-time Enjoyment Of Children's Physical Activity
Cheryl A. Howe, Danielle S. McElhiney, Brian A. Ragan. Ohio University, ATHENS, OH. (Sponsor: Minsoo Kang, FACSM)
(No relationships reported)

Enjoyment is purported to be positively correlated with physical activity participation in children. However, to truly understand the relationship between enjoyment and physical activity participation, a real-time tool to assess children’s perception of enjoyment of different types of games and activities is essential. The Facial Affective Scale is thought to be a way of measuring pain and other constructs in children and has been used for measuring enjoyment.

PURPOSE: To optimize response categorization of the Facial Affective Scale for assessing children’s real-time perception of enjoyment of various types of games and physical activities.

METHODS: Elementary school children (N = 23; 8 - 12 y) volunteered to play 5 common children’s games at least 4 times each during 5 - 10 sessions of an existing afterschool program. Immediately after playing each game for 9-10 min, each child independently answered questions related to the context of the game using a series of 9 facial expressions ranging from happy to sadness. The Rasch Rating Scale Model was used to optimize the response categories (e.g., faces). The criteria used for optimization were: 1) the response options must be ordered; 2) each option must be most probable somewhere on the scale; and 3) each option must have outfit statistics ≤2.0.

RESULTS: The original 9-face scale indicated poor performance. Five of the 9 faces were out of order (Thurston thresholds: 0.85, 0.18, -1.33, -0.68, 0.62, 0.06, 0.16, 0.14), only 3 faces were most probable on the scale and all had acceptable outfit statistics (MNSQ: 0.59 - 1.32). Based on these results the 9-face scale was then collapsed to 123456789 to 111112223. This collapsed scale optimized the response options with order (Thurston thresholds: -0.76, 0.76), each option was most probable somewhere on the scale, and all had acceptable outfit statistics (MNSQ: 0.84 - 1.09).

CONCLUSIONS: The results of the 9-face scale clearly indicated that children do not discriminate 9 different levels of enjoyment. The 3-face scale proposes a clearer measure of children’s real-time perception of enjoyment of physical activity.

3249  Board #214  June 1  3:30 PM - 5:00 PM
The Effect of Moderate Intensity Aerobic Exercise On Risk Preferences
Kaylee L. Davis, David L. Dickinson, Chelsea D. Curry, Ashley N. Lightner, Scott R. Collier, FACSM. Appalachian State University, Boone, NC.
(No relationships reported)

Many physiological and psychological changes post-exercise may alter an adult’s decision-making. It has been shown that physiological changes can affect decision making, therefore exercise may play a role in modulating decisions. The purpose of this study was to profile the risky choices over monetary gains and losses made by adults following a 30-minute bout of aerobic exercise versus a no-exercise control day and a return-to-baseline day.

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METHODS: 18 subjects (40-60 years-old) made 3 visits to the Vascular Biology and Autonomic Studies Laboratory during three weekdays. Visit 1 consisted of anthropometric measures followed by a decision task battery that included a risky choice task, which was followed by a graded exercise test (VO2peak). During visit 2 the subject exercised on a treadmill for 30 minutes at 65% of their VO2peak and then took the decision task battery. Visit 3 was comprised of the decision task battery and represented a return-to-baseline. Individual trial-level data (n=120 total risky choices per subject) was analyzed using Stata statistical software (v9). A random effects probit model was used to estimate baseline and post-exercise likelihood of making riskier choices.

RESULTS: On baseline and return-to-baseline days, our data show subjects are risk-averse over monetary gains but risk-seeking over monetary losses. Probit estimates show a significantly increased probability of choosing a riskier gamble on a given trial in the Gains condition (p<0.05) post-exercise. We find no significant post-exercise effect on risky choice in the Loss condition (p=NSD).

CONCLUSION: Following exercise, individuals are less risk-averse over monetary gains and the physiological changes that occur with exercise contribute to this condition. Since success on certain economic outcomes depends on one’s willingness to take monetary risk, these data suggest that regular exercisers may hold an advantage in certain decision-making contexts.

RESULTS:

Exercise intervals impacts affective response, but not enjoyment. Future studies should examine altering other variables (e.g. intensity, work-to-recovery ratio) to determine their role in influencing affect and enjoyment.

CONCLUSION:

Research investigating the dose-response relationship between exercise intensity and affect suggests that exercising at intensities above the ventilatory threshold elicits a decline in affect. The literature to date has focused almost exclusively on continuous exercise. No research to date has examined affective responses to interval training.

PURPOSE: To determine the impact of interval protocols differing in interval length against valence and enjoyment.

METHODS: Sixteen healthy participants (9 male, 7 female; mean age = 23 years) completed a maximal cycle ergometer test and two counterbalanced trials of interval cycling matched for work, intensity, duration, and work-to-recovery ratio. Each trial lasted 20 minutes inclusive of the warm-up and cool-down. The intensities for both trials alternated between 90% (work) and 10% (recovery) of peak power. The work-to-recovery ratio for each trial was 1:1, with one trial utilizing 30-sec intervals and the other 60-sec intervals. Affect was assessed before, during, and after exercise. Enjoyment was assessed post-exercise.

RESULTS: Data were analyzed using pairwise comparisons. Affect was similar between groups at baseline (p > 0.05) and steadily declined over time during the work portions of exercise (p < 0.05). The decline in affect during exercise was significantly greater during the 60-sec trial compared to the 30-sec trial (p < 0.05). Affect increased during recovery periods from work phases during both trials (p < 0.05). Enjoyment was not different between trials (p > 0.05).

DISCUSSION: Findings suggest that although affect declined during both trials, it is somewhat preserved during the 30-sec trial compared to the 60-sec trial. Affect was also shown to rebound during recovery periods. Despite the greater decline in affect during the 60-sec trial, enjoyment was not different between trials. The results of this study suggest that the length of exercise intervals impacts affective response, but not enjoyment. Future studies should examine altering other variables (e.g. intensity, work-to-recovery ratio) to determine their role in influencing affect and enjoyment.

RESULTS:

Comparison Of Psychophysiological Responses Between Self-paced Walking On Treadmill And Overground In Obese Women

Cosme F. Buzzachen,1 Kleverton Krinski,2 Hassan M. Elsangoud,2 Marsessa P. Krause,1 Luis AG Freitas,4 Julia Z. Durigan,1 Antonio C. Dourado,1 Wagner de Campos,1 Fredric L. Goss, FACSM,5 Sergio G. da Silva,4 1University of North Parana, Londrina, Brazil. 2Federal University of Parana, Curitiba, Brazil. 3Technological University of Parana, Curitiba, Brazil. 4State University of Londrina, Londrina, Brazil. 5University of Pittsburgh, Pittsburgh, PA. (Sponsor: Fredric L. Goss, FACSM)

PURPOSE: To determine whether environmental settings (treadmill vs overground) influence physiological, perceptual, and affective responses of obese women to exercise at a self-selected pace.

METHODS: Thirty females (age 44.39±9.58 yr; BMI 34.72±8.51 kg.m-2), participated in this study. During the orientation session, individuals underwent an initial screening, anthropometric measurements, and familiarization with the experimental procedures. Next, subjects were submitted to a maximal treadmill test. In the two experimental trials, participants performed 30-min bouts of treadmill walking and overground walking at a self-paced, selected pace, which were completed in a counterbalanced order. At least 48h separated experimental trials. During each 30-min walking bout at a self selected pace, physiological (oxygen uptake, VO2) responses were recorded continuously. Perceptual (6-20 Borg-RPE for the overall body) and affective (Feeling Scale) responses were determined every 5-min throughout the test. A paired t-test was used to compare physiological, perceptual and affective responses between the conditions.

RESULTS: The overground walking speed was significantly faster than treadmill walking (1.41±0.15 m.sec-1 and 1.36±0.18 m.sec-1, respectively, p<0.022) during the 30-min bout of self-paced exercise. However, subjects walked in a higher %VO2max during treadmill walking (68.18±1.87%VO2max) than overground walking (66.91±2.16 %VO2max) (p<.024 ). Similarly, ratings of perceived exertion were higher during treadmill walking (12.50±0.72) than overground condition (11.84±0.71) (p<.032). In addition, affective response was more positive during the session of overground walking (2.01±0.62) than during treadmill (1.53±0.74) (p<.014).

CONCLUSIONS: These data extend previous findings by showing that environmental setting influences physiological, perceptual, and affective responses during exercise at a self-selected pace. Self-paced exercise performed overground resulted in lower perceptual and more positive affective responses. Considering that walking at self-selected pace performed overground can lead to a sensation of “feeling good,” the utilization of this strategy should be recommended for using with obese women who are seeking for engaging in an exercise training.

RESULTS:

Concurrent Validity of an Exercise Enjoyment Scale Using Physiological and Psychological Criteria

Amanda M. Haile, 1 Luke Haile, Monica Taylor, 2 Alex Shafer, 1 Kris Wisniewski, 1 Deldin Anthony, 1 George Panzak, 1 Frederick L. Goss, FACSM, Elizabeth Gable, FACSM, 1 Robert J. Robertson, FACSM, 1 University of Pittsburgh, Pittsburgh, PA. (Sponsor: Fredric L. Goss, FACSM, Elizabeth Gable, FACSM, Robert J. Robertson, FACSM)
CONCLUSIONS: In young female and male adults, findings demonstrated concurrent validity for a newly developed EE scale where both psychological and physiological criterion variables were employed during cycle ergometry. It is proposed that on-stimulus EE responses can be used in conjunction with affect responses and RPE to develop programs that promote exercise adoption and maintenance.

<table>
<thead>
<tr>
<th>Exercise Enjoyment</th>
<th>VO2 (l·min⁻¹)</th>
<th>HR (b·min⁻¹)</th>
<th>PO (W)</th>
<th>RPE</th>
<th>A</th>
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</thead>
<tbody>
<tr>
<td>0.24²</td>
<td>0.41¹</td>
<td>0.39¹</td>
<td>0.51¹</td>
<td>0.89²</td>
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</tbody>
</table>

3253 Board #218 June 1 3:30 PM - 5:00 PM Salivary Cortisol Analysis On Infants In Different Environments. Land And Water Activities And At Rest. Marta Martins¹, Ana Palmeira-de-Oliveira², Nuno Garrido³, Tiago Barbosa³, Aldo Costa¹. ¹ESDRM - CIDESD, Ria Maior, Portugal. ²CICS-UBI Health Sciences Investigation Center, Covilhã, Portugal. ³UTAD - CIDESD, Vila Real, Portugal. ¹IPB - CIDESD, Bragança, Portugal. ¹UBI - CIDESD, Covilhã, Portugal. (Sponsor: Carlo Baldari, FACSM) (No relationships reported)

A whole set of new motor skills significantly changes the ways in which the infants’ body moves and interacts with the environment. Aquatic activity programs are related with the acquisition of positive effects on infants’ motor development in. Infants’ acute physiological response during activity, particularly the salivary cortisol, is a suitable parameter to be assessed. It can provide important information about hypothalamic-pituitary-adrenal (HPA) axis activity under normal conditions and in response to stress. The determination of cortisol in saliva has become popular for human research on stress reactions.

PURPOSE: The aim of this study was to compare the cortisol level on infants in different environments: land activity, water activity and at rest.

METHODS: 17 infants were included (22.5 ± 8.7 months) all had with background in a baby swimming program at least 6 months. Salivary cortisol levels were assessed with a Salimetrics® kit. Both land and swimming sessions were oriented by a professional instructor, according to a child centered method and children were constantly accompanied by their parents. The land skills performed were about motor coordination (gross and fine) and manipulation of didactic material. The aquatic skills performed were composed by immersions, jumps and displacements (in prone position, autonomous, vertical position, with didactic material and in back position). Cortisol samples were always taken at the same time of day for all (9 am and 10 am) and at the same day of the week. A K-S one-sample test, Wilcoxon rank test and Spearman’s rank correlation coefficient test were used to analyze data.

RESULTS: The cortisol mean levels obtained were: water activity (WA)=0.117±0.64µg/dL; land activity (LA)=0.100±0.34µg/dL and at rest (R)=0.150±0.84µg/dL. No statistical differences were found between an EF and at rest but in the exercise stress values. Positive correlation was found between the LA and R cortisol values (r=0.826; p=0.001).

CONCLUSION: Salivary cortisol levels are similar for the three conditions above, demonstrating the absence of stress-related activity. After 6 months of aquatic experience, the stress level in the water looks identical to rest or other physical activity. We may also speculate that, in infants whose activity is new, or do the activity without parents, cortisol levels might be higher.

3254 Board #219 June 1 3:30 PM - 5:00 PM Comparison Of Affective Responses To Exercise When Intensity Is Self-selected versus Imposed Kristen M. Lagally, FACSM¹, Shannon O’Hara¹, Anthony J. Amorose³, Liana Suhadolnik³, Jonathan Kurka³. ¹Illinois State University, Normal, IL. ³Arizona State University, Phoenix, AZ. (No relationships reported)

Allowing individuals to have autonomy over the intensity of their physical activity may lead to more positive affective responses about exercise when compared to situations where intensity is imposed.

PURPOSE: The purpose of this study was to compare affective responses between two exercise conditions: 1) where intensity is imposed (i.e. low autonomy) and 2) where intensity is self-selected (i.e. high autonomy).

METHODS: Eleven subjects (6 women, 5 men; age = 22.2±3.8 years, VO2max = 3.14±0.16 ml/kg/min) performed a maximal exercise test to allow determination of relative workloads in the subsequent experimental sessions, which involved 30 minutes of treadmill exercise. During the first experimental session, participants were asked to self-select a speed and grade that they would prefer for a workout and were permitted to adjust intensity at 5-minute intervals. For the second session, the speed and grade were imposed by the investigator, but were the same as in the self-selected session. Speed, grade and heart rate responses were hidden from participants in both sessions.

RESULTS: Participants self-selected intensities that ranged from 68-91% (MgSD=80.7±2.3%) of measured maximal heart rate. Manipulation checks found no significant differences in intensity (i.e. heart rate and RPE) between sessions but found that perceived autonomy was significantly higher in the self-selected session. Repeated-measures ANOVA (Session: self-selected vs. imposed X Time: pre- vs. post-exercise) indicated a significant interaction for positive affect (partial Eta squared = .31). Positive affect increased over time in both sessions, but there was a greater increase in the self-selected session (self-selected = .21 vs. 3.12; imposed = .06 vs. 2.70).

CONCLUSIONS: These results suggest that perceived autonomy is related to affective responses to exercise.

3255 Board #220 June 1 3:30 PM - 5:00 PM Tracking Cardiovascular Responses To Anticipation Of An Exercise Test In Cardiac Rehabilitation: A Preliminary Test Shawn N. Fraser¹, Megan Lefebvre². ¹Athabasca University, Athabasca, AB, Canada. ²University of Alberta, Edmonton, AB, Canada. (No relationships reported)

Cardiovascular reactivity (CVR) refers to relatively high heart rate (HR) and blood pressure (BP) increases in the face of a mental stressor. CVR may be a concern for heart patients since it may precede ischemic events and CVR may be an indicator of relatively poor prognosis. Anticipation of an exercise tolerance test (ETT) results in rapid increases in HR and BP and has been used as a stressor in heart patient to study CVR. However, it is not clear how CVR changes associated with an ETT change after a course of cardiac rehabilitation (CR).

PURPOSE: To examine CVR, specifically HR and systolic (SBP) and diastolic blood pressure (DBP) responses, to anticipation of an exercise tolerance test before and after a course of CR.

METHODS: CVR was recorded for 76 patients at baseline and for a subsample of 23 patients who completed 6 weeks of CR. Identical procedures were used for baseline and post-CR data collection. Resting HR and BP were measured 3 times, 1 minute apart, by an automated oscillometric BP monitor after the patient had been seated quietly and alone for 5 minutes. The patient was then prepped for an ETT and met in the exercise stress testing lab by the researcher. Standing HR and BP measures were taken by the same automated BP device after 1 and 3 minutes of standing on the treadmill immediately prior to beginning exercise. The mean of the 3 seated measures was considered the resting BP and HR. Peak BP and HR standing were used to calculate the cardiovascular response to anticipation of exercise. CVR was defined as peak BP and HR minus resting BP and HR, respectively.

RESULTS: Anticipation of exercise resulted in significant increases (all p’s < .002) in CV parameters with an average CVR at baseline for HR, SBP and DBP of 4.0 bpm, 16.6 mmHg, and 13.5 mmHg, respectively. CVR after a course of CR for HR, SBP and DBP were 4.3 bpm, 15.9 mmHg, and 9.2 mmHg (p < .001). Differences between baseline and post-CR CVR was significant only for the change in DBP (p = .05).

CONCLUSION: Patients responded with a predictable increase in HR and BP in anticipation of an ETT before and after a course of CR. After CR, DBP increases in anticipation of an ETT were lower in magnitude than before CR. Future research should investigate specific components of CR that may help reduce CVR.
3256  Board #221  June 1  3:30 PM - 5:00 PM
The Effect Of A 45-minute Exercise Session On Neural Responses To Pictures Of Food In Normal-weight And Obese Women
James D. LeChemininant, FACSM, Bliss Hanlon, Jenny Roberts, Michael Larson, Bruce W. Bailey, Brigham Young University, Provo, UT.
(No relationships reported)

PURPOSE: This study examined the effect of acute exercise on neural responses to pictures of food in normal-weight and obese women. Strong neural responses to pictures of food may be an index of food motivation. Participants of both groups were matched (except for BMI) and conditions (exercise vs. non-exercise) were randomized and counterbalanced.

METHODS: Fifteen normal-weight (31.6±9.6 yr; 22.6±1.3 kg/m2) and 15 obese (32.5±9.5 yr; 34.3±5.1 kg/m2) women completed an exercise and non-exercise day, each performed on the same day of the week. During the exercise condition, each participant completed an early morning (8-9am) exercise session on a motor-driven treadmill at 3.8 mph and 0% grade for 45 continuous minutes. During the non-exercise condition, participants were tested for body composition between 8-9am. Each participant was immediately tested for food motivation subsequent for both conditions. To test for food motivation, participants were shown a continuous stream of pictures of food and flowers (control) matched for picture intensity and while neural activity was monitored, via electroencephalogram. Data were analyzed using a 2-group x 2-exercise condition x 2-picture type repeated measures analysis of covariance on event-related potential (ERP) amplitudes.

RESULTS: There was no significant group*exercise condition*picture type interaction (P>0.05). However, when the normal-weight and obese women were combined, there was a significant exercise condition*picture type interaction for late positive potential (P=4.62, P=0.04) with participants showing less neurological response to food pictures (-15%) following a 45-minute exercise bout.

CONCLUSIONS: The sample of women studied did not show neurological differences in response to pictures of food based upon BMI. However, exercise decreased neurological responses to food, which may indicate lower food motivation.

3257  Board #222  June 1  3:30 PM - 5:00 PM
Effect Of Capillary Blood Sampling On Psychological And Perceptual Responses During Load Incremented Cycle Ergometry
Anthony R. Deldin, Alex B. Schafer, Wiesiewski Kris, Haile Amanda, Robertson J. Robert, FACSM, Nagle F. Elizabeth, FACSM, Goss L. Fredric, FACSM. University of Pittsburgh, Pittsburgh, PA.
(No relationships reported)

Blood sampling that occurs in medical and research settings can produce adverse psychological reactions. Whether a similar response occurs during exercise testing has not been investigated.

PURPOSE: The purpose of this investigation was to determine the effect of capillary blood sampling on psychological and perceptual responses at the ventilatory breakpoint (V_pt).

METHODS: A multiple observation, within subject, cross-sectional design was employed. Eleven males (age 21.5 ± 3.3 years), and ten females (age 22.7 ± 2.7 years) performed two load incremented cycle ergometer tests (Trial A and Trial B) to determine VO2peak (Pmin-1). Trial A included capillary blood lactate (BLa) measurements taken during the last minute of each stage. Trial B used an identical protocol without the BLa measurements. The order of administration of Trial A and Trial B was counter-balanced. The psychological/perceptual dependent variables measured during the last 30 seconds of each stage were: 1) Affect Valence (AV); 2) Felt-Arousal (FAS); 3) Rating of Perceived Exertion for the overall body (RPE-O); 4) Exercise Enjoyment (EE); and 5) Perceived intensity level (INT). A paired samples t test was used to examine between trial differences in psychological and perceptual variables measured at the Vpt. There were no statistically significant between trial differences found for AV, FAS, RPE-O and EE measured at the Vpt. The perceived INT at the Vpt was significantly (*p<0.05) higher in Trial A than Trial B (Table 1).

CONCLUSIONS: The inclusion of capillary blood sampling during a load incremented cycle ergometer exercise test does not adversely affect psychological or perceptual responses to exercise.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>AV</th>
<th>FAS</th>
<th>RPE-O</th>
<th>EE</th>
<th>INT*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial A</td>
<td>0.20 ± 1.87</td>
<td>3.30 ± 1.22</td>
<td>5.14 ± 1.42</td>
<td>1.14 ± 1.96</td>
<td>2.81 ± .75</td>
</tr>
<tr>
<td>Trial B</td>
<td>1.43 ± 1.57</td>
<td>3.25 ± 1.21</td>
<td>4.67 ± 1.53</td>
<td>1.24 ± 1.48</td>
<td>2.38 ± .74</td>
</tr>
</tbody>
</table>

3258  Board #223  June 1  3:30 PM - 5:00 PM
Response Normalized Affect, Enjoyment, And RPE At The Ventilatory Breakpoint In Recreationally Active Young Adults
Alex Shafer, Kristofer Wiesiewski, George Punzak, Erik Willis, Elizabeth Nagle, FACSM, Robert Robertson, FACSM, Fredric Goss, FACSM. University of Pittsburgh, Pittsburgh, PA.
(No relationships reported)

Response normalized ratings of perceived exertion (RPE) corresponding to the ventilatory breakpoint (V_pt) have been identified in children and adults using the OMNI Scale of Perceived Exertion, and can be used for exercise prescription. However, empirical support for response normalized affect and enjoyment associated with the V_pt is lacking. A better understanding of affect and enjoyment of exercise may lead to more positive exercise experiences, and enhance long term exercise adherence.

PURPOSE: To determine the response normalized affect (A), exercise enjoyment (EE), and RPE-Overall corresponding to the V_p during cycle ergometer exercise.

METHODS: Ten males (21.7 ± 3.4 yrs) and ten females (22.7 ± 2.6 yrs) completed a load incremented cycle ergometer protocol to measure peak oxygen uptake (VO2peak). The Vp was determined for each subject as the %VO2peak at which Ve:VO2 increased without an accompanying increase in Ve:VCO2. The exercise time associated with the Vp was then used to determine the corresponding A, EE, and RPE. A, EE, and RPE were measured each minute of exercise using the Feeling Scale, Exercise Enjoyment Scale, and OMNI RPE-Cycle Scale, respectively.

RESULTS: Values are means ± SD. The Vp was determined for each subject at which Ve:VO2 increased without an accompanying increase in Ve:VCO2. The exercise time associated with the Vp was then used to determine the corresponding A, EE, and RPE. A, EE, and RPE were measured each minute of exercise using the Feeling Scale, Exercise Enjoyment Scale, and OMNI RPE-Cycle Scale, respectively.

CONCLUSION: Response normalized OMNI RPE-V_p noted presently is consistent with previous reports involving progressively incremented cycle ergometer exercise. Exercise intensities corresponding to the Vp produce positive affect and enjoyment responses in recreationally active young adult males and females. These easily measured, non-invasive perceptual analogs of the Vp may be used to self-select exercise intensity. This may lead to improved compliance to exercise programs designed to enhance health-fitness.

3259  Board #224  June 1  3:30 PM - 5:00 PM
Impact Of Aerobic Exercise Of Varying Intensities On Craving In Cannabis-dependent Adults
Stephen P. Bailey, FACSM, Evan Adler, Laura Hamilton. Elon University, Elon, NC.
(No relationships reported)

Acute aerobic exercise has been shown to reduce craving for cigarettes in smokers; however, exercise intensity does not appear to have a unique impact on craving for cigarettes. While there is very limited evidence suggesting that regular exercise reduces cannabis craving in cannabis-dependent adults, it is unclear if acute exercise impacts cannabis craving in a manner similar to craving for cigarettes.
PURPOSE: The purpose of this investigation is to determine if aerobic exercise of varying intensities changes cannabis craving in cannabis-dependent adults.

METHODS: Ten cannabis-dependent adults (Age = 33±2 years; BMI=29.3±2.7) completed 3 randomly applied experimental trials at the same time of day. All subjects were currently enrolled in an outpatient treatment program for addiction and had been abstinent from cannabis use for at least 30 days prior to participation as determined by urinalysis. Experimental trials consisted of 30 minutes of rest, light aerobic exercise (45-50% predicted maximal heart rate), or moderate aerobic exercise (65-70% predicted maximal heart rate). Craving for cannabis, was recorded before, immediately after, 15 minutes after exercise, and 30 minute after exercise using a 20 cm visual analog scale. Subjects also completed the Marijuana Craving Questionnaire (MCQ-SF) before, immediately after, 15 minutes after and 30 minute after exercise.

RESULTS: Craving for cannabis was unchanged as a result of light exercise. In comparison, craving for cannabis was reduced (p<0.05) as a result of moderate exercise at IPE (59.6±7.5%), 15 minutes post exercise (-53.8±7.8%), and 30 minutes post exercise (-34.6±5.4%). Craving for cannabis actually increased during the resting condition (p<0.05) (IPE=90.4±24.5%; 15 Post=120.6±28.5%; 30 Post=160.9±58.6%). Exercise had no impact on responses to the MCQ-SF.

CONCLUSIONS: The results of this investigation suggest that craving for cannabis in cannabis-dependent adults is reduced by aerobic exercise at a moderate intensity and this positive effect is present for at least 30 minutes after the cessation of exercise.
RESULTS: Both mean RT volume (12,655 kg ± 2085) and EE (68.0 kJ ± 10.8) at 80% 1RM were significantly greater than RT volume (8,741 kg ± 1675) and EE (46.8 kJ ± 8.4) at 80% 1RM.

CONCLUSIONS: In this study, a 20% reduction in circuit RT load from 80 to 60% 1RM increased total RT volume and calculated EE by about 45%.

3263  Board #228  June 1  3:30 PM - 5:00 PM  Shoulder Muscle Activation of Novice and Experienced Weightlifters during Dumbbell Bench Press Exercises
Adrienne L. Phillips, Joshua Luczak, George Davies, Bryan L. Riemann. Armstrong Atlantic State University, Savannah, GA. (Sponsor: T. Jeff Chandler, FACSM)

Bench press exercises are commonly used for development of chest and shoulders muscles. Altering the trunk inclination angle changes the angle of the resistive force relative to the body and therefore changes the resistive force line of action. Whether the effects occur similarly for both experienced and novice weightlifters remains unknown.

PURPOSE: To compare muscle activity of the anterior deltoid (AD), clavipectoral (CPM) and sternal (SPM) portions pectoralis major, and upper trapezius (UT) by surface electromyography (sEMG) between horizontal (HBP), incline (IBP), and military (MBP) bench press in experienced and novice weightlifters.

METHODS: sEMG data were recorded at the dominate arm UT, AD, CPM and SPM for 12 experienced female weightlifters (64.3±10.8kg, 1.69±0.07m, 23.0±2.8yrs) and 12 novice (84.5±8.0kg, 1.69±0.04m, 22.6±1.7yrs) female weightlifters. Five repetitions each were performed at horizontal (0°), incline (45°), and military (85°) bench presses. Exercise order was randomized between participants. Average sEMG amplitude for each repetition phase (concentric, eccentric) was computed and averaged across the five repetitions. Separate group by exercise by phase analyses of variance were conducted.

RESULTS: No significant differences were found between experienced and novice weightlifters. For both UT and AD, within both phases, the MBP was significantly greater than IBP which in turn was significantly greater than the HBP. For CP during both phases HBP and IBP were significantly greater than MBP. For CP, during the concentric phase HBP was significantly greater than both the HBP and MBP.

CONCLUSIONS: While there were no differences related to lifting experience, as expected there were differences revealed between the three bench presses. Of the three bench presses, the MBP targeted the UT and AD during both the concentric and eccentric phases. For the pectoralis major, the HBP and IBP equally worked the sternal part during both phases, whereas the CPM was targeted during the concentric phase by the HBP and the IBP during the eccentric phase. These results provide evidence for selecting exercises in resistance and rehabilitation programs.

3264  Board #229  June 1  3:30 PM - 5:00 PM  Effects Of Blood Flow-restricted Low-intensity Muscle Contractions Using An Elastic Band On Muscle Activation
Tomohiro Yasuda1, Kazuya Fukumura1, Takayuki Ohtsuka1, Taira Fukuda1, Yusuke Uchida1, Haruko Iida1, Yugo Chuj1, Yoshiaki Sato2, Tatsuya Yamashita1, Toshikuni Nakajima1.1The University of Tokyo, Tokyo, Japan. 2KAATSU International University, Rajagiriya, Sri Lanka.

Low-load resistance exercise with blood flow restriction (BFR), named as Kaatsu training, leads to increased muscle activation and its response is an important factor of muscle hypertrophy. Compared with machines or free weights, an elastic band is an effective tool for resistance training in older subjects or patients with a lower level of activities. However, Kaatsu exercise using an elastic band has not been explored.

PURPOSE: To examine the effect of BFR contractions using an elastic band on muscle activation.

METHODS: Nine healthy men (ages 23-41 yrs) performed elbow extension and flexion contractions (four sets respectively) by using an elastic band (Thera-Band) with BFR or CON (unrestricted blood flow). During the BFR session, subjects wore pressure cuffs on the proximal region of both arms which were inflated to 170-260 mmHg. Surface electromyography (EMG) was recorded from the triceps brachii and biceps brachii muscles, and mean integrated EMG (iEMG) was analyzed. Blood lactate concentration was obtained before and immediately after both exercises. Ratings perceived exertion (RPE) was measured immediately after the last set of each contraction.

RESULTS: For elbow extension contractions, iEMG increased (p<0.05) progressively during the contractions in the BFR (~46%), which was greater (p<0.05) than those in the CON at the last set. For elbow flexion contractions, there was a progressive increase (p<0.05) in iEMG during the contractions in the BFR (~69%), which was greater (p<0.05) than those in the CON from 2nd to last set. No significant changes in muscle activation were observed in the CON for elbow extension (~12%) and flexion contractions (~23%). Blood lactate concentration increased (p<0.05) in both sessions and was greater (p<0.05) than the CON with the BFR (2.1 and 3.6 mM/L, respectively). Following the contraction bout, increased iEMG was correlated with blood lactate concentration and RPE in elbow extension (r=0.65 and 0.60, both p<0.01) and flexion contractions (r=0.52, p<0.05 and r=0.68, p<0.01).

CONCLUSIONS: Our results suggest that Kaatsu training using an elastic band enhances muscle activation during muscle contractions, which may be an effective method to promote muscle hypertrophy in older subjects or patients with a lower level of activities.

3265  Board #230  June 1  3:30 PM - 5:00 PM  The Effects Of Intensity On Blood Glucose Concentration In Lower Body Free Weight Resistance Training
Cardyl Trionfante, Gregory R. Davis, Arnold G. Nelson, FACSM. Louisiana State University, Baton Rouge, LA.

Previous studies have found that resistance training can significantly affect blood glucose and lactate concentrations (pre/post-ex). Observations also suggest that high intensity low volume (HILV) sets with low rest time can result in lower post-ex blood lactate levels compared to low intensity high volume (LHIV) sets. It has been theorized that low volume sets increase the amount of time under tension (TUT) utilizing the immediate phosphagen (PCr) pathways while high volume sets increase the amount of TUT utilizing glycolytic pathways. If TUT is matched for both protocols, then one can theorize that increased time in glycolysis would increase blood lactate levels to the point of stimulating hepatic glucose output, resulting in increased blood glucose (BG) concentration.

PURPOSE: The purpose of this study is to find the effects of treatment (HILV, LHIV) on BG concentration during lower body resistance training.

METHODS: Ten healthy college age subjects selected for the study. A one repetition max (1RM) test determined workloads for each protocol (HILV=80%, LHIV=55%). The box squat was chosen for the exercise protocols. Subjects participated in both protocols (HILV, LHIV) with a week separating trials. In order to match TUT and total workout time (rest time + TUT), each protocol had a different rest time (HILV: 30 sec, LHIV: 180 sec) to accommodate the difference in repetitions completed per set. Immediately before and after the box squat protocols, a finger prick test was administered to measure BG (Pre, Post-ex).

RESULTS: An effect for time (Pre-86, Post-92) was found statistically significant (p=0.006). The effects of treatment (HILV/LHIV) did not have any statistical significance (p=0.52).

CONCLUSION: This study along with others have shown that resistance training sessions can increase BG (Pre-86, Post-92) concentration regardless of treatment (HILV, LHIV). A possible cause for increased BG is that build-up of metabolic byproducts (ex: lactate, H+ via glycolysis) can increase sympathetic nervous activity (increasing anaerobic metabolism further) which can stimulate hepatic glucose output.

3266  Board #231  June 1  3:30 PM - 5:00 PM  Natural Bodybuilding Contest Preparation - A Six-Month Case Study
Lindy M. Rossov1, David H. Fukuda1, Jeremy P. Loenneke1, Christopher A. Fahn1, Kristina L. Kendall1, Abbie E. Smith2, Jeffrey R. Stout1, Michael G. Bemben, FACSM. 1University of Oklahoma, Norman, OK. 2University of North Carolina Chapel Hill, Chapel Hill, NC.

A detailed examination of the physiological changes that accompany preparation for a drug-free, “natural,” bodybuilding competition has never been performed.

PURPOSE: The purpose of this study was to provide a comprehensive physiological profile of a natural professional male bodybuilder as he prepared for competition.
METHODS: Before (baseline) and during each month of six months of contest preparation, the following measurements were performed: brachial blood pressure (bBP), pulse wave velocity (PWV), pulse wave analysis, calf and forearm blood flow, cardiac ultrasound, dual-x-ray absorptiometry (DXA), 3-site skinfolds, and Profile of Mood States (POMS). At baseline, 3-months, and 6-months into preparation, blood and resting energy expenditure (REE) were assessed. Every other month, 1-RMs and VO2max were assessed. Diet was recorded daily.

RESULTS: Results from the first month (March) to the last measurement date are presented in Table 1. Due to the subject’s low heart rate (HR) in the later months, several cardiovascular measurements could not be obtained. If a measurement was unable to be obtained in the sixth month of contest preparation, September, the last month of measurement is stated.

CONCLUSION: As the bodybuilder prepared for competition, in general, he experienced desirable cardiovascular and body composition changes along with a decrease in strength and resting energy expenditure.

Table 1.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>March (Baseline)</th>
<th>Last Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>bBP (mmHg)</td>
<td>122/80</td>
<td>104/56</td>
</tr>
<tr>
<td>Aortic BP (mmHg)</td>
<td>105/69</td>
<td>86/67 July</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>Stroke Volume Index (ml)</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Cardiac Output Index (L/min)</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Calf Blood Flow (ml/mm/100ml tissue)</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Forearm Blood Flow (ml/mm/100ml tissue)</td>
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<td>16</td>
</tr>
<tr>
<td>Central PWV</td>
<td>3.8</td>
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<tr>
<td>Femoral-Tibialis Posterior PWV</td>
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<td>Common-Radial PWV</td>
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<td>7.4 August</td>
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<tr>
<td>Augmentation Index (%)</td>
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<td>11</td>
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<tr>
<td>Time to Wave Reflection (ms)</td>
<td>50</td>
<td>42 July</td>
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<tr>
<td>Weight (kg)</td>
<td>105</td>
<td>89</td>
</tr>
<tr>
<td>%Body Fat by DXA</td>
<td>32.8</td>
<td>29</td>
</tr>
<tr>
<td>Lean Mass (kg) by DXA</td>
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<td>64.01</td>
</tr>
<tr>
<td>Daily Energy Intake (kcal)</td>
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<td>2500</td>
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<tr>
<td>Sum of 3-Skinfolds (mm)</td>
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<td>32</td>
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<tr>
<td>POMS Total Mood Disturbance</td>
<td>6</td>
<td>43</td>
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<td>VO2max (ml/kg/min)</td>
<td>42</td>
<td>45 August</td>
</tr>
<tr>
<td>1-RMs: Squat, Bench, Deadlift (kg)</td>
<td>211, 161, 260</td>
<td>183, 148, 242</td>
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<tr>
<td>HDL (mg/dl)</td>
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<td>LDL (mg/dl)</td>
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<td>Glucose (mg/dl)</td>
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<td>Creatine Kinase (U/L)</td>
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<td>495</td>
</tr>
<tr>
<td>Resting Energy Expenditure (kcal/d)</td>
<td>2424</td>
<td>283</td>
</tr>
</tbody>
</table>

3267  Board #232  June 1  3:30 PM - 5:00 PM  
Effects on Leg Muscle Activity using the Compression Belt on Squat Exercise  
Koji Kurita¹, Masanori Takemura¹, Yuji Kanoh², Mitsuharu Kaya², Motoaki Tsuchiya², Junzo Tsujiita² ¹Physical Conditioning Production, Osaka, Japan, ²Hyogo College of Medicine, Nishinomiya, Japan, ³Reiessha College of Medicine and Sport, Osaka, Japan, ⁴Hyogo University of Health Science, Kobe, Japan, ⁵MJ Consultant, Osaka, Japan.  
(No relationships reported)  
Resistance training at low loads with blood flow restricted by the use of specific compression belt has been shown to induce muscle hypertrophy and strengthening. However, it is unclear that such effects on muscle activity with the use of specific compression belt.

PURPOSE: To compare the EMG activity of directly compressed muscle (multi joints muscles) and indirectly compressed muscle (single joint muscles) with and without specific compression belt on femoral proximal region.

METHODS: A cross-over interventional study. Nine healthy adults (5 women and 4 men), mean age (SD) age: 29.4 (8.8) yrs, performed 3 sets (5 sec. set interval: 15 sec) of static squat position (bilateral squat (BS) and single leg squat (SS)) during three different conditions; pre-non-compressed (Pre), compressed on femoral proximal region (Comp) and post non-compressed (Post). In the condition of Comp, a specially designed elastic compression cuff belt (30 mm wide) was placed at the most proximal position of the upper leg, and inflated to a pressure calculated by the individual’s maximum pulse wave at resting condition. Surface EMG was recorded from the muscle belly of the rectus femoris (RF; a directly compressed muscle), and vastus lateralis (VL; an indirectly compressed muscle) muscles, and mean integrated EMG (iEMG) normalized as the relative exercise intensity (%) was analyzed (used a 3-way repeated measures analysis of variance, and a Least Significant Difference (LSD) multiple post hoc test).

RESULTS: The activity of muscles in BS (54.6 (10.3) %) were higher than in SS (84.9 (14.1) %) (F=96.6, p<0.01). The interaction between muscles and squat positions was not significant (F=5.24, p>0.05). The interactions between compressive condition and muscles had significant effects (F=6.23, p<0.01), and Pre (71.4 %) and Post (67.1 %) non-compressed were higher compared to Comp (60.7 %) in the RF (F=16.72, p<0.01). However, activity in the VL was not different (Pre=76.4 %, Comp=72.2 %, Post=70.7 %, F=3.30, p>0.05).

CONCLUSION: Increases in activity of the directly compressed upper leg muscle during static squat exercise with a compression belt on femoral proximal region might be influenced by mechanical effect.

3268  Board #235  June 1  3:30 PM - 5:00 PM  
Reliability Of An Instrument To Determine Power In The Bench Press  
Tiffany J. Patrick¹, David Bellar², Jim M. Clemmons³, Lawrence W. Judge¹, Matt Lydum¹, Ellen L. Glickman, FACSM⁴, ¹Defiance College, Defiance, OH, ²University of Louisiana at Lafayette, Lafayette, LA, ³Ball State University, Muncie, IN, ⁴Kent State University, Kent, OH.  
(No relationships reported)  
Power is an attribute often measured in athletics by sport scientists, coaches and teachers; therefore, it is important to have reliable options to quantify it.

PURPOSE: The purpose of this investigation was to examine the reliability of a commercially available optical wire encoder based device with digital readout for assessing power during the bench press.
METHODS: Six male (height: 186.4±3.6 cm, weight: 128.0±12.4 kg) and six female (height: 163.5±6.7 cm, weight: 65.3±14.6 kg) NCAA division 1 track and field athletes volunteered for the investigation. Participants underwent two testing sessions, each consisting of a dynamic warm-up followed by three maximum power bench presses at 50% of one repetition maximum (1RM) previously determined a week prior to data collection. Data were analyzed for reliability within each session, and also between two testing dates, separated by one week using intraclass correlations coefficients (ICC) and Anova.

RESULTS: Results indicated very strong reliability between the three measurements for the first session (F = 0.752, p = 0.482, ICC=0.985) and second session (F= 1.642, p=0.217, ICC=0.984). In examining the test-retest reliability between the separate test dates, the average power was significantly different (F=5.666, p=0.036) but participants’ peak power did not differ (F=1.140, p=0.309).

CONCLUSIONS: Results suggest that the device demonstrated reliability in testing sessions and also when assessing peak power over a period of one week.

3269  Board #234  June 1  3:30 PM - 5:00 PM
The Efficacy Of Combining Weight-bearing Exercises With A Newly-developed Perceived Exertion Scale In Middle-aged Men
Kazufumi Terada1, Toshiaki Nakatani1, Hideyoshi Ue1, Masakazu Nadamoto1, Reiko Shiomi1. 1Tenri University, Nara, Japan. 2Kyoto City University of Arts, Kyoto, Japan.

PURPOSE: The rate of perceived exertion is an easy and practical way to monitor the intensity of resistance exercise in a field setting. The weight-bearing exercise is safer than a resistance training using the weight for in middle-aged person. The purpose of this study was to investigate the effect of exercises with one’s own bodyweight by measuring exercise intensity with the newly-developed perceived exertion Japanese scale (5-scale, on a 5-scale point) in middle-aged Japanese men.

METHODS: Twenty-five healthy men (age range, 40-69 years) were randomly and equally assigned to an exercise training intervention group (EG, n = 13) or a control group (CG, n = 12). EG members performed a structured exercise regimen consisting of group-based and home-based training with their own bodyweight, performing repetitions until they reached a perceived exertion intensity of 3 on the Japanese scale. Participants performed each set of the following exercises, which included resistance training of the upper (push-up) and lower (squat) limbs and abdominal (sit-up) muscles, 3 times a week for 12 weeks. The outcome measures were body composition, abdominal girth, and blood pressure, as well as the 30-second chair-stand test (CS-30), vertical force in sit-to-stand movement from a chair, vertical jump (VJ), shoulder horizontal adduction (SHA, a test of muscle strength), 30-second sit-up test, leg muscle power using the bicycle ergometer, center of foot pressure (a static equilibrium function test), 2-min step test, and chair sit-and-reach test.

RESULTS: There were no incidents of injury or musculoskeletal damage because of the exercise program. At baseline, each group was well matched in physical characteristics. After 12 weeks of intervention, the EG showed significantly greater improvements (p < 0.05) in measures of CS-30 (+11%), VJ (+20%), and SHA (+15%). The CG experienced no significant changes.

CONCLUSION: These results suggest that weight-bearing exercises performed in conjunction with the newly-developed perceived exertion scale provide safe and effective resistance training in middle-aged men.

Supported in part by the 26th research aid of Meiji Yasuda Life Foundation.

3270  Board #235  June 1  3:30 PM - 5:00 PM
Comparison Of Free Weight Bench Press And Slow Velocity Isokinetic Chest Press
Mike T. Lane, Andrew C. Fry, Mike W. Aldrighetti, Matt Andre, Zachary Graham. University of Kansas, Lawrence, KS.

PURPOSE: To compare force development on a free weight bench press (FW) and isokinetic chest press machine (Eserbotics, Tulsa, OK) in recreationally trained men.

METHODS: Recreationally trained males participated in the study (X±SD; n=10, age =22.8±2.6 yrs, ht =1.83±0.06 m, body wt =81.3±7.9 kg). Subjects performed the exercise sessions in random order. One session was a free barbell bench press performed on a ProSpot bar (FW; Prospot Fitness Inc. Pompano Beach, FL) while on a 1-D force plate (Rough Deck, Rice Lake, WI) to measure force at 1000 Hz using a Biopac (Goleta, CA) acquisition system. 1RM FW bench presses were determined, after a brief warm up, followed by regular load increments until a maximal effort was achieved. Kinetic variables (maximum and mean force, time to maximum force) during the 1 RM lift were then determined. During the other session, subjects performed a max effort bench press on an isokinetic chest press (CP) using an interfaced acquisition system sampling at 252 Hz/ROM. Sessions were performed one week apart.

RESULTS: Max FW force = 2998.5±686.0 N, mean FW force = 2203.8±642.3 N compared to max CP force = 2887.9±527.3 N and mean CP force = 2203.7±371.4 N for the concentric action. For the eccentric action, Max FW force = 2998.5±686.0 N, mean FW force = 2203.8±642.3 N compared to max CP force = 2887.9±527.3 N and mean CP force = 2203.7±371.4 N for the eccentric action. The rate of perceived exertion was not different between minimalist shoes and being barefoot.

CONCLUSION: These data indicate there is no difference in maximal or average force produced during either modality, but there is a difference in where maximum force occurs in the range of motion based on the time to maximum force. Both FW and CP produce similar forces, but the time to maximum force is significantly faster using FW.

This project is supported in part by Eserbotics.
INTRODUCTION: The maintenance of both neural activation and intramuscular mechanical sensitivity state are hypothetically implicated in the counteraction of the static stretching-induced impairment on power performance when muscle vibration is simultaneously imposed.

PURPOSE: To determine the residual acute vibration-stretching effect on ground reaction forces, muscle pre-activation levels, short latency stretch reflex responses, and performance during execution of depth jumps (DJ).

METHODS: Eleven amateur athletes performed a set of three 45cm-DJs before and immediately after applying three 30s-sets of static stretching exercise with (VSTR) and without (STR) simultaneous muscle vibration (45 Hz, 5mm). DJ height (DH), contact time (CT), ground reaction force peak (GRFP), time to peak (TP), and electromyographic data including Vastus Lateralis onset/levels of pre-activation and short latency stretch reflex onset (SLRO) and amplitude (SLRA) were recorded.

RESULTS: No changes were induced on DJH after both VSTR (32.1 ± 2.2 vs. 32.3 ± 3.5 cm) and STR (32.7 ± 2.1 vs. 32.6 ± 2.6 cm). However, STR-induced decrements on GRFP (2161.9 ± 52.0 vs. 2144.9 ± 46.3 N, P = .031) and TP (22.8 ± 7 vs. 25.4 ± 9 ms, P = .050) as well as an increment in CT when compared to VSTR post measurements (STR 271.9 ± 84.9 vs. VSTR 250.5 ± 74.2 ms, P = .046) followed a delay in SLRO (25.2 ± 5.7 vs. 29.8 ± 5.4 ms, P = .032) and reduced pre-activation levels (29.3 ± 20.3 % maximal isometric voluntary contraction [MIVC]) of Vastus Lateralis. When vibration was simultaneously imposed to stretching, there was no evidence of significant changes in high-speed force production variables such as GRFP (2154.2 ± 51.5 vs. 2156.5 ± 41.3 N), TP (24.4 ± 6.7 vs. 23.1 ± 7.0 ms) and CT (256.9 ± 72.7 vs. 250.5 ± 74.2 ms). Vastus Lateralis SLRO (26.7 ± 4.8 vs. 27.7 ± 5.4 ms), SLRA (60.2 ± 17.5 vs. 59.1 ± 14.4 % Maximal SLRA) and pre-activation onset (86.9 ± 39.9 vs. 86.5 ± 31.9 ms) and levels (27.4 ± 17.6 vs. 24.4 ± 19.6 % MIVC) remained unchanged after VSTR.

CONCLUSION: Vastus Lateralis SLRO, SLRA, and pre-activation onset did not change when applied simultaneously to static-stretching exercise, appeared to be effective in counteracting decreased MTU stiffness-induced high-speed force production deficit during stretch shortening cycle performance. L.A. Fernandes was supported by CAPES and P.S.C. Gomes by CNPq, Brasil.
METHODS: Twelve recreationally trained men and women (age range 20-35 yrs), with a minimum 8-weeks training history, performed a 5 x 5 x 80% 1RM knee extension exercise protocol. The participants were randomly assigned to one of three groups: no resistance band (control), additional resistance from a rubber band placed over the ankle (RB), or a combination of the two (RB+). Each set consisted of five repetitions, with a 3-minute rest between sets. The exercise was performed in a closed kinetic chain with the legs at 90 degrees of flexion and the body in a functional position. The activity (mean %iEMG) of the infraspinatus muscle was recorded using surface electrodes placed on the muscle belly. Data was collected using a 3-way repeated-measures ANOVA, with a significant p-value of 0.05.

RESULTS: A significant main effect was observed for the combination of groups (Fmax: p=0.001, EMG100ms: p=0.001, iEMG: p=0.001). The combination group showed a higher mean %iEMG compared to the control group for all muscle activation measures. The Fmax and EMG100ms values were significantly higher in the combination group compared to the RB and control groups. The iEMG values also showed a trend towards higher activation in the combination group.

CONCLUSION: The combination of additional resistance from an ankle-based rubber band and a standard ankle resistance band significantly increased the mean %iEMG of the infraspinatus muscle during knee extension exercise. This indicates that the combination of resistance bands can provide a more effective training stimulus for this muscle.

Effect of Resistance Band Assistance on Knee Extension Exercise

Shunsuke Fujitake, Katsuyuki Ida, Shinya Oshita, Junzo Tsujita, Takeshi Tachiiri, Tetsuji Ishida, Shunsuke Fujitake.

(No relationships reported)

To compare the activity in shoulder muscles, particularly the infraspinatus muscle during shoulder elevation at several initial arm positions. To determine whether additional rubber band resistance will induce greater neuromuscular fatigue compared to typical WS power loading.

Ten healthy, non-injured adults (5 female and 5 male) volunteered for the study. Means (SD) age: 25.5 (5.4) years, height: 166.5 (9.1) cm, weight: 58.6 (12.1) kg. Participants were randomly assigned to one of three groups: control, additional rubber band resistance (RB), or combination of WS and RB. Each participant completed a 3x3x5 protocol of 5 x 5 x 80% 1RM knee extension, with 3-minute rests between sets. The activity (%iEMG) of the infraspinatus muscle was recorded using surface electrodes placed on the muscle belly. Data was collected using a 3-way repeated-measures ANOVA, with a significant p-value of 0.05.

RESULTS: A significant main effect was observed for the combination of groups (Fmax: p=0.001, EMG100ms: p=0.001, iEMG: p=0.001). The combination group showed a higher mean %iEMG compared to the control group for all muscle activation measures. The Fmax and EMG100ms values were significantly higher in the combination group compared to the RB and control groups. The iEMG values also showed a trend towards higher activation in the combination group.

CONCLUSION: The combination of additional resistance from an ankle-based rubber band and a standard ankle resistance band significantly increased the mean %iEMG of the infraspinatus muscle during knee extension exercise. This indicates that the combination of resistance bands can provide a more effective training stimulus for this muscle.
METHODS: Muscle activity of the dominant arm biceps brachii (BI), triceps (TR), upper trapezius (UT), anterior deltoid (AD), sternal (SPM) and clavicular (CPM) portions of the pectoralis major and the serratus anterior (SE) were measured by way of surface electromyography (EMG) in 12 novice 64.3±10.08 kg, 1.69±0.07 m, 23.0±2.8 yrs) and 12 experienced (64.5±8.02 kg, 1.69±0.04 m, 22.6±1.7 yrs) weight lifters. Subjects performed five repetitions of three push-up variations, stability discs under hands, stability discs under feet, no stability disc; in a random order. Average EMG amplitude during the concentric phase of each push up variation repetition was computed and averaged across the five trials. Separate group by push up variation analysis of variance was used for each muscle with statistical significance considered at P<0.05.

RESULTS: With the exception of the BI, exercise had significant effects on muscle activity. Four muscles, SPM, CPM, AD and TR, demonstrated significantly higher activity during PUH and SPU compared to PUF. UT demonstrated significantly greater activity during PUH compared to SPU and PUF. SA demonstrated significantly greater activity during SPU compared to PUH. SPM, CPM, and TR, demonstrated group effects with the novice group eliciting significantly greater activity than the experienced lifters.

CONCLUSIONS: Performing push-ups with the hands on the discs did not increase muscle activity compared to standard push-ups. This suggests that PUH can be used to promote stabilizer activity without compromising prime mover activation. Perhaps explaining the reduction in activation for PUF compared to SPU was a change in center of mass position. Higher activation in novices is likely explained in differences in push-up execution.

G-29 Free Communication/Poster - Body Composition II

JUNE 2, 2012 7:30 AM - 11:00 AM
ROOM: Exhibit Hall

3280 Board #1 June 2 8:00 AM - 9:30 AM
Validity of Bioelectrical Impedance Measurement in Predicting Fat-Free Mass of Chinese Children and Adolescents
Lin Wang, Stanley Sai-Chuen Hui, FACSM. The Chinese University of Hong Kong, Hong Kong, Hong Kong.

The validity of bioelectrical impedance analysis (BIA) equations for estimating fat-free mass from in Chinese children and adolescents has not been studied.

PURPOSE: To develop BIA equations for the estimation of fat-free mass (FFM) that are appropriate for Chinese children and adolescents.

METHODS: A total of 255 healthy Chinese children and adolescents aged 9-19 years old (127 males and 128 females) participated in the bioelectrical impedance measurement at 50 kHz between the hand and the foot, as well as the criterion measure of FFM using dual-energy X-ray absorptiometry (DEXA). Multiple regression analysis was employed to develop prediction equations for FFM from BIA measurement. A double cross-validation approach was used to determine the predicative accuracy of developed BIA equations. Differences between measured and predicted FFM were examined by Bland-Altman analysis. Bland-Altman plots were also generated to illustrate the residual errors.

RESULTS: Using multiple linear regression and cross-validation against DEXA measurement, a FFM prediction equation was produced as follow: FFM (kg) = 1.613 + 0.742 × height (cm)/impedance (Ω) + 0.151 × body weight (kg); R² = 0.95; SEE = 2.45 kg; CV = 6.5%. The mean difference between DEXA-measured and predicted FFM was 0.02 ± 2.45 kg; 95% limits of agreement was -4.78 to 4.82 kg FFM.

CONCLUSIONS: From the data collected in the present study, a BIA equation for predicting FFM of Chinese children and adolescents has been developed. The equation is applicable over a larger range of body sizes and age. With the use of appropriate BIA equation, BIA can provide a practical and valid measurement of body composition among Chinese children and adolescents.

3281 Board #2 June 2 8:00 AM - 9:30 AM
Regression Models to Predict Abdominal Obesity With Waist Circumference in Children
João P. Magalhães1, Diana A. Santos1, António Palmeira2, Sandra Martins2, Fátima Baptista1, Ezequiel M. Gonçalves1, Cláudia S. Minderico2, Luís B. Sardinha1.

1Faculty of Human Kinetics technical University of Lisbon, Lisbon, Portugal. 2Lusofona University, Lisbon, Portugal.

BACKGROUND: Waist circumference (WC) is positively correlated with abdominal fat content, and it is considered a good anthropometric indicator for diagnosing abdominal obesity across different age groups, including children. Investigation has confirmed that early obesity in childhood is associated with an increased risk of chronic diseases in adult ages.

PURPOSE: To develop and cross-validate prediction equations to estimate abdominal obesity based on waist circumference, independently for boys and girls in children.

METHODS: Abdominal body fat (ABF) was assessed using Dual Energy X-ray Absorptiometry (DXA) in 271 boys and 241 girls aged 10.3 ± 0.6 years. ABF was measured in a region of interest between L2-L4. WC was measured according to the NIH protocol (on the superior border of the iliac crest), to the WHO protocol (between the lower rib and iliac crest), and to Lohman’s protocol (on the narrowest part of the torso). Prediction equations were developed, independently for boys and girls, using a cross validation method. One hundred and eighty boys and 161 girls were used to develop the two prediction equations (2/3 of the sample). Cross validation was performed on a representative hold-out sample of 91 boys and 80 girls (1/3 of the sample). Cross-validation included paired samples t-tests and analysis of Pearson Correlation Coefficient (r), and standard error of estimate (SEE).

RESULTS: Because the NIH protocol yielded the highest correlation coefficient with ABF, we selected this variable to develop and validate the prediction models. Mean values for ABF in the hold-out sample were 0.7 (±0.54) kg and 0.86 (±0.56) kg, for boys and girls, respectively. Both equations cross-validated very well, for girls (r=0.92 and SEE=0.211 kg) and for boys (r=0.92 and SEE=0.211 kg). There were no differences in the mean values between both equations and ABF assessed with DXA (p >0.05). The new prediction equation for boys was ABF = 0.058 × WC - 3.053 and for girls ABF = 0.061 × WC - 3.192.

CONCLUSIONS: These results indicate that the prediction equations perform very well to predict ABF assessed with DXA for both boys and girls. With these models including a very simple measurement such as WC, one can readily estimate a fatness atherogenic phenotype.

3282 Board #3 June 2 8:00 AM - 9:30 AM
Comparison of Waist Circumference Measurements Using Different Protocols in Children
Diana A. Santos1, João P. Magalhães1, Anaízia M. Silva1, António Palmeira2, Sandra Martins2, Fátima Baptista1, Ezequiel M. Gonçalves1, Cláudia S. Minderico2, Luis B. Sardinha1.

1Faculty of Human Kinetics, Technical University of Lisbon, Cruz Quebrada, Portugal. 2Lusofona University, Lisbon, Portugal.

BACKGROUND: An atherogenic phenotype can be identified using a practical anthropometric measure such as the waist circumference (WC), as it is strongly associated with abdominal obesity. However, there is no agreement between studies on the location of this measurement, mainly when considering national reference percentiles.

PURPOSE: To compare the agreement among three different protocols in the assessment of WC in children, independently for boys and girls.

METHODS: A total of 512 children (271 boys and 241 girls), aged 10-11 years (10.3 ± 0.6) were evaluated. WC was measured according to the NIH protocol (on the superior border of the iliac crest), to the WHO protocol (between the lower rib and iliac crest) and to Lohman’s protocol (measured on the narrowest part of the torso). Statistical analysis included repeated measures and regression analysis.

RESULTS: Mean values for WC in girls were: NIH: 66.6 ± 8.6 cm; WHO, 63.5 ± 7.9 cm; and Lohman’s, 62.5 ± 7.5 cm. In boys the mean values for WC were: NIH: 65.2 ± 8.8 cm, WHO, 63.5 ± 8.1 cm, and Lohman’s, 62.8 ± 7.6 cm. Significant differences between protocols were observed in both genders, and these differences remained significant even adjusting for body mass index (BMI). Further we tested if the differences between protocols were related with the mean of WC measured by the different protocols. In all cases a significant association (p<0.001) was observed (Girls: NIH/WHO, r = 0.32; NIH/Lohman, r = 0.39; WHO/Lohman, r = 0.38. Boys: NIH/WHO, r = 0.53; NIH/Lohman, r = 0.57; WHO/Lohman, r = 0.42). A positive association was also observed between the difference of the protocols and BMI for all measurements and genders.
CONCLUSIONS: In this sample of children aged 10 and 11 years old, there are differences in the WC mean values when using different protocols. Moreover, the differences between measures were dependent on the BMI and WC values, meaning that in children with higher BMI and WC the differences of choosing different locations may be amplified. Our results reinforce the importance of accurately choosing the location of the WC measurement, mainly if considering reference values as a criterion for health outcomes.

3283 Board #4 June 2 8:00 AM - 9:30 AM
Modification Of School Adiposity According To Nutritional Status: An Analysis Of 20 Years
(No relationships reported)
PURPOSE: To analyze the adiposity changes over 20-year-period, according to the nutritional status in schoolchildren.
METHODS: Sample is part of the Ilhabela Mixed-Longitudinal Project on Growth, Development and Physical Fitness*, which is held since 1978. From a data base of 16.000 schoolchildren of both sexes, 1096 students, 488 males and 606 females, from 7 to 10-years-old of both sexes, in the prepubertal stage of sexual maturation. The project was approved by the Ethics Committee. The selected data were part of a database from 1990/1991 (Initial), 2000/2001 (10 years) and 2010/2011 (20 years). The variables analyzed were: body mass (kg), body height (cm) and fatness (nm): average of seven skinfolds (biceps, triceps, subscapular, suprailiac, axillary, abdominal and calf). Children were classified in normal, overweight and obesity. The statistical analysis used was Kruskal-Wallis test for nonparametric data and ANOVA one-way for parametric data, followed by post-hoc ScheffÉ. The level of significance adopted was pc.01.
RESULTS: In a period of 20 years, adipose tissue increased significantly in both sexes, markedly in boys. In males, there was a significant increase in subcutaneous adipose tissue in overweight and obesity groups after a period of 20 years. Among females, there was a significant increase in the normal weight and overweight groups after a period of 20 and 10 years, respectively.
CONCLUSIONS: During the 20 years analyzed, there were changes in adiposity, even when analyzed for nutritional status. It showed that individuals may have similar body mass indexes, although may vary in proportion and distribution of subcutaneous adipose tissue.
*Supported by FAPESP process number 2010/20749-8

3284 Board #5 June 2 8:00 AM - 9:30 AM
Comparison Of Percent Body Fat And BMI In Tracking Of Body Composition Among Adolescents
Wenhao Liu, Randall A. Nichols, Traci D. Zillifro. Slippery Rock University, Slippery Rock, PA.
(No relationships reported)
PURPOSE: To examine to the extent by which differences may exist between percent body fat (%BF, converted from triceps and calf skinfolds) and BMI in tracking of adolescents’ body composition.
METHODS: BMI and %BF (from the two-site skinfold) were assessed for 102 boys (mean age = 11.6 ± .58) and 112 girls (mean age = 11.47 ± .51) at the beginning of their 6th grade (baseline), the end of the 6th grade (follow-up 1), the end of the 7th grade (follow-up 2), and the end of the 8th grade (follow-up 3). Spearman rank correlations and percentage agreements in extreme quartiles were calculated to estimate the stability in body composition measured with the two different methods across the three academic years. Chi-square tests were used to examine differences in the percentage agreements between sexes. In addition, body composition scores at the baseline and the follow-up 3 were compared using paired-samples t tests.
RESULTS: Spearman rank correlations for BMI and %BF were .82, .73, and .66 for boys and .82, .83, and .75 for girls, and they were relatively low in relation to those for BMI and girls had higher tracking of %BF than did boys in the last two follow-ups. As for the percentage agreements in extreme quartiles, the results of chi-square indicated that boys had significantly lower stability in staying in lower quartiles of %BF than girls (p < .001). That is, at the last two follow-ups, only 36.8% and 38.9% boys initially in the lower quartiles of %BF remained in the same quartiles, whereas 60.0% and 63.6% of girls remained in the lower quartiles during the same period. Further, t tests revealed that boys’ %BF decreased significantly (p < .003) during the three years, from 25.70 ± 19.95 to 20.84 ± 10.78, whereas 60.0% and 63.6% of girls remained in the lower quartiles during the same period. Further, t tests revealed that boys’ %BF decreased significantly (p < .003) during the three years.
CONCLUSIONS: The study indicates that tracking levels in %BF (from the two-side skinfold) are lower than those in BMI for adolescents, especially for boys. This may be due to the fact that boys tend to become less fat as they gain more muscle compared with girls during the puberty period. We suggest that %BF and BMI are not be used interchangeably when measuring body composition for male adolescents.

3285 Board #6 June 2 8:00 AM - 9:30 AM
Evaluation Of Body Fat Patterning In Children With Non-Syndromal and Syndromal Pediatric Obesity
Pamela M. Wright, Daniela A. Rubin, Diobel Castner, Daniel A. Judelson, FACSM. California State University Fullerton, Fullerton, CA.
(No relationships reported)
Prader-Willi Syndrome (PWS) is the most characterized form of congenital obesity presenting with hypogonadism and growth hormone deficiency. Adults with PWS typically show increased fat mass in the limbs compared to non-syndromal obese adults who tend to have increased fat mass in the trunk. To our knowledge, these differences in fat patterning have not been studied in children.
PURPOSE: To describe fat patterning in children with PWS as it compares to children with non-syndromal obesity.
METHODS: Thirteen children with PWS and 43 obese (OB=body fat >95th percentile) children ages 8-11 yrs participated. Children completed measurement for body mass, stature, and waist circumference (WC), in addition to a total body dual x-ray absorptiometry. Body fat percentage was derived for total, trunk, gynoid, and android fat. Body mass index (BMI) was calculated.
RESULTS: Independent t-tests showed that children with PWS and non-syndromal OB children had similar BMI (PWS: 26.0 ± 8.0 kg/m2; OB: 27.0 ± 5.0 kg/m2) and WC (PWS: 89.0 ± 18.0 cm; OB: 90.0 ± 13.0 cm) (p>0.05). In addition, no significant differences (p>0.05 for all) were observed for total body fat (PWS: 47.1 ± 9.2%; OB: 43.2 ± 6.0%), trunk fat (PWS: 46.1 ± 11.1%; OB: 45.1 ± 6.2%), gynoid fat (PWS: 54.1 ± 6.0%; OB: 50.3 ± 5.0%), and android fat percentage (PWS: 52.3 ± 11.2%; OB: 52.4 ± 6.0%).
CONCLUSION: Our results showed that children with non-syndromal obesity had similar body fat percentage and distribution as those with syndromal obesity. The differences between our findings and previous results in adults may be explained by 1) the frequent use of growth hormone replacement therapy (which changes body composition) in children with PWS or 2) a presumed lack of circulating sex hormones in this young sample.
Supported by USAMRAA Award W81XWH-08-1-0025

3286 Board #7 June 2 8:00 AM - 9:30 AM
Bmi Growth Curve of Children In Jiangsu, China: 6-18 Yr. Old
Peiyou Chen,1 Yuling zou,1 Shusheng Shi,1 Weimao Zhu,2 Nanjing Normal University, Nanjing, China. 2University of Illinois at Champaign-Urbana, Champaign, IL.
(No relationships reported)
PURPOSE: Growth curves are used widely to evaluate the growth status of individuals or a population. Using the 2010 data of by the National Physical Fitness Surveillance of Jiangsu province, China (JPC), the purposes of this study was to construct body mass index (BMI) growth curves.
METHODS: Height and weight of 38,047 boys and 38,255 girls of JPC, 6-18 yr. old were measured in 2010. Their BMI were computed and growth curves were fitted with the Cole’s LMS method for boys and girls, respectively. The 3rd, 5th, 10th, 15th, 25th, 50th, 75th, 85th, 90th, 95th and 97th centiles were constructed and the results were compared with reference values of CDC in 2000 and WHO in 2006.

870

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RESULTS: At the age of 6 years old, the medians were 16.08 kg/m² and 15.42 kg/m² for boys and girls, respectively. The 50th centile curves increased with age by gender and reached to 19.68 kg/m² for boy and 19.66 kg/m² for girl at age of 14. After that age, the curve of the boy still increased, but the trend became stable for the girls. They reached to 21.08 kg/m² and 20.18 kg/m² at age 18, respectively. The 80th centile curve and 85th centile of JPC boys differed in shape from those by CDC and WHO. JPC boys were fatter in early to mid-childhood but less so in adolescence. For JPC girl, 50th and 85th centile curves had almost the same trend with those by CDC and WHO before mid-childhood, but after age of 15, JPC girls became leaner (Figure).

CONCLUSION: The reference centile curves of BMI clearly described the children growth status. The prevalence of overweight and obesity among children of JPC have been becoming more and more serious, especially for the boys before 15 years old.

3287  Board #8  June 2  8:00 AM - 9:30 AM  Correlates of Relative Skeletal Muscle Index in Young Males: Lower-Limb Strength and Body Composition Measures.
T. Brock Symons, Jody L. Clasey, FACSM. University of Kentucky, Lexington, KY.
(No relationships reported)

Relative skeletal muscle index (RSMI), the sum of appendicular mineral free lean mass divided by height squared (kg/m²), has been found to correlate with strength and body density measures in young females. The associations between RSMI and lower-limb muscle function and measures of body composition is less well understood in young males and may be body site specific.

PURPOSE: To explore the potential relationship between RSMI and measures of lower-limb muscle function and total body and regional measures of body composition in 21 young males (age 25 ± 5 yrs).

METHODS: Total body and right and left proximal femur dual energy x-ray absorptiometry (DXA) scans were used to determine RSMI and total body and regional measures of mineral free lean mass (MFL), bone mineral content (BMC), and bone mineral density (BMD). Right lower-limb muscle function was evaluated with knee extensor isometric (MVC; knee angle 90°) and isokinetic concentric (CON; at 90°/s and 180°/s) peak torque (PT), peak work (PW), and peak muscle power (PP). Pearson’s zero-order correlation coefficients were computed to determine significance (p<0.05).

RESULTS: RSMI (9.7 ± 0.9 kg/m²) was significantly correlated to both total body MFL mass and BMD (66.1 ± 8.9 kg; r=0.80 and 1.3 ± 0.5 g/cm²; r=0.41), but not total body BMC. Right and left total proximal femur BMC was found to be related to RSMI (45.1 ± 6.0 g; r=0.54 and 45.7 ± 5.5 g; r=0.55); whereas, right and left total proximal femur BMD was not. Right and left femoral neck BMC correlated with RSMI (6.6 ± 1.0 g; r=0.55 and 6.6 ± 0.9 g; r=0.52); however, no relationship was found between RSMI and BMD. Only right greater trochanter BMC was related to RSMI (16.6 ± 2.9 g; r=0.55). RSMI correlated with MVC (343.0 ± 78.1 Nm; r=0.65) and CON PT at 90°/s and 180°/s (234.8 ± 45.3 Nm; r=0.64 and 182.8 ± 38.9 Nm; r=0.60). CON PW was associated with RSMI at both angular velocities (90°/s: 254.4 ± 53.7 J; r=0.54 and 180°/s: 209.2 ± 46.2 J; r=0.57). RSMI was not associated with CON PP.

CONCLUSION: Previously, RSMI was found to correlate with lower-limb muscle function and BMD in young females. Our results in young males are in agreement regarding lower-limb muscle function but differ with respect to BMD. Supported in part by the University of Kentucky PEP Laboratory Endowment Fund, and grant number UL1RR033173 to the University of Kentucky CCTS.

3288  Board #9  June 2  8:00 AM - 9:30 AM  Accuracy Of Obesity Cut-off Values Of BMI and Waist-to-hip Ratio For Koreans With Intellectual Disabilities.
Miyoung Lee1, Haeya Chun2, Bo Fernhall, FACSM3. 1Kooin University, SEOUL, Korea. Republic of; 2 Soon Chun Hyang University, SEOUL, Korea, Republic of. 3University of Illinois at Chicago, Chicago, IL. (Sponsor: Bo Fernhall, FACSM)
(No relationships reported)

PURPOSE: The obesity cut-off value of Koreans is typically a body mass index (BMI) of ≥25kg/m². In addition, a waist-to-hip ratio (WHR) of ≥0.8 for females and ≥0.9 for males increases the risk of health. These cut-off values have not been validated for Koreans with intellectual disabilities (ID). The purpose of study was to examine the accuracy of cut-off values of BMI and WHR for persons with intellectual disabilities in Korea.

METHODS: A total of 93 healthy individuals with intellectual disabilities in Korea (ages 18-50yrs; 65 males, 168.07±9.78cm, 70.13±14.79kg vs. 28 females, 154.24±8.27cm, 56.65±10.73kg) participated. Body fat % (BF%) was estimated by DXA (Hologic, USA) as the criterion measure, and the cut-off vales of the obesity was set at 25% for male and 32% for females. To examine the accuracy of cut-off values for BMI and WHR, R adjusted for gender was calculated from the linear regression analysis, and ROC analyses were conducted to determine the true-positive (Sensitivity; ST) and false positive (1-specificity; SF) rates utilizing SPSS 19 (IBM SPSS Inc., USA).

RESULTS: BMI and WHR were highly correlated with BF% (R=0.86 and 0.73, respectively). In terms of the area of ROC curves, BMI was 93 (95%CI: 91-100) for males and 89 (76-100) for females, which is an excellent agreement. WHR showed 93 (87-99) and 67 (44-93) for males and females, respectively. Based on cut-off values, the ST and SF of BMI at ≥25kg/m² were 96 vs .., 19 for males, and 1.00 vs .., 53 for females, respectively. On the other hand, ST and SF of WHR were 1.00 vs .., 56 for males and 67 vs .., 41 for females.

CONCLUSION: The standard cut-off values for BMI of both males and females are relatively accurate to determine the obesity for Koreans with ID, but false positive rates are acceptable. With the obesity cut-off of BMI ≥25kg/m², ST and SF are increased up to 1.00 vs .., 78 and 1.00 vs .., 82 for both genders, respectively. On the other hand, WHR is less accurate than BMI, especially for females with ID. Larger sample size is required to generalize the findings from this study to the target population.

This work was partially supported by the new faculty research program 2010 of Kookmin University and Soon Chun Hyang University in Korea.

3289  Board #10  June 2  8:00 AM - 9:30 AM  Body Composition For Health And Performance: A Survey By The Working Group Of The IOC
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(No relationships reported)

Low body mass (BM) and lean physique to enhance performance are the norm in weight-sensitive sports.

PURPOSE: To assess current use of body composition (BC) methods and identify problems and solutions with current BM and BC approaches.

METHODS: A 24-item survey was developed, including demographic and content questions related to BC methods. Content validity was obtained by review of the Ad Hoc Research Working Group on BC for Health and Performance of the IOC Medical Commission (n=7). The survey was distributed among international sporting organizations in electronic format. Frequencies and Chi-square analyses were computed.

RESULTS: 216 individuals responded, from 33 countries, representing various institutions, sports, and competitive levels. Of the sample, 86% currently assess BC, most frequently using skinfolds (ISAK: 50%; conventional: 40%; both: 28%), DXA (38%), BMI (29%), ADP (17%), and hydrostatic weighing (10%). Of those using skinfolds, more use ISAK at the international level, whereas conventional approaches are more common at regional/national level (p=0.006). The physiologist/sport scientist (54%) and sports dietitian/nutritionist (57%) were most frequently the professionals assessing BC, followed by MDs and ATCs, with some reporting the coach (5%). 36% of 116 respondents assess hydration status: more do so at international than regional/national level (p=0.028). Of 125 subjects answering the question of whether they thought that BC assessment raised problems, 69% said “yes”, with most providing ideas for solutions. The most compelling solutions appeared to center around alternatives to BM and BC, such as frame size and height but most responses were sport-specific.

CONCLUSION: Results show a high use of BC, variable standardization, and high perception of problems related to BM and BC in sport. Future work should emphasize BC standardization and sport-specific use of parameters other than BM and BC.
1.36; Waist: 79.9 +

Comparative descriptive statistics, frequencies, and relative frequencies were used. Outliers were identified and variables were transformed to ensure normality, where necessary. A stepwise regression analysis was performed to determine which variables are effective when predicting BC.

RESULTS: A total of 352 students were recruited. With 4 of them excluded as outliers, 149 males and 199 females were included in analysis. The best model included the following predictors: sex, square root of body mass index, MPU, logit transformation of total physical activity, waist circumference and number of days having breakfast (R²=0.84, SEE=3.27). A alternative model which did not include fitness testing variables was tested. Significant predictors of this model were sex, perceived general health, logit transformation of alcohol consumption, square root of sleeping problems (R²=0.55, SEE=5.53).

CONCLUSIONS: Sex, physical fitness measures and health behaviors were significant predictors of BC in US college students. The alternate model which included just sex and health behaviors, without anthropometric measurements and fitness testing, was also effective when predicting BC.

PURPOSE: Evaluate the relative contributions physical fitness and health behaviors to predict body composition of US college students.

METHODS: College students from a mid-Western university were recruited via face-to-face contact, email, and fliers. Physical fitness was assessed with three measures: PACER multi stage 20-meter shuttle run, modified pull-up (MPU), and one-minute sit-up. Anthropometric assessment included height, weight, and average of 3 waist circumference measurements. Body composition (BC) was measured by bioelectrical impedance analysis (BIA). Self-reported questionnaire of health behaviors included physical activity, eating, sleeping and drinking habits. Outliers were identified and variables were transformed to ensure normality, where necessary. A stepwise regression analysis was performed to determine which variables are effective when predicting BC.

RESULTS: 21 overweight or obese students (over 85 percentile in BMI score) aged 9-16 yrs completed 8 week summer intervention including 15 hour physical activity and 2 hour nutritional education per week and bi-weekly diet program. Students were later randomly assigned to follow-up telephone intervention for 10 months (TI) and control (CON). Physical characteristics, sit and reach (flexibility), grip strength (muscular strength), and 1 mile walking (estimated VO₂max) were obtained before, a week after (POST) and 10 months following 8 week summer intervention (YEAR).

CONCLUSIONS: It is known that children gain most of extra weight and lose physical fitness during summer months due to physical inactivity and an increase in food intake. Summer intervention may reduce the prevalence of obesity in children; however reduction in body fat may be regained after finishing summer intervention.

PURPOSE: The purpose of this study was to determine the effects of 8 week summer lifestyle intervention and 10 month follow-up telephone intervention on changes in body composition and level of physical fitness in Hispanic Children.

METHODS: The purpose of this study was to determine the effects of 8 week summer lifestyle intervention and 10 month follow-up telephone intervention on changes in body composition and level of physical fitness in Hispanic Children.

RESULTS: We previously reported (Med Sci Sports Exerc: 43(5): S624, 2011) that eight week summer lifestyle intervention significantly reduced % body fat and improved flexibility, muscular strength, and estimated VO₂max in 21 students. TI statistically maintained % body fat (POST:23.7±2.1% → YEAR:25.9±2.3, Mean±SE, P=.134), flexibility (31.9±1.4cm →30.4±1.8, P=.43), and estimated VO₂max (44.1±6.6ml·kg⁻¹·min⁻¹ →42.7±1.4, P=.215) during 10 month telephone intervention period. CON lost all improvement during 10 month follow-up period: % body fat (22.2±2.0% → 26.9±1.8, P=.001), flexibility (32.7±1.7→27.3±1.2, P=.03), and estimated VO₂max (45.9±1.8→39.8±2.0, P=.005). Muscular strength was slightly increased in both TI and CON, but it was not significant.

CONCLUSIONS: 8 week summer lifestyle intervention improved body composition and level of physical fitness in Hispanic children. Results indicate that telephone intervention is an effective tool to maintain the improvement in body composition and levels of fitness obtained from an intensive summer lifestyle intervention program.

PURPOSE: To determine the variations in regional and total adiposity in active individuals.

METHODS: Fifty college aged students participated in the study. The men comprised groups of recreationally competitive athletes (RCA; n = 13) and recreationally active men (RCM; n = 13). The women comprised groups of collegiate athletes (CA; n = 12) and recreationally active women (RAW; n = 12). Body composition measures included height, weight, waist circumference, truncal (subscapular, abdominal, mid-axillary, suprailiac crest) and appendicular skinfolds (anterior thigh, medial calf, tricep and bicep), and whole body adiposity via air-displacement plethysmography.

RESULTS: Descriptive data (means and standard deviations) were calculated for each group (RCA - Age: 20.2±1.3; Waist: 79.9±3.8; Trunk: 43.5±11.9; App: 22.7±8.9; VO₂max 3.85; RCM - Age: 21.4±1.3; Waist: 80.4±4.0; Trunk: 39.8±7.8; App: 31.7±9.25; CA - Age: 20.1±0.67; Waist: 69.7±6.89; Trunk: 27.3±1.40; BOYER: 56.9±12.75; BF: 21.6±5.0; RAW - Age 20.1±0.31; Waist 71.0±3.32; Trunk: 66.7±23.07; App: 77.3±24.93; BF: 25.3±5.25. Paired-sample t-tests showed no significant differences (alpha = 0.05) for any score when comparing the two men’s groups and the two women’s groups together except for the women’s sum of appendicular skinfolds (t = 2.07, p = 0.05).

CONCLUSIONS: Variations in physical activity classification does not appear to effect total or regional adiposity in active college age individuals with the exception of the sum of appendicular skinfolds between female collegiate athletes and recreationally active females. Potential explanations for this include that at this age, active individuals are similar in body composition regardless of the reason for why they are active. Further investigation into why recreationally active females store more adipose appendicularly than collegiate female athletes is necessary.

Comparisons of Body Composition and Self-Perception of Body Type Among College Students

Previous research suggests that individual perception of body size varies between gender and race, and that some cultural groups are more accepting of overweight body types. If particular groups of individuals positively value a specific body type, or erroneously classify their own body weights as acceptably healthy, when in fact they are deemed to be clinically overweight or obese, then they may be un receptive to typical approaches toward weight management. This may result in an increased risk for the development of obesity-related chronic diseases.

PURPOSE: To examine the relationship between perceived body image and actual body composition, across race and gender, in a group of 240 college-aged students.

METHODS: Participants underwent skinfold body composition assessment and completed a questionnaire designed to elicit perceptions of body image and body weight status. Data summary of this cross-sectional study design included comparative descriptive statistics, frequencies, and relative frequencies.

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PURPOSE: To examine the relationship between perceived body image and actual body composition, across race and gender, in a group of 240 college-aged students.

METHODS: Participants underwent skinfold body composition assessment and completed a questionnaire designed to elicit perceptions of body image and body weight status. Data summary of this cross-sectional study design included comparative descriptive statistics, frequencies, and relative frequencies.
RESULTS: Results suggested that one in four females, regardless of race, categorized as in the acceptable range for body fat percentage, identified themselves as overweight. Nearly 22% of males and 38% of female participants were categorized as overweight or obese, with 14 females and one male categorized as obese. Overweight and obese female participants were more than twice as likely as men to misperceive their overweight status. Only 44% of overweight and obese women correctly identified their weight category, whereas nearly 8 of 10 overweight and obese male participants accurately identified themselves as overweight or obese. Over half of all Asian (56%), Black (50%), and Hispanic (67%) males, categorized as in the acceptable range for body fat percentage, identified themselves as overweight. Over half of White males (57%) and females (80%), and Black females (50%), categorized as overweight, were none the less identified to be of “about the right weight”. A far greater percentage of males (48%) compared to females (28%) fell into the lean category.

CONCLUSION: The results of this study suggest that there is a great deal of heterogeneity in the perception of body type. Clearly, men and women, and different ethnic groups, perceive their own body types quite differently, and incongruity exists even within groups.

PURPOSE: To determine the validity of self-reported BMI among novice runners.

METHODS: Data on BMI was obtained from a prospective follow-up study investigating the link between training exposure and the development of RRI. Healthy novice runners between the age of 18 to 65 and without lower extremity injuries were able to participate in the study. During July and August 2011 the participants were included in the study based on an online questionnaire. 1532 persons completed the questionnaire, of these, 970 were invited to a test at baseline after meeting the requirements for participation. Information about BMI was obtained in two ways; firstly, from the online based questionnaire where the participants had to report height and weight themselves. Secondly, the weight was measured with calibrated weight (Tanita SC-330) while their height was measured with a tape measure. Based on these data BMI were calculated based on the equation: BMI = mass (kg) / (height (m))^2. Paired t-test was used to compare mean difference between self-reported BMI and measured BMI. Bland Altman limits of agreement were used to calculate the 95% prediction limits.

RESULTS: A total of 931 participants were measured and eligible to participate, of these, 2 were excluded due to data loss. The gender distribution was; 464 women with a mean age of 36.8 ±10.0 and a measured BMI of 25.4 ± 4.2 and 465 men with a mean age of 37.6 ± 10.6 and a measured BMI of 26.6 ± 3.8. Compared with measured BMI both men and women had a significant lower mean self-reported BMI of -0.23 [-0.34; -0.12], p<0.001 and -0.41 [-0.51; -0.31], p<0.001, respectively. Among men and women the 95% limits of agreement were from -2.63 to 2.72 and from -2.56 to 1.74, respectively.

CONCLUSION: Based on the findings from current study, BMI based on self-reported height and weight should be used with caution if the association between BMI and RRI is investigated.

3294 Board #15 June 2 8:00 AM - 9:30 AM Can Self-reported BMI Be Used As A Valid Measure Among Novice Runners?
Martin S. Juul, Rasmus O. Nielsen, Sten Rasmussen. Aarhus University Hospital - Aalborg Hospital, Aarhus, Denmark.

(No relationships reported)

There is an increased risk of running related injuries (RRI) among novice runners with a Body Mass Index (BMI) above 25. Information about BMI can be collected through questionnaires, when studies investigate if there is an association between BMI and RRI among novice runners. But can self-reported BMI be used as a valid measure compared to BMI measured with a calibrated weight.

PURPOSE: To describe the relationships between stress, body fat distribution and PA in women.

METHODS: This cross sectional study recruited women (25-65 years; N = 78) from the local Phoenix metropolitan area. A subgroup was randomly selected for objective measures of stress (morning saliva cortisol samples: 4 samples-15 min time periods), PA (Actigraph GT1M-7 day period), estimated VO2 (submaximal Treadmill Test), %body fat (%BF-Bioelectrical Impedance) and waist circumference (WC).

RESULTS: Stress can affect the intention-behavior relationship for physical activity (PA) and elicit physiological responses that can affect health (Logan & Barkdside, 2008; McEwen & Lasley, 2003). Central or visceral obesity is now accepted as an independent risk factor for many chronic diseases. The physiological stress response has been shown to increase central body fat. PA may have an influence on this relationship.

PURPOSE: To describe the relationships between stress, body fat distribution and PA in women.

METHODS: Stress had a positive association with %BF and WC. %BF had an inverse association with PA and level of fitness. Participants with the lowest level of stress had higher %BF. Stress was a lower level for those who had higher fitness levels and greater minutes of PA per week. From these results indicate that PA can affect stress and %BF in women. Considering the increasing rates of metabolic diseases associated with inactivity properly coping with stress may be a key factor in improving health.

3295 Board #16 June 2 8:00 AM - 9:30 AM The Relationships between Stress, Physical Activity and Body Composition in Women
Jenelle R. Walker, Darith James, Pamela Swan, FACSM. Arizona State University, Phoenix, AZ.

(No relationships reported)

Analysis: Subjects were grouped by cortisol levels into tertiles using area under the curve values. Data were analyzed using Pearson correlations, one-way ANOVA and Post Hoc analyses with PASW 18.

RESULTS: Descriptive statistics of the subgroup (N = 26) were mean age (41±10y), %BF (32±10.8), WC (79.6±12.9 cm), minutes of PA (141.8±114.8), and estimated VO2 (34.2±6.4 ml/kg/min). A positive association was shown for stress level and %BF (r=.359, p=.029) and WC (r=.379, p=.056). An inverse association was shown for %BF and estimated VO2 (r=.785, p=.000) and minutes of PA (r=-.363, p=.068). Significant between group differences were found when comparing stress to %BF between the lowest and highest stress groups (p=.031). Significant between group differences were found when comparing stress to estimated VO2 (p=.024) and PA level (p=.034) in the two highest stress groups.

CONCLUSION: Stress had a positive association with %BF and WC. %BF had an inverse association with PA and level of fitness. Participants with the lowest level of stress had higher %BF. Stress was a lower level for those who had higher fitness levels and greater minutes of PA per week. These results indicate that PA can affect stress and %BF in women. Considering the increasing rates of metabolic diseases associated with inactivity properly coping with stress may be a key factor in improving health.

3296 Board #17 June 2 8:00 AM - 9:30 AM Does the Body Adiposity Index (BAI) Predict Change in CVD Risk Factors in Obese Women?
Anne E. Mishler, John M. Jakicic, FACSM. University of Pittsburgh, Pittsburgh, PA.

(No relationships reported)

Excess adipose tissue increases risk for cardiovascular (CVD) and other chronic diseases. The Body Adiposity Index (BAI), computed with measures of height and hip circumference, has recently been recommended for estimating adiposity. However, whether BAI is more predictive of change in CVD risk factors following weight loss compared to traditional measures of adiposity (weight and waist circumference) is unclear.

PURPOSE: To examine the association between change in BAI, weight, and waist circumference and change in CVD risk factors in overweight and obesity adults across a 6 month weight loss intervention.

METHODS: 184 female subjects (BMI: 32.6±4.2 kg/m²; Age: 37.7±5.6 kg/m²) participated in a 6-month behavioral weight loss intervention. Subjects were prescribed a reduced calorie diet (1200-1500 kcal/d). Subjects were also prescribed structured home-based exercise of 150-300 min/wk at a moderate-to-vigorous intensity. Weight, waist circumference (WC), BAI, along with fasting total cholesterol (CHOL), HDL cholesterol (HDL), LDL cholesterol (LDL), triglycerides (TRIG) were assessed at 0 and 6 months.

RESULTS: Weight (-3.8±4.8 kg), WC (-6.5±8.3 cm), and BAI (-3.5±2) significantly decreased from 0 to 6 months (p<0.05). Weight change was significantly (p<0.001) associated with change in WC (r=.51) and BAI (r=.79). CHOL (-5.7±21.7 mg/dl), TRIG (-16.4±11.4 mg/dl), and LDL (-10.3±25.9 mg/dl) decreased, whereas HDL increased (+1.3±7.0 mg/dl). Change in weight (β=0.708, t=6.230, p<0.001), but not WC or BAI predicted change in CHOL. Change in BAI (β=0.513, t=2.333, p=0.021), but not change in weight or WC, predicted change in HDL (R²=0.024, p<0.05). Neither change in weight, WC, or BAI predicted change in LDL or TRIG.

CONCLUSIONS: The weight loss intervention was effective at reducing weight, WC, and BAI and this was accompanied by reductions in CHOL, TRIG, and LDL, and improvement in HDL. While BAI was more predictive of change in HDL than either weight or WC, BAI was not predictive of change in LDL or TRIG. BAI was not superior to change in weight to predict change in CHOL. Further investigation is necessary to determine the utility of the BAI for predicting changes in risk factors with the context of a behavioral weight loss intervention. Supported by the National Institutes of Health (HL64991)
**PURPOSE:** The purpose of this investigation was to characterize the magnitude of dehydration and acute weight gain (AWG) in mixed martial arts (MMA) fighters prior competition.

**METHODS:** Urinary measures of hydration status and body mass were determined at ~24 h prior and then again ~2 h prior to competition in 40 MMA fighters (mean ± SD, age: 25.2 ± 4.1 yr, height: 1.77 ± 0.07 m, body mass: 75.80 ± 9.17 kg). AWG was defined as the amount of body weight the fighters gained in the ~22 h period between the official weigh-in and the actual competition.

**RESULTS:** On average, the MMA fighters gained 3.40 ± 2.18 kg or 4.4% of their body weight in the ~22 h period prior to competition. Urine specific gravity (Usg) significantly decreased (p < 0.001) from 1.028 ± 0.007 to 1.020 ± 0.009 during the rehydration period. 40% of the MMA fighters presented with a Usg of greater than 1.021 immediately prior to competition indicating significant or serious dehydration.

**CONCLUSIONS:** MMA fighters undergo significant dehydration and fluctuations in body mass (4.4 % avg) in the 24 h period prior to competition. Urinary measures of hydration status indicate that a significant proportion (40%) of MMA fighters are not successfully rehydrating prior competition and subsequently competing in a dehydrated state.

**PURPOSE:** To create a model to estimate the efficiency index for achieving a body mass index (BMI) of 25 (EIBMI25), determining the importance of each variable.

**METHODS:** One hundred eighty-five overweight and obese people (BMI: 25-34.9 kg·m²), aged from 18 to 50 years, participated in the study. Four types of treatments were randomly assigned: strength training (S), endurance training (E), strength and endurance training (SE), and control group (C). All participants followed a 25% caloric restriction diet. The EIBMI25 expresses the way in which the participants achieved the BMI of 25, representing this goal the 100% of efficiency. A multivariate discriminant model including the variables age, sex, height, type of treatment (T), initial body weight (BW), initial fat mass (FM), initial muscle mass (MM) and initial bone mineral density (BMD) were performed having into account the groups above and below the mean of the EIBMI25. The discriminant model was built using the inclusion method in SPSS PASW 18 allowing us to find a function that could predict the efficiency index that an overweight or obese person could achieve in a 6 months weight loss intervention.

**RESULTS:** The discriminant model obtained would discriminate between the two groups of EIBMI25 with 84.3% of correct classification. The discriminant function obtained was (Wilks' Lambda=0.499, p<0.001): Discriminant score = 9.015 - (0.018 x age) + (0.631 x sex [0=males; 1=females]) - (12.684 x height) - (0.202 x T [1=S; 2=E; 3=SE; 4=C]) + (0.077 x BW) + (0.118 x FM) + (0.021 x MM) + (1.189 x BMD).

**CONCLUSION:** The developed model could predict the EIBMI25 in the following way: if the discriminant score is close to 0.95 the range of EIBMI25 will be from 68.55 to 90.76 %, and if it is close to -1.05 the range will be from 90.76 to 117.35 %.

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mechanisms are well known, the knowledge about the regulation of HIF-1α, especially transcriptional and post-transcriptional, is still incomplete. Especially the expression of natural antisense transcripts (αHIF-1α-variants) has not been studied in detail so far.

**PURPOSE:** We aimed to explore expression and localization of two so far unknown αHIF-1α-variants under defined conditions in vitro and in vivo to enlarge the state of knowledge of the posttranscriptional regulation of HIF-1α.

**METHODS:** We broadly analyzed the HIF-1α gene locus on chromosome 14 by dint of UCSC genome browser. We considered several aspects, in particular mRNAs and Expressed Sequence Tags, CpG-islands, Poly-A-signals and transcription factor binding sites. In silico analysis, was followed by selection of primers to explore the expression of αHIF-1α-variants. Two unknown αHIF-1α-variants emerged which were analyzed in in vivo and in vitro trials.

**RESULTS:** Expression of the two novel αHIF-1α variants, terminating in exon 2 (αHIF-1αEx2) and exon 14 (αHIF-1αEx14) was confirmed in different cell lines. We verified them as spliced antisense variants of the HIF1α-gene locus by sequencing and in silico analysis. Expression analysis of cellular fragments with GAPDH and 7sk as housekeeping genes allowed us to identify αHIF-1αEx2α as nuclear and αHIF-1αEx14α as cytoplasmatic variant. In vitro trials revealed that both variants are differentially expressed after induced hypoxia (CoCl2) and that αHIF-1αEx14 expression correlates significantly with the HIF1α splice variants with and without exon 14 (r=0.953 and 0.949, respectively). However, exercise induced hypoxia in vivo (half marathon) showed no effect on expression of the two antisense RNAs.

**CONCLUSION:** Due to their specific localization, ubiquitous and differential expression in response to hypoxia, both αHIF-1α-variants are presumably associated with the regulation of HIF1α and thereby with the regulation of HIF-1α.

**Purposes:**
- To determine the effect of short-term exercise on VEGF and vessel growth of middle-aged brain.
- To investigate the effects of acute and short-term exercises on the capillary density and expression of angiogenic and inflammatory factors of young and middle-aged brain regions.

**Methods:**
- 3- and 12-month old male Sprague-Dawley rats were assigned to young control (YC), young exercise (YE), old control (OC) and old exercise (OE). Hippocampus and motor cortex were collected after single and 3-week swimming exercise. The protein expression of VEGF, VEGF receptors, Angiopoietin and its receptor, RAGE and CD68 with capillary density were analyzed.

**Results:**
- Comparing to YC, ~2-fold expressions of partial angiogenic factors (Flt-1 and Ang-1) and CD68 were determined in OC motor cortex but not hippocampus. Only for young, angiogenic factors in both brain regions significantly responded to acute exercise but with no further changes observed after 3-week swimming. Meanwhile, capillary density was significantly higher in YE than YC for both brain regions after 3-week swimming but not in the middle-aged (Motor cortex: 316.6±19.5 vs. 492.6±41.0 mm²; Hippocampus: 303.3±24.5±391.2±20.2 mm²).
- Otherwise, the inflammatory response expressed by CD68 was noted in OE, particularly in hippocampus.

**Conclusions:**
- These findings suggested angiogenic factors can be modulated to perform the appropriate vascular network following the exercise challenge in the brain. Importantly, exercise might accomplish an environment for middle-aged brain toward angiogenesis.

**Keywords:** angiogenesis, age, swimming exercise, hippocampus

**References:**

**A 12 Week Of Aerobic Exercise Training On VEGF Related Proteins After 3 Month Detraining In Human Skeletal Muscle**

- **Purpose:** The present study was performed to investigate the effect of long-term endurance training on VEGF and HIF-1α protein expressions in skeletal muscles after 3 month detraining.
- **Methods:** Five female aerobic athletes and age matched five untrained subjects were participated in the present study. All subjects refrained regular physical activities for three months before this study. The exercise program, for the experimental group, consisted of 10-minute stretching and 60-minute treadmill walking with 60-80% of VO2max for 12 weeks. Muscle samples obtained from vastus laterals before and after training, and analyzed a relevant protein expressions using SDS-PAGE and Western blotting.
- **Results:** There were no differences between the two groups in total VEGF protein expression. The protein expression of VEGF165 isoform increase by 37.5% (p= .014) in untrained group, whereas unchanged in trained group. The same trend was demonstrated that HIF-1α protein expression in untrained group increased by 69.4% (p= .015), whereas unchanged in trained group.
- **Conclusions:** A 12 week of aerobic training may not induce an increase in endothelial cell growth related protein expression in well-trained athletes even after 3 month detraining.
Type 1 diabetes is associated with endothelial dysfunction and reduced bioavailability of nitric oxide (NO), resulting in impaired vasodilation. High-intensity endurance training improves endothelium-dependent vasodilation. Additionally, antioxidants are likely to reduce oxidative stress and increase NO bioavailability.

**PURPOSE:** To examine the effects of short-term high-intensity endurance training and Vitamin C on endothelium-dependent vasodilation in different arteries within the vasculature.

**METHODS:** Twenty male Sprague-Dawley rats were assigned to a control diabetic (CD; n=10) or a high-intensity endurance training (HI; n=10) group. Diabetes was induced with Streptozotocin and insulin pellets were implanted to maintain glucose concentration within 9-15 mM. HI exercised on a treadmill with a 6% grade at 27 m/min, 5 times a week, 1 h a day for 6 weeks. Rats were sacrificed 15 h after their last bout of exercise. Femoral and aorta arteries were excised, cleaned of connective tissue and rings of ~2 mm length were mounted onto a myography system. Vasorelaxation responses to acetylcholine (ACh 10^(-5), (ACh)) and ACh 10^(-4) plus Vitamin C 10^(-4) (VIT C) were measured and modeled as a mono-exponential function using non-linear regression.

**RESULTS:** The adjustment for the vasorelaxation response (τ) was faster in HI (6.1s) compared to CD (9.2s) (p<0.05). The τ of the femoral artery was shorter (6.0s) than that of the aorta artery (9.3s). Adding vitamin C resulted in no significant changes in the responsiveness of the vessels (overall response 7.6s and 7.8s for ACh and VIT C, respectively with no interaction effects). The time delay (TD) before the onset of vasorelaxation did not differ between groups or vessels but was shorter in ACh (4.1s) compared to the VIT C (4.5s) condition (p<0.05). Thus, the mean response time (τ+TD) remained the same in both conditions (ACh, 11.7s and VIT C, 12.3s) but it was still shorter in HI (10.3s) compared to CD (13.7s) and in the femoral (10.4s) compared to the aorta (13.5s).

**CONCLUSION:** Although vascular responsiveness was faster in response to HI in both the aorta and femoral arteries, the rate of adjustment in the femoral was always faster than in the aorta. Finally, adding vitamin C as an antioxidant resulted in no further changes in the dynamic adjustment of the vessels.

Supported by: CIHR, OMRI
In contrast, cerebral CO₂ reactivity (the sensitivity of the MCA \(V_{\text{mean}}\)-\(P_{\text{ETCO}_2}\) relationship) was significantly decreased during LBNP from 1.43 ± 0.18 to 1.36 ± 0.17 cm/s/mmHg (\(P=0.001\)). Orthostatic stress induced-changes in \(V_S\) were significantly associated with decreases in MCA \(V_{\text{mean}}\) from supine to LBNP (\(P=0.018\)), but were not associated with changes in \(P_{\text{ETCO}_2}\) (\(P=0.2\)).

**CONCLUSIONS:** These findings support our hypothesis that postural reductions in CBF modify the central ventilatory chemoreflex by moving its point of operation. We speculate that orthostatic stress induced decreases in CBF attenuate the "washout" of CO₂ from the brain and result in augmented increases in \(V_S\) via the central chemoreflex.

**3308 Board #29 June 2 9:30 AM - 11:00 AM**

**Low-dose Aspirin Attenuates Heart Rate but not Blood Pressure Increase during Isometric Exercise in Humans**

Rachel C. Drew, Matthew D. Muller, Michael D. Herr, Cheryl Blaha, Jessica Mast, Todd Nicklas, Lawrence I. Sinoway. Pennsylvania State University, Hershey, PA.

(No relationships reported)

Muscleafferent feedback is known to contribute towards the increased heart rate (HR) and mean arterial blood pressure (MAP) observed during exercise. Group III and IV afferent nerve fiber endings (muscle mechanoreceptors and metaboreceptors, respectively) can both be stimulated by metabolites produced during muscular work. However, the role of one such metabolite, thromboxane \(A_2\), in causing the increased HR and MAP during exercise in humans is unknown.

**PURPOSE:** Therefore, we sought to determine the effects of blocking thromboxane \(A_2\) production via low-dose aspirin on HR and MAP during isometric calf exercise in humans.

**METHODS:** Nine young, healthy subjects (4 male) attended on 2 separate days and performed 2 trials on each day; a 2-min baseline followed by either 1.5 mins of further rest (0% maximal voluntary contraction (MVC)), or 1.5 mins of one-legged isometric calf exercise at 70% MVC (70% MVC). One visit was after having taken a placebo (Pla) for 7 days, and one visit after taking low-dose (81mg) aspirin (Asp) for 7 days. The order of visits was counterbalanced, as was the order of trials within each visit. HR (ECG) and MAP (Finapres) were continuously recorded during all trials.

**RESULTS:** Baseline HR was similar in all trials over both visits (59±2, 61±2, 61±3 and 63±3 b.min \(^{-1}\)) for 0% Pla, 70% Pla, 0% Asp and 70% Asp, respectively. HR did not change significantly from baseline during either of the 0% MVC trials. However, the HR increase from baseline observed during 70% MVC with aspirin (11±3 b.min \(^{-1}\)) was significantly lower than during 70% MVC with placebo (15±3 b.min \(^{-1}\)) (\(P=0.046\)). Baseline MAP was similar in all trials over both visits (87±2, 86±3, 85±2 and 85±3 mmHg for 0% Pla, 70% Pla, 0% Asp and 70% Asp, respectively). MAP did not change significantly from baseline during either of the 0% MVC trials. The MAP increase from baseline observed during the 70% MVC with aspirin (93±3 mmHg) was similar during 70% MVC with placebo (93±3 mmHg).

**CONCLUSION:** These results suggest that low-dose aspirin attenuates the increase in HR but not MAP during isometric calf exercise in humans. This is likely due to reduced metabolite stimulation of muscle afferents during exercise when thromboxane \(A_2\) production is inhibited, which affects the control of HR more than MAP.

**3309 Board #30 June 2 9:30 AM - 11:00 AM**

**Muscle Metaboreflex Modulates Dynamic Cardiovascular and Cerebrovascular Responses to Acute Hypotension in Humans**

Masashi Ichinose, Kazuhito Watanabe, Bun Tsuji, Takeshi Nishiyama. Meiji University, Tokyo, Japan. 2University of Tsukuba, Tsukuba, Japan.

(No relationships reported)

During heavy exercise, the arterial baroreflexes and the muscle metaboreflex are hypothesized to be activated, and to interact in ways that lead to modulation of the primary cardiovascular reflex responses. However, the interaction of these two reflexes in cerebral circulation has never been investigated.

**PURPOSE:** We aimed to investigate whether the muscle metaboreflex modulates arterial baroreflex-mediated cardiovascular responses as well as cerebrovascular responses to acute hypotension in humans.

**METHODS:** Acute hypotension was induced nonpharmacologically in six healthy subjects by releasing bilateral thigh cuffs after nine minutes of suprasystolic resting ischemia with and without muscle metaboreflex activation (via post exercise muscle ischemia after one minute static hand grip exercise at 50% MVC). We simultaneously measured beat-to-beat mean arterial pressure (MAP), heart rate (HR), cardiac output (CO), forearm blood flow (FBF) and middle cerebral artery mean blood velocity (MCAVM). Changes in measured variables induced via thigh cuff release were determined relative to their concomitant baseline values.

**RESULTS:** The thigh cuff release evoked rapid reductions in MAP, FBF, forearm vascular conductance and MCAVM and rises in HR, CO, TVC and cerebrovascular conductance index to similar extent in control and during muscle metaboreflex activation. The muscle metaboreflex activation enhanced the arterial baroreflex mediated peripheral vasconstriction as evidenced by an earlier start of MAP recovery (control vs. muscle metaboreflex activation; length of time before the start of MAP recovery, 11.5 ± 1.1 vs. 5.8 ± 0.7 s, \(P<0.05\) and faster returns of MAP and TVC to the baseline (0.9 ± 0.2 vs. 2.3 ± 0.5 and -5.4 ± 1.1 vs. -9.8 ± 1.1 %/s, \(P<0.05\)). In addition, the rate of regulation, an index of cerebral autoregulation, was enhanced during muscle metaboreflex activation (1.3 ± 0.1 vs. 4.3 ± 0.6 %/s, \(P<0.05\)). Furthermore, MCAVM recovered faster with muscle metaboreflex activation (1.3 ± 0.1 vs. 4.3 ± 0.6 %/s, \(P<0.05\)).

**CONCLUSION:** These results suggest that during muscle metaboreflex activation, the arterial baroreflex mediated peripheral vasconstriction as well as the cerebral autoregulation to acute hypotension are augmented and result in a faster recovery for the cerebral blood flow.

**3310 Board #31 June 2 9:30 AM - 11:00 AM**

**Contribution of Endothelin-1 to Skeletal Muscle Blood Flow and Oxygen Consumption during Exercise**


(No relationships reported)

**PURPOSE:** Although it has been documented that endothelin-1 (ET-1) - mediated vasconstriction is attenuated during exercise in an intensity-dependent manner, the role of endogenous ET-1 in regulating skeletal muscle blood flow and its ultimate effect on oxygen consumption (\(V_O_2\)) over a large spectrum of exercise intensities is unknown.

**METHODS:** Six healthy men and women (25 ± 2 yrs) performed knee-extensor exercise at 20, 40, 60, 80, and 90% of maximal work rate (\(WR_{\text{max}}\)) before and after local ET-1 receptor subtype A (ET\(_A\)) blockade (intramuscular infusion of BQ-123 at 10 nmol/min/l thigh volume). Arterial blood pressure (femoral arterial catheter), heart rate (3-lead ECG), single-leg blood flow (Doppler ultrasound), single-leg arterial-venous oxygen difference (\(a-V_{\text{O}_2\text{diff}}\)) and single-leg \(V_O_2\) were determined at rest and during all levels of exercise.

**RESULTS:** At rest, ET\(_A\) receptor inhibition did not alter leg blood flow, \(a-V_{\text{O}_2\text{diff}}\), or single-leg \(V_O_2\) (\(P>0.05\)). In contrast, ET\(_A\) receptor inhibition during exercise induced an ~18% increase in leg blood flow of the exercising limb across all levels of exercise (\(P<0.05\)). This increase in leg blood flow was accompanied by a ~10% increase in single-leg \(V_O_2\) (\(P<0.05\)) across all work rates, in light of an unaltered \(a-V_{\text{O}_2\text{diff}}\) (\(P>0.05\)) between control and BQ-123 trials. Heart rate and arterial blood pressure increased in an intensity-dependent manner during exercise, but did not differ between the control and BQ-123 trials (\(P>0.05\)).

**CONCLUSION:** These data reveal, for the first time, an ET\(_A\) receptor-mediated restraint of skeletal muscle blood flow during knee-extensor exercise in young, healthy humans, and further suggests that altering blood flow will directly augment \(V_O_2\).

**3311 Board #32 June 2 9:30 AM - 11:00 AM**

**ATP/S Does Not Potentiate the Muscle Chemoreflex Response to Lactic Acid**

Audrey J. Stone, Katsuya Yamauchi, Anna K. Leal, Marc F. Kaufman. Penn State College of Medicine, Hershey, PA.

(No relationships reported)

**PURPOSE:** Birdsog et al. (Neuron 68: 739-749, 2010) have shown that acute exposure to ATP potentiated acid sensing ion channel (ASIC) evoked currents from single dorsal root ganglion cells innervating hindlimb muscles of rats. This finding prompted us to determine whether the results seen in a freshly dissociated single cell preparation in vitro would translate to an in vivo preparation.
RESULTS: We measured the pressor and baroreceptor responses to injecting lactic acid (24mM; 0.4mL), an ASIC agonist, into the femoral artery of decerebrated rats (N=6) whose hindlimbs were freely perfused both before and after administration of ATPS (200mg/kg), a stable agonist of purinergic 2 receptors, to examine whether ATPS could potentiate the muscle chemoreflex evoked by lactic acid in rats with freely perfused hindlimbs. Supported by NIH R01-HL030710 and P01 HL096570.

CONCLUSIONS: ATPS does not appear to potentiate the muscle chemoreflex evoked by lactic acid in rats with freely perfused hindlimbs. Supported by NIH R01-HL030710 and P01 HL096570.
Previous studies have shown a significant reduction in left ventricular (LV) twist and strain (‘LV mechanics’) following ultra-endurance exercise, however, this may be caused by accompanying dehydration and not exclusively reflect cardiac impairments.

**METHODS:** Six male cyclists (age: 30±6 years) performed two 6h cycling trials, one with maintained hydration (EUHY) and one with ~2% dehydration (DEHY). Exercise intensity was fixed at 15% below a lactate concentration of 4 mmol. In both the EUHY and DEHY trial, LV volumes and mechanics were measured at three time points: i) pre, ii) post and iii) 24h post cycling exercise. Significant effects of exercise or dehydration as well as their interaction were identified using 2-way repeated measures ANOVA.

**RESULTS:** End-diastolic volume (EDV) and stroke volume (SV) decreased significantly post 6h cycling in both EUHY and DEHY (ΔEDV: −18±10 ml, ΔSV: −16±7 ml) while heart rate was significantly higher post exercise in both trials (Δ: −21±10 bpm). The ratio of early to late diastolic filling velocity (E/A) declined post exercise in both trials (Δ-0.70±15). Radial strain was unaltered while circumferential strain was mildly reduced post EUHY and DEHY (Δ-4±2%). In contrast, diastolic basal rotation velocity was significantly enhanced post DEHY compared with EUHY (74±21 vs. 63±22 deg/sec, P=0.03). All values returned to pre exercise levels 24h post exercise.

**CONCLUSION:** Moderate dehydration (2%) does not exacerbate the change in LV volumes, heart rate or LV mechanics post ultra-endurance exercise. Therefore, the present data provide evidence that previously shown reductions in LV mechanics following competitive ultra-endurance events are likely caused by reductions in LV function and not by hydration status.

**INTRODUCTION:** Nitric oxide (NO) bioavailability modulates both O$_2$ delivery relative to O$_2$ uptake and muscle vascular control. Acute dietary nitrate supplementation decreases resting and exercising mean arterial pressure (MAP) while preserving hindlimb skeletal muscle BF during exercise.

**METHODS:** Young male Sprague-Dawley rats (3-6 months) were randomized into control or nitrate-supplemented groups. Nitrate supplementation was administered in drinking water via oral gavages (2.5 ml/day of nitrate-rich beetroot juice (0.065 mmol/ml)). Either untreated (control, n=8) or nitrate supplemented (BR, n=8) tap water was available ad libitum for 3 days while daily consumption was verified. Following supplementation, BF was assessed using radiolabeled microspheres at rest and during treadmill running (20 m/min, 5% grade).

**RESULTS:** BR supplementation decreased MAP significantly by 15% at rest (control: 138±4; BR: 117±7 mmHg; P<0.05) and 10% during exercise (control: 136±3; BR: 123±6 mmHg; P<0.05). Similar BF values for 28 individual hindlimb muscles resulted in no change in total hindlimb BF at rest (control: 17±2; BR: 23±3 m/min/100g; P=0.05) or exercise (control: 114±2; BR: 116±10 m/min/100g; P=0.05).

**CONCLUSIONS:** Dietary nitrate supplementation did not change exercising hindlimb BF and, therefore, O$_2$ delivery despite a reduced arterial driving pressure; providing evidence for an improved hemodynamic response to exercise. Combined with recent results that nitrate supplementation reduces the O$_2$ cost of exercise, these data support the hypothesis that nitrate supplementation elevates O$_2$ delivery relative to O$_2$ demand, which suggest one potential mechanism by which nitrate supplementation improves metabolic control.

**Support:** NIH HL-108328, AHA Midwest Affiliate

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**INTRODUCTION:** Heart rate variability (HRV) reflects autonomic function and is an indicator of cardiovascular health. Previous research has shown that autonomic balance is shifted towards greater sympathetic and less parasympathetic modulation following exercise. However, sex differences in autonomic recovery following aerobic exercise are not well delineated.

**PURPOSE:** To examine sex differences in autonomic recovery following a 45-min bout of aerobic exercise in healthy individuals.
METHODS: Heart rate (HR), HRV frequency-domain parameters and brachial blood pressures were obtained at rest and following exercise in 60 healthy individuals (31 males and 29 females). Low-frequency (LF) and high-frequency (HF) power, low-frequency to high-frequency ratio (LF/HF), low-frequency normalized units (nLF), and high-frequency normalized units (nHF) of HRV were evaluated in the supine position, before and at 30 and 60 minutes following 45 min of walking at 70% of heart rate reserve.

RESULTS: Men exhibited higher LF/HF at rest and increased LF/HF more than women after exercise (205.97 ± 29.68 to 595.38 ± 73.08 to 209.21 ± 80.34 mmHg vs. 159.56 ± 32.63 to 355.17 ± 38.28 to 167.42 ± 42.08 mmHg, p<0.05 for interaction). Men also exhibited higher nLF (0.61 ± 0.03 to 0.76 ± 0.03 to 0.72 ± 0.03 mmHg vs. 0.51 ± 0.04 to 0.61 ± 0.03 to 0.54 ± 0.03 mmHg and lower nHF at baseline and following exercise (0.38 ± 0.03 to 0.22 ± 0.03 to 0.27 ± 0.03 mmHg vs. 0.47 ± 0.04 to 0.47 ± 0.04 to 0.44 ± 0.03 mmHg, p<0.05 for time and sex effects).

CONCLUSIONS: Men and women exhibit different HRV responses following aerobic exercise. The higher nLF and lower nHF coupled with a greater increase in the LF/HF ratio following exercise suggests men exhibit reduced vagal but increased sympathetic dominance following submaximal exercise compared to women. Future work is needed to determine if this is related to increased risk of untoward events during and following exercise in men compared to women.

3319 Board #40 June 2  9:30 AM - 11:00 AM Cerebral Hemodynamic Responses During Carbon Dioxide Rebreathing, Aerobic Exercise And Cognition
Hercules Grant, Mayank Rehani, Yagesh Bhambhani. University of Alberta, Edmonton, AB, Canada. (Sponsor: Bob Haennel, FACSM)

Increases in cerebral blood volume (total Hb) and oxyhemoglobin (O2Hb) with concomitant declines in deoxyhemoglobin (Hb) measured by near infrared spectroscopy (NIRS), collectively referred to as hemodynamics, are indicative of neuronal activation.

PURPOSE: To determine the inter-relationship between these acute hemodynamic responses during CO2 rebreathing which increases cerebral blood flow, aerobic fitness and cognition in healthy males.

METHODS: Informed consent was obtained from eight healthy males (20 - 58 yrs, predicted VO2max = 35.06 ± 8.5 ml/kg/min) with high school to university education. NIRS was used to measure the acute changes (peak minus baseline) in hemodynamic responses over the prefrontal lobe during 5% CO2 rebreathing for 90 sec. Astray/Rhyming test to predict VO2max, and digit span testing, (a subset of Wechsler Adult Intelligence Scale IV).

RESULTS: Significant increases were observed in total Hb and O2Hb with concomitant declines in Hb during CO2 rebreathing and cycle ergometry. Cognition elicited a trend of increasing O2Hb and decreasing Hb with digit span scores which was not significant. Changes in O2Hb and total Hb were significantly correlated with relative VO2max (r = 0.792 and 0.841 respectively), but not with cognition. Change in PetCO2 (surrogate for cerebral blood flow) was significantly correlated with relative VO2max, (r = 0.721, P<0.05). Correlation between delta PetCO2 and [O2Hb] during cycling was approaching significance (r = 0.586, P<0.10).

CONCLUSIONS: Higher levels of prefrontal neuronal activation are associated with enhanced aerobic fitness. However the relationship between these increases in neuronal activation and cognition were not evident, possibly due to the heterogeneity of the small sample evaluated.

3320 Board #41 June 2  9:30 AM - 11:00 AM Hemodynamic Mechanism of Rate Pressure Product Increase at Voluntary Exhaustion during Maximum Incremental Test
Marcelo G. Boia Nascimento1, Ricardo Jacon2, Hugo R. Paulista3, Tacio S. Santos2, Renata E. Dantas3, Marcio R. Mota4.1 Centro Universitário de Brasília-UNICEUB, Brasília, Brazil; 2Universidade de Brasília-UnB, Brasília, Brazil; 3Universidade de Brasília-UnB, Brasilia, Brazil; 4Centro Universitario de Brasilia, Brasilia, Brazil. (No relationships reported)

Rate pressure product (RPP) is a physiological indicator that includes the heart rate (HR) for systolic blood pressure (SBP) product. It is used to evaluate the cardiovascular stress and its increase may occur through HR’s rise, SBP’s rise, or both. The knowledge of responsible variable for RPP increase at voluntary exhaustion (VE) during maximum incremental test (MIT) is important for a better understanding of MIT hemodynamic.

METHODS: To determine the responsible variable for RPP increases at VE during MIT.

METHODS: Took part in the study 10 active female subjects (25±5 years; 165±7 cm; 62±11 kg; 27±6% body fat). MIT was done with a Bruce’s non-inclination adapted treadmill protocol (Centurion 300 - Micromed) with 5.5 km/h initial velocity and 1 km/h per minute increment until VE. HR and SBP were recorded at rest and at VE (FS150 Frequency Meter - Polar and BP 3AC1-1 Digital Sphygmomanometer - Microlife, respectively), but not with cognition. Change in PetCO2 (surrogate for cerebral blood flow) was significantly correlated with relative VO2max, (r = 0.721, P<0.05). Correlation between delta PetCO2 and [O2Hb] during cycling was approaching significance (r = 0.586, P<0.10).

CONCLUSIONS: Higher levels of prefrontal neuronal activation are associated with enhanced aerobic fitness. However the relationship between these increases in neuronal activation and cognition were not evident, possibly due to the heterogeneity of the small sample evaluated.

3321 Board #42 June 2  9:30 AM - 11:00 AM Hemodynamic Response to Active Standing in Swimmers with Orthostatic Intolerance: Prevalence of Initial Orthostatic Hypotension
William N. Lampe, Michael D. Kennedy. University of Alberta, Edmonton, AB, Canada. (No relationships reported)

Orthostatic intolerance or hypotension (OH) defined as a transient decrease >20 mmHg in systolic blood pressure (SBP) and/or a transient decrease >10 mmHg in diastolic blood pressure (DBP) within 3 min of standing has been reported in endurance athletes. However the prevalence of initial orthostatic hypotension (IOH) (defined as a transient decrease in SBP; >40 mmHg and/or DBP; >20 mmHg within 15 seconds of active standing) has not been examined in endurance athletes.

PURPOSE: The purpose of this study was to determine the prevalence of IOH in trained male swimmers with OH and to determine the hemodynamic response to active standing.

METHODS: 10 male swimmers with no reported history of syncope (age: 20.8±1.5 yrs; ht: 178.0 ± 7.6cm; wt: 79.9 ± 8.5 kg) completed an active stand orthostatic challenge test (5 min supine, 3 min standing). Subjects reported no physical activity, or caffeine or alcohol consumption within the previous 12 hours. Arterial blood pressure was measured continuously by finger photoplethysmography (Finometer Medical Systems). Mean Arterial Pressure (MAP), SBP, DBP, Heart Rate (HR), Stroke Volume (SV) and Total Peripheral Resistance (TPR) were derived from beat by beat blood pressure and averaged over 3 cardiac cycles.

RESULTS: 8 of 10 swimmers met both SBP and DBP, 1 met SBP and 1 met DBP OH criteria (mean decrease of 30.6±13.3 and 14.7±6.5 mmHg for SBP and DBP respectively). IOH was observed in 8 of 10 swimmers (Decrease of SBP: 48.8±19.3 mmHg; Decrease of DBP: 29.6±10.0mmHg; Decrease of MAP: 36.2±12.2mmHg with MAP nadir occurring at 8.7±2.8 sec returning to baseline at approximately 18.2±3.4 sec after standing. The primary hemodynamic response with decreasing MAP to nadir was increase in HR of 37.5±13.6 beats/min observed in 8 of 10 swimmers (Decrease of SBP: 48.8 ±19.3 mmHg; Decrease of DBP: 29.6±10.0mmHg; Decrease of MAP: 36.2±12.2mmHg, p<0.05 for time and sex effects).

CONCLUSIONS: These results suggest that IOH is prevalent in male swimmers with OH. In response to active standing an immediate uptake in HR with a latent increase in TPR act to equilibrate MAP from nadir.

3322 Board #43 June 2  9:30 AM - 11:00 AM Cardiorespiratory Response to Continuous Passive Motion Exercise in People with Spinal Cord Injury
Sangouk Wee, Konstantinos Vrongistinos, Shane D. Stecyk, Taeyou Jung, Byron Lai. California State University Northridge, Northridge, CA. (No relationships reported)

Continuous passive motion exercise (CPME) is commonly implemented for people with spinal cord injury (SCI). Many individuals with paralysis use CPME for their rehabilitation programs, but the research on its cardiorespiratory effects is limited.

PURPOSE: To investigate the cardiorespiratory responses to CPME in individuals with SCI. 
METHODS: Eleven individuals with SCI (6 men and 5 women, 40.7±9 yr) and 11 healthy controls (6 men and 5 women, 35.8±5 yrs) completed performing 3 exercise modes on separate days in a randomized order. Participants were also subject to an orientation visit to determine exercise intensity. Modes of exercise included 6-minute active arm ergometer exercise at their submaximal level which was set at 60-80% of maximum heart rate in order to estimate the maximum oxygen consumption, 20-minute seated CPME (passive cycling movement) and 20-minute supine-lying CPME (passive walking movement) at a matched movement speed. A telemetric metabolic system was used to compare the cardiorespiratory variables among three exercise modes. Test sessions were separated by minimum of 24 hours to avoid any carry-over effect from the previous session.

RESULTS: Multivariate analysis of variance (MANOVA) revealed significant differences in the oxygen consumption in the SCI group between the pre-exercise baseline and steady state exercise during the supine-lying CPME (Multivariate Pillai’s Trace = .615, F(1,20) = 11.161, p=.012) and during the seated CPME (Multivariate Pillai’s Trace = .562, F(1,20) = 8.972, p=.020). The levels of oxygen consumption were 8% (seated) and 14% (supine) of the estimated maximal oxygen consumption respectively.

CONCLUSIONS: Our findings suggest that CPMEs elicit an increase of cardiorespiratory responses, which may lead to favorable training effects on cardiorespiratory fitness in people with SCI.

Isometric handgrip (IHG) training leads to significant reductions in blood pressure (BP) and improves endothelial function assessed by flow mediated brachial artery dilation (FMD). Nevertheless, the acute hemodynamic responses elicited by IHG have not been fully explored.

METHODS: 15 healthy volunteers (7 females, 26.7±6y, 75±17kg, 170±4±7cm) completed two visits to the laboratory. After a 10-min rest period, subjects performed four sets of 2-min bilateral IHG at 30% of their maximum voluntary contraction, intercalated by 1-min rest interval. Brachial artery diameter (BAD) was measured using high-resolution ultrasound, BP was measured by oscillometry, Mbv and Mox range values (difference between maximum and minimum absolute values) from the flexor digitorum profundus of right forearm were monitored by dual wave near infrared spectroscopy.

RESULTS: Time-course analyses indicate non-significant changes in BAD (t-test P=.00), only discrete ranges in Mbv and Mox, and no significant changes in BP (ANOVA with repeated measures). Absolute values obtained for all variables and ICC are presented, revealing poor to excellent reliability.

CONCLUSION: IHG exercise has a negligible acute effect on FMD, BP and Mbv/Mox; monitoring BP by oscillometry is a reliable way of assessing BP changes, whereas Mbv and Mox ranges were moderately reliable, supporting their utilization in this type of exercise.

Financial support: FAPERJ #E-26/111.781/2010 and CNPq #58/2009
CONCLUSION: reduction documented in the young one (A1) amongst the 4 conditions was compared using repeated ANOVA (with Tukey post-hoc test). of HR was reduced (p = 0.05) with increasing LBNP level. As a consequence, A1 of CO exhibited only a trend (p = 0.06) to increase from 1.93 ± 0.79 to 2.42 ± 0.72, 3.01 ± 1.47 and 3.19 ± 0.73, p < 0.01; slope = 0.00049 ± 0.00012, p = 0.002). Unlike the young, where eNOS inhibition ablated this relationship (r = 0.1, p = 0.5; slope = 0.00005 ± 0.00006), the diameter/shear rate relationship was significant (p<0.05) in H subjects only. LF/HF ratio slightly but not significantly increased in both groups (H: 0.1±1.5; N: 0.7±1.6), as a results of an increase in LF and a reduction of HF, the latter being significant (p<0.05) in H subjects only. 

METHODS: 

PURPOSE: To evaluate the acute cardiovascular effects of mud-pack treatment in pharmacologically treated hypertensive patients. 

METHODS: 28 subjects (MF: 10/18; 67±11 yrs, m/s/SD) were divided in 2 groups, matched for age and anthropometric characteristics: normotensive (N) and hypertensive (H) subjects, treated with beta-blockers, ACE-inhibitors or angiotensin II receptor antagonists (no diuretics). Beat-by-beat systolic (SBP) and diastolic blood pressure (DBP) (finger plethysmography), and heart rate (HR) were recorded before, in supine position (10 min), and during mud bath treatment (mud temperature 42°C, 15 min). Cardiac output and total peripheral resistance were calculated from the computed aortic-flow waveform. HR variability spectral indexes of sympathovagal balance (HF, High Frequency; LF, Low Frequency and LF/HF ratio) were finally calculated.

RESULTS: Compared to basal (pre-treatment) conditions, mud treatment tended to decrease SBP (difference between mud immersion and basal condition; H: -6±16 mmHg; N: -3±5 mmHg), whereas DBP did not differ (H: -2±7 mmHg; N: 7±5 mmHg) in both groups. HR significantly increased (p<0.05) in both groups (H: 7±6 bpm; N: 8±4 bpm). Cardiac output decreased significantly (p<0.01) in H subjects only (H: -1.5±2.0 l/min; N: 0.5±1.6 l/min), whereas total peripheral resistances decreased in H and increased in N subjects (H: -160±237 l/min; N: 97±124 dyn/s/cm^3)p<0.05). LF/HF ratio slightly but not significantly increased in both groups (H: 0.1±1.5; N: 0.7±1.6), as a results of an increase in LF and a reduction of HF, the latter being significant (p<0.05) in H subjects only. 

CONCLUSIONS: Mud-pack treatment seems to be safe in pharmacologically treated hypertensive subjects. Partially supported by FoRST (Fondazione per la Ricerca Scientifica Termale, Italy).

The kinetics of cardiac output (CO) at the onset of exercise is characterized by two phases. The first rapid phase (phase I), which has a time constant of less than 5 s, is generally attributed to the sudden withdrawal of vagal tone. Yet the hypothesis was put forward that a mechanical effect related to sudden increase in venous return at exercise start might also play a role, especially by increasing stroke volume (SV) via the Frank-Starling mechanism. If the latter was the case, then application of increasing levels of lower body negative pressure (LBNP) would generate a progressively greater increase in phase I amplitude (A1) of SV at exercise start, which may also affect A1 for CO.

To test this hypothesis, 8 healthy subjects (24.8 ± 5.0 years) repeated 3 transitions of 5 min moderate (50 W) pedaling exercise in supine position, with 0 (control), -15, -30 and -45 mmHg of LBNP respectively. The time constant of phase 1 was ranged between 1.5 and 3.5 s and remained unaffected by LBNP exposure for either SV, HR or CO.

CONCLUSIONS: The kinetics of cardiac output (CO) at the onset of exercise is characterized by two phases. The first rapid phase (phase I), which has a time constant of less than 5 s, is generally attributed to the sudden withdrawal of vagal tone. Yet the hypothesis was put forward that a mechanical effect related to sudden increase in venous return at exercise start might also play a role, especially by increasing stroke volume (SV) via the Frank-Starling mechanism. If the latter was the case, then application of increasing levels of lower body negative pressure (LBNP) would generate a progressively greater increase in phase I amplitude (A1) of SV at exercise start, which may also affect A1 for CO.

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METHODS: To test this hypothesis, 8 healthy subjects (24.8 ± 5.0 years) repeated 3 transitions of 5 min moderate (50 W) pedaling exercise in supine position, with 0 (control), -15, -30 and -45 mmHg of LBNP. The pulse pressure waveform of a left hand’s finger was continuously recorded using Portapres device, allowing calculation of CO, SV and heart rate (HR) on a beat-by-beat basis using Modelflow method (Wesseling et al., 1993). After superimposition of the 3 transitions, kinetics of CO, SV and HR were fitted using bi-exponential model, and the amplitude of phase one (A1) amongst the 4 conditions was compared using repeated ANOVA (with Tukey post-hoc test).

RESULTS: A1 of SV was significantly increased from 7.5 ± 3.7 to 9.5 ± 3.8 to 16.7 ± 4.2 and 21.4 ± 7.9 ml, for 0 (control), -15, -30 and -45 mmHg of LBNP respectively. By contrast, A1 of HR was reduced (p = 0.05) with increasing LBNP level. As a consequence, A1 of CO exhibited only a trend (p = 0.06) to increase from 1.93 ± 0.79 to 2.42 ± 0.72, 3.01 ± 1.47 and 3.19 ± 0.73, p < 0.01; slope = 0.00049 ± 0.00012, p = 0.002). Unlike the young, where eNOS inhibition ablated this relationship (r = 0.1, p = 0.5; slope = 0.00005 ± 0.00006), the diameter/shear rate response remained statistically unchanged in the old (r = 0.61, p < 0.01; slope = 0.00011 ± 0.00007). However, eNOS inhibition attenuated the BA diameter increase by 50% in the old compared to the 70% reduction in the young, indicating a substantial yet reduced role of NO with age. Blood flow was unaffected by eNOS inhibition in the old which contrasts with the ~25% reduction documented in the young.

CONCLUSION: These findings reveal that with age both shear stress mediated BA vasodilation and BA blood flow are less NO dependent during handgrip exercise and support the use of the progressive handgrip paradigm as a valid and novel approach to the non-invasive assessment of NO bioavailability in humans across the lifespan.
METHODS: TR mice ran on a motorized treadmill at progressively increasing speeds up to 22m/min, 1hr/day, 6 days/wk for 12 wks. TR and SED mice of both genders were sacrificed immediately following exercise to the point of exhaustion and compared to SED resting controls. LV was rapidly excised, freeze-clamped, homogenized and AMPK activity measured by β3P ATP radioimmunoassay with S-Adenosyl methionine (SAMS) as substrate.

RESULTS: Irrespective of gender, trained mice demonstrated a relative cardiac hypertrophy (HW/BW) compared to sedentary mice (males 5.28 ± 0.20 vs. 4.30 ± 0.18 mg/g; females 4.97 ± 0.15 vs. 4.45 ± 0.14 mg/g; P < 0.01 and P < 0.05 respectively). Regardless of training status, male mice (n=19) demonstrated a ~3.5-fold higher AMPK response to the same level of exhaustive exercise compared to female mice (n=18) (0.117 ± 0.009 vs. 0.034 ± 0.003 nmols/mg/min; P < 0.001). Irrespective of gender, trained mice also exhibited higher AMPK activity (P < 0.05) compared to sedentary counterparts.

CONCLUSION: As AMPK is recognized as a fuel regulator in the heart under stressful conditions including ischemia, the sex- and training-induced differences in cardiac AMPK response to exhaustive exercise warrant further investigation.

*This work was supported by grants from NIH, University of Wyoming Northern Rockies Regional IDE Network for Biomedical Research Excellence (INBRE) 5P20RR016474, and the American Federation for Aging Research (AFAR) 08007.

3329 Board #50 June 2 9:30 AM - 11:00 AM
Acute Sedentary Behavior and Markers of Cardiometabolic Risk: A Systematic Review of Intervention Studies
Travis I. Saunders, Richard Larouche, Rachel C. Colley, Mark S. Tremblay, FACSM. Children’s Hospital of Eastern Ontario Research Institute, OTTAWA, ON, Canada.
(No relationships reported)

PURPOSE: North Americans spend half their waking hours engaging in sedentary behavior. Although several recent interventions suggest that short bouts of uninterrupted sedentary behavior may result in acute increases in cardiometabolic risk, this literature has not been reviewed systematically. The purpose of the present study was to systematically review the impact of uninterrupted sedentary behavior lasting ≤7 days on markers of cardiometabolic risk (insulin sensitivity, glucose tolerance, and lipid levels) in humans.

METHODS: Interventions were identified through systematic searches of Medline and Embase, and screened by 2 independent reviewers.

RESULTS: A total of 22 interventions were identified that examined the impact of imposed sedentary behaviour on biomarkers of interest. The majority of these studies focused on healthy young men, with very little identified research on females or other age groups. We found consistent, moderate quality evidence that uninterrupted sedentary behaviour ≤7 days results in moderate and deleterious changes in insulin sensitivity and plasma triglyceride levels, respectively. In contrast, there is inconsistent, very low quality evidence linking uninterrupted sedentary behaviour with changes in glucose tolerance, HDL or LDL Cholesterol.

CONCLUSIONS: These findings suggest that uninterrupted bouts of sedentary behaviour should be avoided in order to prevent or attenuate transient increases in metabolic risk.

3330 Board #51 June 2 9:30 AM - 11:00 AM
Measurement of Leg Blood Flow During Exercise Using Strain Gauge Plethysmography: Effect of Venous Occlusion Pressure
Christopher D. Askew, James A. Matthews. Queensland University of Technology, Kelvin Grove, Queensland, Australia. (Sponsor: Jeff Coombes, FACSM)
(No relationships reported)

Venous occlusion strain gauge plethysmography (VOP) is well established as a non-invasive technique for the measurement of limb blood flow. While the susceptibility of the technique to movement artefact has limited its use primarily to the assessment of resting blood flow, VOP has recently been shown to compare favourably with Doppler ultrasound for the measurement of contraction-by-contraction blood flow during lower limb exercise. Before VOP can be recommended for use during exercise, the effect of venous occlusion on muscle performance needs to be determined. Furthermore, it is plausible that exercise in the upright position, which increases venous pressure in the lower limbs, would negate or minimise the need for venous occlusion, although this has not been tested.

PURPOSE: To compare the effect of standard (60 mmHg), low (30 mmHg) and no (0 mmHg) venous occlusion pressure on leg blood flow and muscle fatigue during intermittent isometric plantar flexion exercise.

METHODS: Eighteen male participants (age: 21 ± 2 y) attended three testing sessions, 7 days apart, and performed a 5-min intermittent isometric plantar flexion exercise test at a target force of 50% MVC, with one of three venous occlusion pressures (thigh cuff at 0, 30 or 60 mmHg) in a random order. Contraction-by-contraction blood flow data were fitted to a biexponential curve to determine the mean response time and magnitude of blood flow. MVCs were performed before and after each bout of exercise to determine the magnitude of fatigue.

RESULTS: Muscle fatigue, relative to pre-test MVC force, increased with increases in occlusion pressure (mean + SD: 0mmHg = 9.86 ± 6.45; 30mmHg = 13.66 ± 6.04; 60mmHg = 13.41 ± 5.30%; p<0.05). Blood flow mean response time was longer (0mmHg = 20.80 ± 7.49; 60mmHg = 23.46 ± 7.53 s; p<0.05) and magnitude was higher (0mmHg = 53.04 ± 14.98; 60mmHg = 56.92 ± 12.90 ml/100ml/min; p<0.05) at 60 mmHg compared with 0 mmHg, but was not different to the 30 mmHg condition.

CONCLUSION: The use of a standard venous occlusion pressure of 60 mmHg to measure lower limb blood flow during exercise has a negative effect on muscle fatigue. This effect may be minimised, without significantly influencing blood flow, by using an occlusion pressure of 30 mmHg.

3331 Board #52 June 2 9:30 AM - 11:00 AM
Chronotropic and Perceptual Responses To Deep Water Running
Fiddy Davis, Bhamini Rao. Manipal University, Udupi, India.
(No relationships reported)

Deep Water Running (DWR) is gaining popularity as a means to maintaining and improving cardiorespiratory endurance in people for whom weight bearing aerobic exercise is contraindicated. However there is limited knowledge about the chronotropic and perceptual responses of the body to DWR.

PURPOSE: To compare the Heart Rate (HR) and Rating of Perceived Exertion (RPE) responses during Treadmill Running (TMR) and DWR and to investigate the relationship between HR and RPE in these environments.

METHODS: 10 male recreational athletes aged between 18 and 30 years performed TMR and DWR on two different days at six incremental levels of speed (6,7,8,9,10 & 11 kmph). Participants exercised for four minutes in each level and were given eight minutes recovery between levels. DWR was performed by immersing the individual till the neck level in an upright position using a floating device. At the end of each level, HR and RPE were measured. HR was measured using a radio telemetric tester and RPE was measured using modified Borg’s scale.

RESULTS: Paired t-test and Wilcoxon signed rank test was used to measure the difference in HR and RPE across environments in each level. HR was significantly lower in DWR than in TMR in all levels of speed except the first two levels of speed (p=0.29 & 0.24) and RPE was significantly higher in DWR at all levels of speed. The mean HR difference in the last four stages was 20 beats/min. Pearson product moment correlation was used to measure the relationship of the dependent variables. HR and RPE had a moderate correlation in TMR and DWR (0.670 and 0.580). Regression analysis was performed and an equation was derived to predict HR during DWR from RPE.

CONCLUSIONS: HR was found to be consistently lower and RPE was consistently higher in DWR than in TMR for a given workload. HR in DWR can be predicted through RPE with this equation (6.29 × RPE + 110.48).

3332 Board #53 June 2 9:30 AM - 11:00 AM
The Effect Of Nicotine On Cardiorespiratory Responses And Energy Expenditure During Exercise
Takashi Nakagata1, Hisashi Naito1, Hiroyuki Kobayashi2, Shizuo Katamoto1. 1Juntendo University, Tokyo, Japan. 2University of Tsukuba, Tsukuba, Japan.
(No relationships reported)

PURPOSE: Recently, nicotine patches or chewing gums have been often prescribed for smokers to quit smoking. To date, studies have investigated the effect of nicotine on cardiorespiratory responses and energy expenditure during exercise to reveal any possible cautions to be taken when prescribing exercise. These studies however used a fixed low exercise intensity, so that the
effect of nicotine on cardiorespiratory responses and energy expenditure during varying exercise intensities, especially exhaustion remains to be investigated.

To examine the effects of transdermal nicotine patch on cardiorespiratory responses and energy expenditure during incremental pedaling exercise.

METHODS: Twelve healthy males aged 21-29 year-old performed an incremental step exercise on a cycle ergometer at a cadence of 60 rpm (initially 0.5 kp, increased by 0.5 kp until 4.0 kp every 4 min) on two occasions. Subjects were administered either a placebo (control) or 7 mg transdermal nicotine patch 10 hr before the exercise using a randomized-order cross-over method. The patch was attached on the left arm until the completion of the exercise. Heart rate (HR), the volume of oxygen consumption (VO2), energy expenditure (EE), respiratory exchange ratio (RER), rate of perceived exertion (RPE), and blood lactate (La) were measured at each exercise intensity. Data were analyzed using two-way repeated measures ANOVAs.

RESULTS: Four out of twelve subjects exhausted and terminated exercise at 3.5 kp for both placebo and nicotine conditions. RPE for the eight subjects who could pedal at 4.0 kp ranged between 18 and 22. EE, RER and La responses during the incremental exercise were similar between placebo and nicotine. Only HR was affected by nicotine (P = 0.005), and was higher for nicotine condition for all intensities investigated compared to control (mean difference=6.3%).

CONCLUSIONS: A 7 mg transdermal nicotine administration resulted in slightly higher HR compared to control. Therefore, the nicotine effect should be taken into consideration when estimating physical fitness level or determining exercise intensities using HR during exercise.

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3334 Board #54 June 2 9:30 AM - 11:00 AM
Noninvasive Quantification of Absolute Blood Flow and Oxygen Consumption Rate in Exercising Skeletal Muscle
Katelyn Gurley, Yu Shang, Guoqiang Yu. University of Kentucky, Lexington, KY.

Many common diseases (peripheral vascular disease, fibromyalgia) affecting skeletal muscle involve moderate to severe impairments in circulatory and metabolic functions. A hybrid optical instrument combining near-infrared spectroscopy (NIRS) and diffuse correlation spectroscopy (DCS) has been developed to noninvasively monitor multiple tissue hemodynamic parameters. Using this hybrid instrument with a few simple physiological manipulations, we demonstrate, for the first time, a noninvasive optical method for obtaining the absolute measurements of blood flow, oxygenation, and oxygen consumption rate in exercising muscle.

PURPOSE: To noninvasively monitor absolute blood flow, oxygenation and oxygen consumption rate in skeletal muscle.

METHODS: DCS monitors relative blood flow (rBF) by measuring the speckle fluctuations caused by moving red blood cells, while NIRS measures tissue absorption and scattering to determine tissue blood oxygen saturation (StO2). Relative oxygen consumption rate (rVO2) is calculated by the Fick principle using the measured StO2 and rBF. Absolute baseline blood flow (BF) and VO2 were characterized in the forearm of 7 healthy subjects using venous and arterial occlusions, respectively. Both parameters were manipulated by 5 minutes of rhythmic isotonic handgrip exercise, while absolute values of BF and VO2 during exercise were determined by multiplying rBF and rVO2 with absolute baselines. Previous problems with muscle fiber motion artifact in optical measurements during exercise were mitigated in this study by using a gating algorithm to determine the contraction status of the muscle based on the position of the handgrip device.

RESULTS: Baseline BF and VO2 values were 1.7 ± 0.5 ml/100ml/min and 3.6 ± 0.8 µmol O2/100ml/min, respectively. During exercise, values of BF and VO2 increased to 9.8 ± 4.0 ml/100ml/min and 17.5 ± 5.2 µmol O2/100ml/min. These values are comparable to those found in the literature using other techniques (strain gauge, catheter).

CONCLUSIONS: Our results show that DCS/NIRS can noninvasively monitor absolute BF, StO2, and VO2 in exercising muscle. The information provided by such measurements can be highly valuable in assessing the functionalities of the microcirculation and metabolism in regards to skeletal muscle disease.

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3333 Board #55 June 2 9:30 AM - 11:00 AM
Comparison of Intra-arterial vs Manual Auscultation of Blood Pressure During Exercise in Healthy Humans
Sarah E. Baker1, Courtney M. Wheatley1, Eric M. Snyder1, Michael J. Joyner, FACSM2, Bruce D. Johnson2, Thomas P. Olson2. 1University of Arizona, Tucson, AZ. 2Mayo Clinic and Foundation, Rochester, MN.

PURPOSE: Blood pressure (BP) is a key measure of cardiovascular function. As such accurate measurement is important to ensure proper clinical evaluation, diagnosis, and treatment. We compared intra-arterial (Direct) vs. cuff auscultation (Manual) measurement techniques at rest and during multiple steady-state submaximal exercise intensities.

METHODS: Sixty-four adults (ages 29±1.5, 52% female, h=174±1 cm, w=73±2 kg, BMI=24.1±0.4 kg/m², BSA=1.87±0.03 m²) participated in the study. Blood pressure was measured directly via radial artery catheter and manually by brachial auscultation with sphygmomanometry at rest and during two levels of submaximal steady-state exercise (9 min at 40% and 75% max watts). Cardiac output was measured via open circuit acetylene uptake. Measures were taken in triplicate (1x every 3 min).

RESULTS: At rest, low and moderate intensity Direct measurement demonstrated a significant elevation in systolic (SBP) and diastolic (DBP) blood pressure (Bias for SBP: 22±13, 29±19 and 27±3 mmHg and DBP: 5±10, 5±12 and 17±15 mmHg; rest, low and moderate intensity respectively; p<0.001 for all). At rest, the correlation and agreement between the two methods was modest (SBP: r=0.56, bias=+22 mmHg; DBP: r=0.53, bias=+5 mmHg; p<0.001 for both). Although there was good correlation and agreement with SBP at low and moderate intensity, we noted the Manual method demonstrated a weaker relationship for DBP (SBP: r=0.74 and 0.74; bias=+30.2 and +26.8 mmHg; DBP: r=0.39 and 0.28; bias=+7.1 and +13.4 mmHg, for low and moderate intensity respectively, p<0.001). Further, Manual measurement demonstrated a greater slope for the relationship between pulse pressure and cardiac output (13.6±0.4 vs 12.3±0.4, p=0.03). These changes resulted in a narrowing of the difference in PP between techniques during moderate intensity.

CONCLUSIONS: Our results suggest that as exercise intensity increases Manual DBP tends to bias low compared to Direct DBP, which when combined with parallel increases in SBP, leads to no differences in pulse pressure between methods at moderate intensity exercise. Due to the use of PP in calculation of other cardiovascular parameters (MAP, SVR), the intensity of exercise is an important consideration when determining the most appropriate technique for measurement of BP.
PURPOSE: It is not well established as to whether the nocturnal sleep would be affected by the preceding exercise in daytime. While the exercise is known to elicit acutely a reduction in blood pressure (BP) for approximately 2-3 hours (i.e. post-exercise hypotension: PEH) even in healthy subjects, it is still unclear as to whether the PEH would be lasting until the bedtime of the following night. We, therefore, determined the effect of aerobic exercise in early evening on the quality/quantity of sleep and its hemodynamic response in the following night, not in laboratory, but in subject’s own bedroom.

METHODS: 12 healthy young male subjects (age: 18-25 yr) participated first in preliminary protocol, in order to check whether he could accustom to equip the ambulatory BP recording device for one day from the early evening to the noon of next day and the special watch for continuous HR recording for bedtime, without exercise intervention. As a result, 10 of 12 subjects had no serious disturbance to usual daily life including the bedtime. Then 10 subjects performed two main protocols either with or without the cycle ergometer exercise (60 min at 50% HR reserve) in early evening (i.e. 1st day), in random order. The ambulatory monitoring of BP/HR (Holter type) and physical activity by accelerometer (AW-16 Actiwatch) were started from the previous night. In addition, the special watch (NEM-T1 Toshiba) for identifying the sleep stage by HRV analysis was equipped, instead of the constraint EEG monitoring, during the bedtime. To avoid any effect induced by the food intake, the standardized contents of lunch and dinner of 1st day and breakfast of the 2nd day were offered.

RESULTS: There were no substantial differences in the objective indices of sleep between with and without preceding exercise. Compared to control (i.e. without exercise), the mean value of BP during nocturnal sleep showed a tendency to be lowered by the preceding exercise.

CONCLUSIONS: The aerobic exercise in early evening has no acute effect to the sleep itself, but some residual effect to the hemodynamic response during sleep, i.e. the prolonged PEH. Supported by JSPS-KAKENHI (#20700526 to MYE, #21370111 to YF, #21500689 to AM).
RESULTS: As expected, Ex decreased infarct size (53 ± 3 and 42 ± 2% for Sed and Ex respectively; P<0.05). Treatment of Sed animals with MTP-131 led to a significant decrease in the size of infarction (41 ± 3%; P<0.05 vs. Ex saline). Apocynin abolished the cardioprotective effects of exercise (53 ± 2%; P<0.05 vs. Sed saline).

CONCLUSIONS: By using both a mitochondria-targeted antioxidant and an inhibitor of NAPDH oxidase we were able to determine that the locus of ROS production during exercise plays a vital role in cell signaling. Our results suggest that ROS generated through NAPDH oxidase, and not within the mitochondria, are potent signaling molecules involved in exercise-induced cardioprotection. Future experiments that seek to investigate the signaling mechanisms downstream of ROS production by NAPDH oxidase. This study was supported by American Heart Association Predoctoral Fellowship 11PRE7590086 and Stealth Peptides, Inc.
Investigation Of C-reactive Protein And Leptin As Biomarkers Of Obesity With Potential Clinical Utility
Rachel A. Friedman, Scott Lyons, James Navalta, Mark Schafer, Scott Arnett. Washington University, St. Louis, MO. Western Kentucky University, Bowling Green, KY. (No relationships reported)

Obesity is a major health problem in the United States with life-threatening associated disease states. Obesity itself is considered a problematic condition due to the chronic effects it has on the body. Intense exercise also stresses the body, putting humans in recovery from exercise in a condition that may be analogous to a disease state.

**PURPOSE:** The purpose of this study was to examine biomarkers associated with obesity (CRP and Leptin) before and after continuous and intermittent bouts of exercise in an obese sample vs. a non-obese sample.

**METHODS:** The obese group’s biomarkers at rest were compared to those of the non-obese group after exercise. Eighteen male subjects performed a VO\textsubscript{2} max test and a series of three Wingate tests in a cross-over study design. Blood was taken PRE, POST, and 1-HR POST to CRP- Wingate, Leptin-VO\textsubscript{2} max day.

**RESULTS:** During the VO\textsubscript{2} max test, the non-obese group’s CRP levels decreased POST and returned to baseline 1-HR POST, while the obese group’s CRP levels increased immediately after and returned to baseline after 1 hour (changes not significant). Significant differences were noted between groups PRE on the VO\textsubscript{2} max testing day with the obese group’s resting levels at 94±54 mg·dl\textsuperscript{-1} and the healthy group’s at 49±27 mg·dl\textsuperscript{-1} and in Leptin levels on the Wingate test day with the obese group’s at 18.68±13.29 ng·ml\textsuperscript{-1} and the non-obese group’s at 5.39±4.24 ng·ml\textsuperscript{-1}. On the Wingate test day, the CRP response was the opposite of those on the VO\textsubscript{2} max day, with a significant change in CRP from POST to 1-HR POST in the obese group (1.18±.72 to 97±60 mg·dl\textsuperscript{-1}). Serum Leptin levels for both groups increased POST after both exercise modes and returned to baseline 1-HR POST (changes not significant). Non-obese participants were examined individually. Two of them demonstrated the possibility of being at risk for obesity based on post exercise elevations in CRP and Leptin on at least 3 of the 4 conditions (CRP-VO\textsubscript{2} max, Wingate, Leptin-VO\textsubscript{2} max, and Leptin-Wingate) that caused the levels of the biomarkers to approach the obese group’s at rest. Three additional subjects demonstrated two elevations and reported parental obesity. Therefore, five participants could potentially be “at-risk” based on the assumptions of the present study.

**CONCLUSION:** These results suggest CRP and Leptin could possess the ability to classify individuals in a “pre-obesity state.”

3345 Board #66 June 2 8:00 AM - 9:30 AM
No Effect Of Kinesio Taping On Jump Performance In Female Track And Field Athletes
Thorsten Schiffer\textsuperscript{1}, Anne Möllinger\textsuperscript{2}, Billy Sperlich\textsuperscript{2}, Daniel Memmert\textsuperscript{1}.\textsuperscript{1}German Sport University Cologne, Cologne, Germany.\textsuperscript{2}University Heidelberg, Heidelberg, Germany. (No relationships reported)

**PURPOSE:** Previous studies have indicated that kinesio taping (KT) alters muscle activation and proprioception in patients. Since muscle activation and proprioception are known to influence the jumping performance it was the aim of the study to test the hypothesis whether the application of KT enhances the jumping performance of healthy non-injured elite female track and field athletes.

**METHODS:** A double one-legged jump test was performed before and after application of KT and immediately after removal. Eighteen German female elite track and field athletes (age: 21 ± 2 years, active time in their sport: 13 ± 4 years, posture: 172 ± 4 cm, body mass 62 ± 5 kg) participated in the study.

**RESULTS:** The results revealed no significant differences in jumping performance between the tests (p=0.05, d=0.26).

**CONCLUSIONS:** These findings demonstrate that KT applied onto the muscles had no influence on the jumping performance in healthy non-injured female elite athletes.
**METHODS:** Thirteen healthy and recreationally active adults, six male and seven female ranging from 19 to 33 years of age participated in this study. Participants were subjected to five different stretch interventions in a random order on separate days. The five different stretch conditions which were implemented were: 1) isometric, 2) concentric and 3) eccentric contractions - all using the Thera-Band® Stretch Strap for resistance and maximum ROM - and 4) partner isometric PNF which were all compared to 5) static stretching. RT, MT, dynamic, active, and passive hip flexion ROM were measured twice before and after the intervention and dynamic angular velocity was calculated during the dynamic stretch.

**RESULTS:** There was a positive main effect for time (p < 0.05) with all the stretching conditions, increasing by 2.6%, 2.75% and 5.37% from pre- to post-intervention with dynamic, active and passive stretches respectively. There was a negative main effect for time (p < 0.05) with dynamic angular velocity decreasing 9.2% from pre- (70.54 ± 4.03 degrees/sec) to post-intervention (64.01 ± 3.55 degrees/sec). As well there was a negative main effect (p < 0.05) with regards to MT, pre- (p = 0.47 ± 0.027 sec) and post-intervention (0.49 ± 0.023 sec). However, there were no significant differences found in the participants RT pre-post stretching and there was no interaction between the stretch conditions for any of the measures.

**CONCLUSION:** TheraBand® Stretch Strap may be used as an alternative to assisted PNF protocols as it can provide similar increases in ROM.

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**3347 Board #68 June 2 8:00 AM - 9:30 AM**  
**The Relationship Between The Toe Exercises And The Medial Longitudinal Arch**  
Takashi Shirosita,1 Toru Fukubayashi,1 Gamua PAZ College, Gunma, Japan, 2Waseda University, Saitama, Japan.  
(No relationships reported)

**PURPOSE:** The toes play an important role, yet the toe flexor strength is poorly understood. We have been researching clinical and electromyogram (EMG) studies about the toe exercises we developed. However, the relationship between the toe exercises and the medial longitudinal arch (MLA) was unclear. The purpose of this study is to examine the relationship between the toe exercises and MLA.

**METHODS:** The subjects were 35 feet of 21 participants (11 males, 18 females), whose mean age was 23.1±4.5 years old. The participants performed three toe exercises and the towel gathering exercise. The three toe exercises were isotonic contractions (10 times) of the great toe flexor, 2nd-to-5th toe flexors and 3rd-to-5th toe flexors.

All subjects randomly performed the three toe exercises and the towel gathering exercise. Before and after each exercise, we assessed MLA using the navicular drop test (NDT) Brody developed.

This study was performed with the consent of the Ethics Committee for Human Research of Waseda University and Gunma Paz College.

For statistical analysis we performed Repeated ANOVA using IBM SPSS Statistics19. Results were considered significant at values of p<0.05.

This study was performed with the consent of the Ethics Committee for Human Research of Waseda University and Gumma Paz College.

**RESULTS:** NDT of before the training was 4.50 mm (within the range of the normal value). NDT of the towel gathering was 5.20 mm, showing significant drop in comparison with before exercise. Also, in the great toe exercise, it was 5.39 mm, showing a significant drop in comparison with before (p<0.05) in the 2nd-to-5th toe exercises and 3rd-to-5th toe exercises, these were 3.16 mm, 3.28 mm respectively. These exercises showed significantly no drop in comparison with before (p>0.05).

**CONCLUSIONS:** The towel gathering and the great toe flexor exercise significantly decreased MLA. In regard to the great toe flexor exercise, the tendency was stronger. On the other hand, the exercises of 2nd-to-5th toe flexors and 3rd-to-5th toe flexors increased MLA.

This study has limits, as it was not possible to get rid of influence of fatigue. We consider that it is necessary to study the toe exercises we developed by longitudinal method research.

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**3348 Board #69 June 2 8:00 AM - 9:30 AM**  
**Electromyographic Analysis of the Lower Extremity Position during Trunk Exercise in Prone Position**  
Tetsuji Ishida,1 Masanori Takeamura,2 Shunsuke Fujitake,2 Chihiro Debara,2 Moonwha Park,1 Yu Hashiguchi1, Junzo Tsujita1,1 Shiga Medical Center for Children, Moriyama, Japan, 2Hyogo College of Medicine, Nishinomiya, Japan. 5Tachibira Orthopedics, Kyoto, Japan. 6Gakkentoshi Hospital, Seika, Japan. 5Graduate School of Medicine, Kyoto University, Kyoto, Japan.  
(No relationships reported)

**METHODS:** Fifteen healthy adults (10 males and 5 females, means (SD) age: 26.7 (4.3) years) participated in this study. Each subjects performed maximal voluntary isometric contractions (MVIC) of trunk extension, then they performed three exercises for back muscles in the prone position. Those three exercises were hip extension at hip abduction of 0 degree (EXT), hip extension at hip abduction of 20 degree (EXT-ABD) and hip internal rotation at hip abduction of 20 degree and hip external rotation (EXT-ABD-ER). Surface EMG was recorded from the muscle belly of longissimus thoracis (LT), iliocostalis lumborum (IC), lumbar multifidus (LM) and gluteus maximum (GM) muscles, and EMG root mean square (RMS) were calculated and normalized to MVIC (%MVIC). Furthermore, the LM : contralateral IC, LM : contralateral LT, LM : ipsilateral IC, and LM : ipsilateral LT ratio were calculated as the local : global muscles activity ratio. Statistical analysis were performed a 3-way analysis of variance (ANOVA) with exercises and muscles activity ratio as within-subject variable and sex as between-subject variable and a Least Significance Difference (LSD) multiple comparison test.

**RESULTS:** The activity (%MVIC) of ipsilateral LM were 48.9 (26.8) at EXT, 52.2 (29.1) at EXT-ABD-IR, and 53.8 (26.2) at EXT-ABD-ER. The muscles activity ratio at EXT, EXT-ABD-IR, and EXT-ABD-ER were 1.32 (0.67), 1.51 (0.72), 1.40 (0.74) as LM : contralateral IC, 1.53 (0.98), 1.72 (1.06), 1.49 (1.16) as LM : contralateral LT, 1.56 (0.73), 1.55 (0.65), 1.68 (0.79) as LM : ipsilateral IC, and 1.64 (0.05), 1.61 (0.81), 1.85 (1.28) as LM : ipsilateral LT, respectively. The LM : contralateral IC and TL were significantly higher EXT-ABD-IR compare to EXT and EXT-ABD-ER. Although the LM : ipsilateral IC and TL were not difference.

**CONCLUSION:** The result of this study showed that the prone back muscles exercise with hip extension at hip abduction of 20 degree and hip internal rotation (similar to PNF diagonal and spiral functional pattern) was activated selectively the lumbar multifidus muscle as local muscles.

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**3349 Board #70 June 2 8:00 AM - 9:30 AM**  
**Precision Of The GE Lunar iDXA Densitometer for the measurement of Total Body Composition and Fat Distribution in Severely Obese Adults**  
Tamara E. Carver1, Nicolas V. Christou2, Ross E. Andersen, FACSM1. 1McGill University, Montreal, QC, Canada. 2McGill University Health Centre, Montreal, QC, Canada.  
(No relationships reported)

**PURPOSE:** To evaluate the precision of the iDXA for total body composition and fat distribution measurements.

**METHODS:** 36 severely obese participants with a mean age of 45±10 yrs, BMI of 48.3±10.5 kg/m², and mean body mass of 136.4±20.4 kg took part in the study. Two consecutive iDXA scans of the total body with repositioning were conducted for each participant. The coefficient of variation (CV), the root-mean-square (RMS) averages of standard deviations of repeated measurements, and the corresponding 95% least significant change (LSC) were calculated.

**RESULTS:** Precision was excellent for all measurements particularly for total body percentage fat (%TBF), fat free mass (FFM), total fat mass (TFB), total body lean mass (TBL), and bone mineral content (BMC) (RMS 0.407%, 0.690 kg, 0.708 kg, 0.693 kg, 0.035 kg, CV 0.7%, 0.97%, 1.00%, 0.02%, and 1.12% respectively). Precision was better for gynoid fat distribution (%GF) (RMS 0.627 kg, CV 1.30%) than for android fat distribution (%AF) (RMS 1.096 kg, CV 1.86%).

**CONCLUSIONS:** The Lunar iDXA provided excellent precision for total body composition measurements and is the first study to assess reproducibility of the GE Lunar iDXA in severely obese adults.

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888
CONCLUSION: The present study suggested that both LM, local muscles, and LT and IC, the global muscles were activated significantly at 180 degree compared to 0 degree of abduction. It was suggested that the LM could not activate selectively by different positions of upper-limb during back muscles exercises in prone position in this study. To increase the LM activity, therapists should increase trunk extension loads of the exercise in clinical practice. Also, the increase of the LM activity was not affected by facilitative effect of the increased LD activity. It is suggested that the EMG activity in local and global muscles of lumborum and thorasic at various positions of upper-limb during back muscles exercises in prone position for LBP should be analyzed, because of previous studies showed the lower activity of LM.

RESULTS:

- RMS CV (%) RMS CV (%)
- BMD 0.05 1.12 0.06 1.11
- %TBF 0.407 0.79 0.128 2.19
- FFM 0.690 0.97 0.910 2.68
- TRF 0.706 1.00 0.956 2.76
- TBL 0.695 1.02 0.921 2.83
- %AF 0.096 0.86 0.037 5.15
- %GF 0.627 0.30 0.756 5.9

CONCLUSION: Younger women’s physical function is most dependent on the lean mass of the leg and not MQ or adiposity, whereas the physical function of older women is impacted on the quality of the muscle and adiposity, which may be in part related to muscle activation and/or fat infiltration into the muscle.

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CONCLUSIONS: A twice weekly program of exercise, group support, and education for Hispanic mothers and their children was associated with positive changes in some cardiovascular risk factors associated with obesity.

3353 Board #74 June 2 8:00 AM - 9:30 AM
Comparison Of Handheld Device And Electromechanical Dynamometer For Measuring Plantarflex Force
Federico Pozzi, Ali Alnuhadi, Adam Marmon, Lynn Snyder-Mackler. University of Delaware, Newark, DE.
(No relationships reported)

Measurements of muscle force are a standard component of clinical examinations. Handheld devices (HH) provide quick and reliable measure of muscle force; however the amount of resistance provided by the clinician may influence the reading. Electromechanical dynamometers (ED) allow better experimental control and provide more accurate measurements of force, but are expensive and are difficult to set up.

PURPOSE: to assess the concurrent validity of measuring plantarflex force (PPF) with a HH using the ED measurements as a gold standard.

METHODS: Five healthy subjects (2M/3F, 25±4 yr age, 1.72±0.12 m, 68.5±12.9 kg) were recruited for the study. PPF of the right limb was assessed with an ED and a HH by the same experienced clinician. During testing, subjects lay supine, with the ankles flexed to 90°. Subjects were asked to push as hard as possible; for the ED testing, the ED arm was fixed and for the HH testing, the clinician was held on the ball of the foot by the clinician. Lever arm was constant between conditions. For each device, three trials were collected and one minute rest was given between trials. The order of testing was randomized. The peak value from each trial was averaged and compared between devices using an interclass correlation coefficient (ICC). Pearson Product Moment correlations were calculated between conditions and between PPF from each device and body mass.

RESULTS: Peak PPF ICC was -0.191 (p = .641). PPF from HH and ED were not significantly correlated (r = -.271, p = .659). Body mass was significantly correlated with ED force measures, but not with HH measures (Figure 1).

CONCLUSION: The lack of a relation between HH measurements of PPF to the gold standard or body mass suggests that HH does not provide valid and accurate measures of PPF.

3354 Board #75 June 2 8:00 AM - 9:30 AM
Neuromuscular Responses to Acute Whole Body Vibration
Caroline J. Ketcham, Paul C. Miller, George Wentz, Andrea Gross, Kelly Brand, Paul Riuli. Elon University, Elon, NC. (Sponsor: Eric E. Hall, FACSMD)
(No relationships reported)

Whole body vibration (WBV) has shown to positively impact neuromuscular activity. Studies have shown significant improvements in muscular strength and power following acute bouts of WBV in trained participants (Cochrane et al., 2009; Cochrane et al., 2008; Stewart et al., 2009). Less is understood about the exact mechanisms for these changes in strength and power.

PURPOSE: The purpose of this research is to determine the neuromuscular mechanisms underlying changes in contractile function following an acute bout of WBV. It was hypothesized that WBV may alter neuromuscular activation resulting in changes to anaerobic power production.

METHODS: Twelve non-resistance trained male and female completed this study (20.6±0.9yrs). The experimental protocol required three days of testing for each participant. Day one was a familiarization trial. On days two and three, participants were randomly assigned to either no vibration or WBV condition. Participants then completed a 6-stage cycle ergometer anaerobic power test. EMG was recorded during each stage.

RESULTS: There was a significant condition effect for EMG activity with lower EMG activity during the cycling task following the WBV condition (p<0.05). These were not related to differences in power production between the conditions (p>0.05).

CONCLUSIONS: These results support the hypothesis that WBV does impact muscle function. Specifically, lower muscle activity followed WBV while maintaining the same level of power output suggesting improved muscular efficiency.

3355 Board #76 June 2 8:00 AM - 9:30 AM
Cardiovascular And Metabolic Responses To Exercising With The Glidetrak Compared To Running
Aaron W. Johnson, Pat Velurs, FACSM, James George, Gil Felinham, Jordan Perry. Brigham Young University, Provo, UT.
(No relationships reported)

PURPOSE: To evaluate the cardiovascular and metabolic responses of treadmill exercise using the GlideTrak (GT) device as compared with unassisted treadmill (UT) exercise. Previous research indicates that the GT reduces ground reaction forces by 85%; thus, one would expect the exercise intensity to be less when using this device. Because the GT may provide a viable form of exercise for those who cannot otherwise exercise independently (due to amputation, obesity, injury, or arthritic joints) we sought to understand the exercise response of this device.

METHODS: Participants were 20 healthy untrained individuals (male: 11, female: 9) with an average age of 22 ± 2.1 years, height of 1.71 ± .13 m, and body mass of 72.4 ± 14 kg. For both GT exercise and UT exercise, a submaximal exercise test protocol was completed, which included a series of 3-minute stages: walking at a natural pace, walking at a self-selected brisk walking pace, walking at a brisk pace with a 2% grade, and jogging at a self-selected speed. Following 3 minutes of jogging, the incline of the treadmill was increased by 2% each stage until the participant reached an RER of 1.0 or 90% of the age-predicted maximal HR. Steady-state VO2 and HR were recorded during each stage. After a 10-15 minute rest, the participant completed a graded maximal exercise test to determine VO2max. After a 3 minute warm-up period, participants jogged at a self-selected speed. Every minute thereafter we increased the incline by 1.5% until VO2max was achieved. In the GT condition we increased the incline 2% and the speed by 1 mph until VO2max was achieved.

RESULTS: We examined the HR/VO2 relationship in both modes of exercise. There was an overall gender effect between genders across both modes of exercise. There was a statistical difference between exercise modes (p < .05) in VO2max (GT: 38.1 ± 7.0, UT: 49.0 ± 9.0), HRmax (GT: 183.5 ± 9.0, UT: 194.3 ± 9.0), RPE (GT: 17.9 ± 1.9, UT: 19.4 ± 0.6), and in MPHmax (GT: 6.9 ± 2.2, UT: 5.8 ± 0.7), but not in RER (GT: 1.1 ± 0.05, UT: 1.1 ± 0.04).

CONCLUSIONS: The GT allows for appropriate cardiovascular training, but compared with UT exercise the VO2 response is about 15-20% lower at any given exercise HR. To experience a similar cardiovascular training effect, those who use the GT device should work at a higher relative percentage of HRmax while maintaining a comparable RPE response.

3356 Board #77 June 2 8:00 AM - 9:30 AM
Association Between Physical Activity Levels And Chronic Disease Risk In Early Postpartum.
Melanie Bonin1, Yaiza Cordero-Rodríguez2, Stephanie-May Ruch&1, Ashley Smith1, Michelle F. Mottola, FACSM1. 1Univ. of Western Ontario, London, ON, Canada. 2Universidad Politecnica de Madrid, Madrid, Spain.
(No relationships reported)

The early postpartum period is a critical time period for women to return to being physically active in order to reduce weight retention from pregnancy. Weight retention, body mass index (BMI), waist circumference and waist:hip ratios may be important predictors of future chronic disease risk. Weight retention, body mass index (BMI), waist circumference and waist:hip ratios may be important predictors of future chronic disease risk. Weight retention, body mass index (BMI), waist circumference and waist:hip ratios may be important predictors of future chronic disease risk. Weight retention, body mass index (BMI), waist circumference and waist:hip ratios may be important predictors of future chronic disease risk. Weight retention, body mass index (BMI), waist circumference and waist:hip ratios may be important predictors of future chronic disease risk.

PURPOSE: To examine daily physical activity levels and cardiovascular disease risk factors in women at two months postpartum (6 normal weight (NW); BMI=18.5-24.9kg/m2, 18 overweight (OW); 25-29kg/m2 and 16 obese (OB); ≥30kg/m2).

METHODS: Physical activity was assessed at 2 months postpartum using an accelerometer and a pedometer worn simultaneously fixed on a belt for an average of 5 days. The 3 BMI groups were compared for chronic disease risks and physical activity levels using ANOVA.

RESULTS: At 2 months postpartum, NW, OW and OB women presented similar (p>0.05) waist:hip ratios, all greater than 0.85, and similar weight retention, all greater than 3.0 kg. NW women had a waist circumference < 88 cm, however, NW and OW women had a lower waist circumference than OB women (84.3±11.2 cm, 91.7±5.2 cm and 109.0±13.3 cm, respectively, ≥30kg/m2).

CONCLUSION: A twice weekly program of exercise, group support, and education for Hispanic mothers and their children was associated with positive changes in some cardiovascular risk factors associated with obesity.

890
p<0.05). NW and OW reported higher pedometer daily step counts than OB women (NW: 8784±2927 steps/day, OW: 8219±1981 steps/day, OB: 6134±1843 steps/day; p<0.05). Uploaded accelerometer daily step counts were higher in OW (9364±2299 steps/day) but not in NW (8234±3701 steps/day), compared to OB women (6572±2777 steps/day, p<0.05). Comparing pedometer (self-reported) and accelerometer step counts, the pedometer significantly underestimated daily step counts in OW women (-1145±2194, p=0.02).

CONCLUSIONS: Women at 2 months post-delivery, irrespective of their BMI, are at risk for long-term chronic disease and are not meeting the step recommendations of 10,000 steps per day. OB women presented the highest risk for chronic disease and were classified in the low active category, indicating that the promotion of an early healthy postpartum lifestyle is particularly important in OB women. The difference found in step counts obtained from a pedometer compared to an accelerometer in OW women needs to be further examined.

Funded by CIHR & Rx&D Health Research Foundation of Canada. SMR is funded by a postdoctoral fellowship from the Canadian Diabetes Association.

Individual Training Response In Allogeneic Stem Cell Transplant Patients Depending On Baseline Fitness Level
Joachim Wiskemann1, Dirk Jaeger2, Cornelia M. Urich1, Gerhard Huber1, Peter Dreger2, Rainer Schwerdtfeger2, Martin Bohus2,1. National Center for Tumor Diseases, Heidelberg, Germany. University Clinic Heidelberg, Heidelberg, Germany. German Clinic for Diagnostic, Wiesbaden, Germany. Central Institute of Mental Health, Mannheim, Germany.

RESULTS: Significant differences were found between patients and control subjects for every submaximal and maximal intensity. The percentual deoxy[Hb+Mb] (mean values ± SE) at 20% (p<0.019), 30% (p<0.001), 40% (p<0.001), 50% (p<0.002) and 60%MVC (p<0.001) for patients were respectively 24.96 ± 8.47% and for controls 72.82 ± 23.56 (p=0.019), 30% (p<0.001), 40% (p<0.001), 50% (p=0.002) and 60%MVC (p<0.001). Total quality of life did not improve at onset, but a significant 10.1% increase (p=0.006) occurred from 2ND to 3RD reassessments.

CONCLUSION: A 21 month full-body exercise program has been shown to elicit improvements in physiological and psychological measures in cancer survivors. The greatest improvements occur during the first three months of training then plateau. This suggests that a 3-month exercise intervention is sufficient to return cancer survivors to normal functional capacity.

3359 Board #50 June 2  8:00 AM - 9:30 AM
Individual Training Response In Allogeneic Stem Cell Transplant Patients Depending On Baseline Fitness Level
Jouchim Wiskemann1, Dirk Jaeger2, Cornelia M. Urich1, Gerhard Huber1, Peter Dreger2, Rainer Schwerdtfeger2, Martin Bohus2,1. National Center for Tumor Diseases, Heidelberg, Germany. University Clinic Heidelberg, Heidelberg, Germany. German Clinic for Diagnostic, Wiesbaden, Germany. Central Institute of Mental Health, Mannheim, Germany.

RESULTS: Significant differences were found between patients and control subjects for every submaximal and maximal intensity. The percentual deoxy[Hb+Mb] (mean values ± SE) at 20% (p<0.019), 30% (p<0.001), 40% (p<0.001), 50% (p<0.002) and 60%MVC (p<0.001) for patients were respectively 9.45 ± 6.70%, 13.52 ± 6.70%, 12.73 ± 8.75%, 20.47 ± 12.24%, 17.94 ± 21.14%.

CONCLUSION: Microvascular O2-extraction is significantly lower in a MM population during this protocol, which can be used as an evaluation tool of the muscle oxidative capacity for the MM patients.
PURPOSE: To determine the effectiveness of WBV training on increasing intramuscular temperature (IMT) of the medial gastrocnemius (MG) and vastus lateralis (VL) compared to traditional bike warm-up.

METHODS: 20 male subjects (avg age 21.4 ± 2.3 yrs) with less than ½ cm subcutaneous fat levels over the VL and MG qualified for this study. 10 subjects in each of two groups (bike, vibration). Resting baseline muscle temperatures of the VL (1.5 cm depth) and MG (5 cm) were made using intramuscular thermistors. IMT’s were measured two more times: immediately following either 5 minutes of pedaling at 70watts or oscillating WBV at 26Hz/4mm amplitude. Then immediately following another 5 minutes of biking or WBV.

RESULTS: Data were analyzed using a 3 factor mixed models analysis of covariance blocking on individual subjects, with baseline temperature being the covariate. A post hoc Tukey pairwise comparisons of means was used where needed. No significant differences in treatment existed (p=0.2247) or in the muscle*treatment interaction (p=0.9672). Temperatures did significantly increase over time (p=0.0097), with only vibration showing a significant increase in temperature from 2nd to 3rd temperature measurement (p < 0.0001).

CONCLUSIONS: Both treatments are effective at increasing IMT. While no statistical difference was found between bike and vibration treatments, the mean changes were: MG = 50°C (bike) and 57°C (vibration) and VL = 1.58C (bike) and 1.95°C (vibration). Thus, oscillating platform vibration appears to show a trend towards greater IMT increases, particularly after the first 5 minutes as compared to bike pedaling. This increase in temperature may also be correlated to the performance enhancements reported in the vibration training literature, although this has yet to be shown.

Further investigation of temperature responses in other muscle groups and at different frequencies is needed.

3361 Board #81 June 2 8:00 AM - 9:30 AM

The Intra-Hemodialytic Protein And Exercise(IHOPE) Study: Rationale And Study Design

Ken Wilund1, Bo Fernhall, FACSM2, Shane Phillips2, Edward McAuley, FACSM3, Emily Tomayko1, Barbara Yudell2, Peter Fitschen1, Hae Ryong Chung2, Jinhee Jeong3, Brandon Kistler1, Elizabeth Jeans2. 1University of Illinois @ Urbana-Champaign, Urbana, IL, 2University of Illinois @ Chicago, Chicago, IL, 3University of Texas @ El Paso, El Paso, TX.

PURPOSE: Chronic kidney disease (CKD) patients receiving hemodialysis therapy suffer from a variety of co-morbid diseases. Protein malnutrition and muscle wasting are especially common, and these lead to reduced muscle strength and function. Physical inactivity exacerbates these functional declines, and also promotes cardiovascular disease (CVD) and bone disorders. In an attempt to deter functional declines and wasting, the National Kidney Foundation has increased the protein recommendation for dialysis patients to 1.2 g/kg/day. Previous acute studies indicate that intradialytic oral protein supplementation, with or without concomitant intradialytic exercise, may help reverse the negative protein balance that occurs during dialysis. However, little is known regarding the efficacy of chronic protein supplementation and exercise training in dialysis patients. To study this question, we recently initiated a randomized, controlled clinical trial called the Intra-Hemodialytic Oral Protein and Exercise (IHOPE) study.

METHODS: We will recruit ~150 dialysis patients over 5 years to complete this study. At baseline, 6 and 12 months, we will measure a variety of factors related to physical function, cardiovascular disease risk, body composition, and quality of life (QOL). Following baseline testing, subjects will be randomized to 1 year of either (a) 1) non-protein (control) supplement, 2) whey protein supplement, or 3) whey protein supplement and endurance exercise training.

RESULTS: During our first year of the study, we enrolled 39 patients (n = 13/group). Selected baseline characteristics of the current participants include the following: 1) average age = 52.7±10.5 yrs; 2) gender = 44% male; 3) BMI = 32.7±8.5 kg/m2; 4) serum albumin = 4.0±0.4 g/L; 5) diabetes prevalence = 58%. There are no statistically significant differences in these variables between groups.

CONCLUSIONS: When completed, this study will provide novel information regarding the long-term effects of protein supplementation and exercise training on clinical outcomes and the QOL in hemodialysis patients. Results from both studies will enable clinicians to make more informed decisions regarding the extent to which these low-cost treatment strategies should be included as a component of the standard care in their clinics.

3362 Board #82 June 2 8:00 AM - 9:30 AM

The Influences of 4-Week Walking Training with Blood Flow Restriction on Lower Limb Strength in Elderly

Wei-Hsiu Lin, Che-Yu Kuo. National Chiayi University, Chiayi, Taiwan.

PURPOSE: Few researches indicated that walking with blood flow restriction (BFR) increase the lower limb strength in elderly. In previous studies, the training intensity of BFR-group was relatively higher than no BFR group (NBFR-group) since both groups were trained at the same walking speed instead of the same percentage of maximal heart rate reserve (MHRR).

METHODS: Eleven physically active men and women (62~73 yrs; 160.2±7.2 cm; 66.5±8.4 kg) participated in this study and were divided into BFR (n = 6) and NBFR (n = 5) groups. The individual cuff pressure of BFR-group was set at 50% of complete blood occlusion pressure. All of the subjects performed 20-minute treadmill walking at 35%~45% MHRR, 5 days/week for 4 weeks.

RESULTS: After 4-week walking training, the dorsiflexion peak torque and total work in BFR-group improved 6.9%~9.1% and 1.8%~14.3% respectively; plantar flexion peak torque and total work in BFR-group improved 26.6%~28.3% and 35.9%~41.1% respectively (plantar flexion total work at 120s increased significantly after training, p<0.01).

CONCLUSIONS: BFR-walking training at 35%~45% MHRR enhance the calf strength but the thigh strength. Low training intensity and wide cuffs might limit the training effect on thigh muscles.

3363 Board #83 June 2 8:00 AM - 9:30 AM

Increasing Strength And Muscle Mass In HIV+ Men Recovering From Substance Abuse

Carianne M. Cregar1, Jakob L. Vingren1, John H. Curtis1, Kiannah Williams1, Julius F. Cantu2, David W. Hill, FACSM3. 1University of North Texas, Denton, TX, 2Homeward Bound, Inc., Dallas, TX, 3University of Texas @ El Paso, El Paso, TX.

PURPOSE: The purpose of this study was to examine the effect of resistance training on measures of muscle mass and strength in the context of co-occurring substance abuse and HIV.

METHODS: Seventeen untrained men (Mean ± SD: 42 ± 11 years, 89.7 ± 10.6 kg, 179.7 ± 9.1 cm, 18.9 ± 5.5 %fat) who are infected with HIV and enrolled in an in-patient substance abuse treatment program completed six weeks of either resistance training (RT) (three sessions per week) or no-exercise prescription (Control). Before (Pre) and after (Post) the 6-week period, anthropometric (e.g., body mass, skinfolds, and circumference measurements), strength (bench press and isometric squat), and power (vertical jumps) measurements were obtained.

RESULTS: Predicted bench press 1-repetition maximum (1-RM) increased significantly (p<0.05) for RT (Pre: 73.4 ± 23.4 kg; Post: 85.0 ± 30.4 kg) but not for Control (Pre: 54.9 ± 24.6 kg; Post: 57.3 ± 27.0 kg). Peak isometric squats force increased significantly for RT (Pre: 2627 ± 1071 N; Post: 2892 ± 1171 N) but not for Control (Pre: 2411 ± 675 N; Post: 2394 ± 592 N). Peak vertical jump power also increased significantly for RT (Pre: 35.9 ± 3.5 W·kg-1; Post: 36.2 ± 5.0 W·kg-1) but not for Control (Pre: 33.9 ± 3.9 W·kg-1; Post: 35.7 ± 4 W·kg-1). Muscle mass
increased significantly for RT (Pre: 46.4 ± 8.2 kg; Post: to 50.5 ± 8.1 kg) but not for Control (Pre: 46.9 ± 13.0 kg; Post: 47.8 ± 12.4 kg). Upper arm and forearm circumference increased only for RT. No adverse effects of the resistance training program were observed.

CONCLUSION: Resistance training for six weeks increases muscle strength and power, and induces muscle hypertrophy, in men who are infected with HIV and recovering from substance abuse. These findings support the efficacy for including resistance training in the standard of care for men with HIV undergoing in-patient treatment for substance addiction/abuse.

3364  Board #85  June 2  8:00 AM - 9:30 AM  Do Parameters Of Exercise Capacity Predict Mortality In Adolescents With Cystic Fibrosis?  Erik Huizbros, Hanna Bomhof-Roodlink, Pauline van de Weert - van Leeuwen, Bert Arets, Tim Takken. University Medical Center Utrecht, Utrecht, Netherlands.  (No relationships reported)

PURPOSE: Several determinants, such as lung function, nutritional status and exercise capacity (VO2max/kg), are known to be associated with mortality in patients with Cystic Fibrosis (CF). The aim of the current study was to develop a model to predict survival from parameters derived from a cardiopulmonary exercise test (CPET), in addition to resting lung function.

METHODS: Data of 127 adolescents with CF (57 girls and 70 boys, mean age 12.7 ± 0.9 years, mean forced expired volume in 1 sec (FEV1) = 77.7% predicted ± 15.6%) were available for analysis. Cox regression analysis was performed to determine which (combination) of parameters was best in predicting mortality and/or lung transplantation. FEV1, VO2max/kg, peak minute ventilation (VE/VO2peak), VE/VO2max, VE/VO2max and breathing reserve (1 - (VE/VO2-MVV)) were included in one model. A backward selection procedure was used. All predictors were also dichotomized. ROC curves were used to determine the criterion value, and combined into one model.

RESULTS: Mean duration of follow-up was 7.5 ± 2.7 years, 9 patients died and 6 underwent lung transplantation. The best model to predict survival in this population included FEV1 expressed as percentage of predicted and VE/VO2max. This was both the case when variables were used continuously (FEV1%pred. (HR)=.918, p<.001) and VE/VO2max (HR =1.088, p=.02) or dichotomized (FEV1%pred. (HR=1.368, p<.001) and VE/VO2max (HR =5.179, p=.03).

CONCLUSIONS: This findings show the relevance of performing a CPET in adolescents with CF because VE/VO2max combined with FEV1%pred is a significant predictor of survival. In clinical practice this can be used to distinguish patients with a lower risk and patients at risk and to offer the patients at risk additional therapy and/or a more intensive follow-up.

3365  Board #86  June 2  8:00 AM - 9:30 AM  Therapeutic Effects Of Whole Body Vibration On Chronically Knee Osteoarthritis  Ho Jun Lee,1 Dong Yoon Cha,1 Min-Kyun Oh,1 Kyung Jae Yoon.1 Dongguk University, College of Medicine, Geongju-si, Gyeonggi-do, Korea, Republic of; 2Dongguk University, College of Medicine, Gyeongju-si, Gyeongsangbuk-do, Korea, Republic of; 3Gyeongsang National University Hospital, Jinju-si, Gyeongsangnam-do, Korea, Republic of; 4Kangbuk Samsung Hospital, Sungkyunkwan University, School of Medicine, Seoul, Korea, Republic of.

(No relationships reported)

PURPOSE: To investigate the effect on pain reduction and strengthening of whole body vibration in chronic knee osteoarthritis.

METHODS: Thirty six female patients were randomly divided to study group and control group. Study group patients performed whole body vibration (20 minutes, 3 times) with home based exercise and control group only home based exercise for 8 weeks. 11 patients in each group completed study. We measured pain intensity with Numeric Rating Scale, functional scales with Korean Western Ontario McMaster score. We also measured strength with isokinetic and isometric torque and dynamic balance with a kind of balance board before training and at 1 and 2 month after training.

RESULTS: Pain intensity was significantly decreased in each group and change of pain intensity was significantly larger in study group (1.5±1.7 vs 0.6±2.9, p<.004) at 2 months after training. Functional scales improved in both groups but no significant differences of changes between groups (8.5±1.17 vs 2.1±9.2). Isokinetic strength of right quadriceps and isometric strengths of both quadriceps improved in both groups but no significant differences of changes between groups (isokinetic, right: 15.65±10.91 vs 10.30±8.2, isometric (right/left): 13.98±16.91/ 13.08±14.54 vs 16.33±19.19/ 19.13±15.73). Isokinetic strength of left quadriceps did not improve in both groups (change: 8.70±11.88 vs 2.84±19.03). Dynamic balance improved in both groups but no significant differences of changes between groups (anterior-posterior: 0.96±1.16 vs 1.28±2.12, medial-lateral: 1.75±2.05 vs 0.73±1.00).

CONCLUSIONS: In chronic knee osteoarthritis patients, whole body vibration and home based exercise reduced pain intensity and increased strength of right quadriceps and dynamic balance. When compared with home based exercise, whole body vibration had additional effect only in pain reduction.

3366  Board #87  June 2  8:00 AM - 9:30 AM  The Effect of Preconditioning on Initial Physiological and Psychological Assessments Following Treatment  Brent M. Peterson1, Trent L. Lalonde2, Kurt Dallow, FACSM3, Reid Hayward1, Carole M. Schneider, FACSM1, 4Rocky Mtn Cancer Rehab, Univ Northern Colorado, Greeley, CO; 5North Colorado Family Medicine, Greeley, CO.

(No relationships reported)

Exercise has been associated with the improvement of various physiological and psychological variables in cancer survivors post cancer treatment. However, little information exists on the role prior physical activity may have on functional capacity.

PURPOSE: To assess the differences between prior physical activity and the initial physiological and psychological assessments in cancer survivors following treatment.

METHODS: A total of 412 cancer survivors that had undergone radiation and/or chemotherapy were eligible for this study. Participants completed comprehensive physical assessments and Piper fatigue and Beck depression inventories. Functional capacity was determined during an initial assessment including VO2max (multistage treadmill protocol). Prior physical activity (PA) was defined as being none (1), low (2), and moderate (3) based on frequency, intensity, and duration according to the ACSM guidelines. A multivariate analysis of variance (MANOVA) determined the group variance differences.

RESULTS: There was a significant (p<0.05) main effect for prior PA. Post hoc pairwise comparisons determined that there were significant (p<0.05) differences between groups 1 and 3 for VO2max (21.23 ± 6.70 vs 23.46 ± 7.02 mL·kg·min−1), respectively, groups 1 and 3, and groups 2 and 3 for fatigue (5.09 ± 2.23 vs. 4.28 ± 2.19 and 5.07 ± 2.03 vs. 4.28 ± 2.19, respectively) and groups 1 and 3 for depression (12.03 ± 7.74 vs. 9.90 ± 6.19, respectively). Moderately active individuals showed greater initial assessment values for functional capacity (VO2peak).

Additionally, greater decreases were observed in fatigue and depression in the moderate activity group.

CONCLUSION: Cancer treatment-related side-effects lengthen the recovery process post treatment for cancer survivors. The results of this study demonstrate the importance of moderate prior physical activity for the attenuation of treatment-related reductions in functional capacity, fatigue and depression.

3367  Board #88  June 2  8:00 AM - 9:30 AM  Evidence Of Functional Aerobic Impairment Among Adults Living With HIV  Jason R. Jaggers1, Vivek K. Prasad1, Wesley D. Dudgeon2, Erica McDivit2, Stephanie Burgess1, Steven N. Blair, FACSM3, Gregory A. Hand, FACSM1, 4University of South Carolina, Columbia, SC; 5The Citadel, Charleston, SC. (Sponsor: Gregory A. Hand, FACSM)

(No relationships reported)

PURPOSE: Published results from our lab show that males living with HIV exhibit functional aerobic impairment (FAI) as indicated by a 25% lower age predicted VO2 max. It is well established that a lower aerobic capacity increases the risk of chronic disease and all-cause mortality among healthy populations. Currently no investigation has assessed aerobic capacity in a sample of HIV+ females. The purpose of this study was to examine aerobic capacity, as measured by peak VO2, in a sample of HIV+ adults.

METHODS: Preliminary data was used from an ongoing exercise intervention that included a total of 10 males and 15 females. All participants underwent a maximal exercise treadmill test at baseline prior to randomization in which VO2, heart rate, and blood pressure were assessed. FAI was determined if the participant exhibited a peak VO2 < 25% of their age-predicted VO2.

Evidence Of Functional Aerobic Impairment Among Adults Living With HIV  
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METHODS: Preliminary data was used from an ongoing exercise intervention that included a total of 10 males and 15 females. All participants underwent a maximal exercise treadmill test at baseline prior to randomization in which VO2, heart rate, and blood pressure were assessed. FAI was determined if the participant exhibited a peak VO2 < 25% of their age-predicted VO2.
RESULTS: Both males and females exhibited FAI (males: FAI = 37%; females: FAI = 47%) according to their age-predicted VO2 max. When separated by gender males had a peak VO2 of 24.16 ± 2.52, whereas females had a significantly lower peak VO2 of 15.37 ± 0.97 (p = 0.001). Both genders had a peak heart rate significantly less than their age predicted max (males: 138 ± 8 bpm; females: 136 ± 5 bpm).

CONCLUSIONS: These results agree with previous studies that show males living with HIV often present FAI, possibly due to a sedentary lifestyle and/or disease related fatigue. The current data indicate that females living with HIV have greater FAI compared with males. Caution should be taken when prescribing aerobic exercise with this population and should be initiated at a light intensity less than the current recommendations for the general population.

This project is supported by the NIH/NINR and Thera-Band®

Knee osteoarthritis (OA) is one of the most frequent causes of physical disability and pain among older persons. Evidence suggests incorporating kinesthesia, balance and agility (KBA) exercise with resistance training (RT) results in greater improvements than RT alone. However, the efficacy of KBA alone is unknown.

**PURPOSE:** To determine the efficacy of a home-based KBA knee OA exercise program to improve symptoms and quality of life.

**METHODS:** Fifty-four persons age ≥ 50y with knee OA were randomly assigned to 8-weeks KBA, RT, KBA + RT, or Sham. Participants trained 3 times per week for 60 minutes. KBA utilized exercises such as cross-over walking, side-stepping, and backward stepping, plus single-leg static and dynamic balancing. RT used elastic resistance bands for open chain lower extremity exercises. KBA + RT performed selected exercises from each technique to ensure the total exercise exposure remained equal. Sham applied inert lotion daily in a manner that avoided self-massage. Outcomes included the OA specific WOMAC Index of Pain, Stiffness, & Physical Function (Pf), community activity level, exercise self-efficacy, and self-report knee stability.

**RESULTS:** Thirty-three participants completed the trial. The analysis of Variance comparing baseline, mid-point, and follow-up measures revealed significant (p < 0.05) improvements in WOMAC Pain, Stiffness, Pf, and Total scores among KBA (n = 8), RT (n = 8), KBA + RT (n = 9), and Sham (n = 8), with no differences between groups. There were no significant changes in community activity level. Only Sham improved exercise self-efficacy. Knee stability was significantly improved in the RT and Sham conditions.

**CONCLUSION:** The three exercise conditions relatively equal and reduced the severity of knee OA. Sham results indicate a strong placebo effect. However, Sham WOMAC improvements peaked at 4-week mid-point, whereas improvement in the exercise conditions continued at 8-weeks. In conclusion, our results indicate that KBA, RT, or a combination of the two administered as home exercise programs are effective in improving symptoms and quality of life among persons with knee OA. Patient preferences, costs, and convenience should be considered when choosing an exercise rehabilitation approach for knee OA.

Supported by Thera-Band Academy product grant.

**Knee Osteoarthritis And The Efficacy Of Home-based Kinesthesia, Balance & Agility Exercise Training**

Matthew W. Rogers¹, Nauris Tamulevicius², Stuart J. Semple¹, Zarko Kljelaj³, ¹University of Zalalund, KwaDanglewa, South Africa. ²Barry University, Miami Shores, FL. ³North-West University, Potchefstroom, South Africa.

(No relationships reported)

**Effects of Atorvastatin on Resting and Peak Exercise Blood Pressure**

Marianne L. Mentch¹, Beth A. Parker², Jeffrey A. Capizzi², Adam S. Grimaldi³, Priscilla M. Clarkson, FACSM⁴, Stephanie M. Cole¹, Stuart Chipkin¹, Justin Keadle³, C. Michael White¹, Paul D. Thompson, FACSM⁴, Linda S. Pescatello, FACSM⁴. ¹University of Massachusetts, Amherst, MA. ²University of Connecticut, Storrs, CT. ³Hartford Hospital, Hartford, CT. ⁴University of Massachusetts, North-West University, Potchefstroom, South Africa.

(No relationships reported)

Statins reduce low density lipoprotein cholesterol and decrease cardiovascular events. They are also reported to lower resting blood pressure (BP), but this is controversial.

**PURPOSE:** To determine if 80mg of atorvastatin reduces resting BP and peak systolic BP (SBP) on a graded exercise test.

**METHODS:** Subjects were double-blinded and randomized to 80mg•d⁻¹ of atorvastatin (n=202) or placebo (n=217) for 6 months. Resting BP and peak SBP were measured by auscultation at baseline and 6 months. Repeated measures ANCOVA tested differences in resting BP and peak SBP over 6 months by drug treatment group and gender with age and body mass index (BMI) as covariates.

**RESULTS:** Subjects were 44.1 ± 0.8 y (mean ± SEM) with resting BP of 118.9 ± 0.675.3 ± 0.5 mmHg and BMI of 26.4 ± 0.2 kg/m². Men (n=203) had higher resting BP (121.6 ± 0.976.5 ± 0.7 vs. 116.2 ± 0.974.7 ± 0.7 mmHg) and peak SBP (177.5 ± 1.9 vs. 161.3 ± 1.7 mmHg) than women (n=216) (p=0.001). Subjects reduced resting SBP (atorvastatin, -4.0 ± 0.8; placebo -3.0 ± 0.7 mmHg, p=0.005), but did not influence resting SBP (p=0.726) over 6 months, regardless of atorvastatin or placebo. However, women on atorvastatin (n=203) tended to reduce peak SBP 3.0 ± 1.5 mmHg more than women on placebo (p=0.06). There was no difference in resting SBP between atorvastatin and placebo among men (p=0.66). In the total sample, peak SBP was not different between atorvastatin and placebo over 6 months (p=0.99). However, women on atorvastatin reduced peak SBP 6.4 ± 3.3 mmHg more than women on placebo over 6 months (p=0.02). There was no difference in peak SBP between atorvastatin and placebo among men (p=0.13).

**CONCLUSION:** Participation in a clinical trial reduced resting SBP, independent of assignment to atorvastatin or placebo. Moreover, in women but not men, atorvastatin reduced resting SBP and peak SBP more than placebo, and atorvastatin did not influence resting and peak SBP among men. The mixed findings regarding the antihypertensive effects of statins may be attributable to not accounting for trial and drug placebo effects and gender differences. Supported by NHLBI/NIH grant 1HL081893A2.

**Heart Rate Recovery in Juvenile Idiopathic Arthritis: Relationship with Aerobic Fitness, Disease Subtype and Severity**

Joyce Obied¹, Marco van Brussel², Brian W. Timmons³, Tim Takken². ¹McMaster University, Hamilton, ON, Canada. ²University Medical Center Utrecht, Utrecht, Netherlands. (Sponsor: Boguslaw Wilk, FACSM)

(No relationships reported)

Youth with JIA may be at an increased risk of developing cardiovascular (CV) disease, with early signs of atherosclerosis manifesting as young as 4 years of age. Heart rate recovery (HRR) following maximal exercise is a strong predictor of CV health and all-cause mortality in adults. The relationship between HRR and health outcomes in JIA is of considerable interest as HRR at 1-min post-exercise was similar between youth with JIA and healthy controls (50 ± 14 vs. 53 ± 14 bpm, p>0.25), as was HRR expressed as a percentage of heart rate reserve (61.5 ± 18.5 vs. 54 ± 15.8%, p=0.51). The strongest significant predictors of HRR in JIA included JIA subtype (systemic vs. others), age at testing, Wpeak, and HRpeak in the following model: HRR ( bpm) = 114.804 - 11.041 x JIA (0=toligo-, poly-JIA; 1=systemic) - 2.338 x age at testing + 9.395 x Wpeak - 0.373 x HRpeak (R² = 0.33; SEE = 12.2). Inclusion of BMI, VO2peak, disease duration and/or joint count did not improve HRR prediction.

**CONCLUSIONS:** While HRR is similar between JIA and healthy controls, it appears that the type of JIA (systemic) may play an important role in modulating HRR. Future work should focus on linking HRR in youth with systemic JIA to more direct markers of CV damage.

Joyce Obied was supported by a CIHR Michael Smith Foreign Study Supplement.

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CONCLUSION: Hispanic adults living with HIV infection. Funded by NIH/CTSA KL2-RR024151

METHODS: A group of 88 Hispanic adults (58 HIV and 30 non-HIV) completed a resting VO2 test and a graded exercise test (VO2max) using the modified Bruce protocol while wearing an accelerometer. METs, heart rate (HR), and steps/min were measured in each stage of the protocol and compared between groups using ANOVAs and linear regressions.

RESULTS: The HIV group had lower MET values compared with the non-HIV group in all stages of the protocol except the first (1.7 mph, zero inclination) where MET values were not different between groups. HR response during all stages was not different between groups, and step cadence in the HIV group was higher compared to the non-HIV group only in the first stage of the protocol. A 100 steps/min cadence was equivalent to 5.8 METs in the HIV group and 7.8 METs in the non-HIV groups.

CONCLUSION: The use of MET values to identify exercise intensity, functional capacity and/or energy expenditure must be population specific to prevent errors, particularly among Hispanic adults living with HIV infection. Funded by NIH/CTSA KL2-RR024151

G-32 Free Communication/Poster - Ergonomics and Clothing
JUNE 2, 2012 7:30 AM - 11:00 AM
ROOM: Exhibit Hall

3371 Board #92 June 2 8:00 AM - 9:30 AM Steps/min and Mets During Incremental Exercise In Hispanic Adults Living With and Without HIV Infection
Celina Corteguera, Farah A. Ramirez-Marrero, FACSM. Univ. of Puerto Rico, San Juan, Puerto Rico.
(No relationships reported)

A walking cadence of 100 steps/min or more is used to demark moderate intensity level activity (at least 3 METs). However, because resting VO2 is higher among people living with HIV, such cadence might represent a different MET value.

PURPOSE: We tested the hypothesis that MET values would be lower in adults with living with HIV infection compared to non-HIV adults exercising at the same intensity level.

METHODS: A group of 88 Hispanic adults (58 HIV and 30 non-HIV) completed a resting VO2 test, and a graded exercise test (VO2max) using the modified Bruce protocol while wearing an accelerometer. METs, heart rate (HR), and steps/min were measured in each stage of the protocol and compared between groups using ANOVAs and linear regressions.

RESULTS: The HIV group had lower MET values compared with the non-HIV group in all stages of the protocol except the first (1.7 mph, zero inclination) where MET values were not different between groups. HR response during all stages was not different between groups, and step cadence in the HIV group was higher compared to the non-HIV group only in the first stage of the protocol. A 100 steps/min cadence was equivalent to 5.8 METs in the HIV group and 7.8 METs in the non-HIV groups.

CONCLUSION: The use of MET values to identify exercise intensity, functional capacity and/or energy expenditure must be population specific to prevent errors, particularly among Hispanic adults living with HIV infection. Funded by NIH/CTSA KL2-RR024151

3372 Board #93 June 2 8:00 AM - 9:30 AM Factors Influencing The Effect Of Exercise On Bone Mass Density In Women With Postmenopausal Osteoporosis
Antonio Sagadi, Marianna Broccatelli, Simona De Bellonia, Alessia Rabini, Roberto Bernabei. Catholic University of Sacred Heart, Rome, Italy.
(No relationships reported)

Osteoporosis is a condition resulting in an increased risk of skeletal fractures due to a reduction in the density of bone tissue. Interventional studies based on physical exercise programs have demonstrated modest increases in bone mineral density (BMD) in older postmenopausal women. It has been argued that in this population the capacity of the skeleton to adapt to mechanical stress of exercise is impaired due to a series of factors such as inadequate intake of specific nutrients, altered hormonal status, low level of physical activity (PA), and medications or comorbidities which may facilitate osteoporosis.

PURPOSE: To investigate if subject’s characteristics, lifestyle habits, medications, comorbidities, dietary intake of nutrients, calcium and Vit.D, level of PA in everyday life, influenced the effect of an exercise program on BMD in 155 women with postmenopausal osteoporosis.

METHODS: Forty-seven women with lumbar or femoral osteoporosis, regularly exercising at the University Hospital Fitness Facility for >1 year, were recruited (EXE group); 108 sedentary women attending the Outpatient Clinic and matched by gender, age, duration of the observation period, and BMD values, were allocated to the control group (SED group). Main outcome was percent change in BMD. Concurrent diseases, medications, risk factors for osteoporosis, level of PA (Paffenbarger scale), dietary intake of macronutrients as well as of Ca, K, and P were recorded.

RESULTS: The mean (±s.d.) follow-up time was 37.7±15.4 months in the EXE and 36.0±17.3 in the SED group. The age was 66.2±6.3 years, with no differences between the two groups. During the follow up time the BMD increased from 0.688±0.087 to 0.710±0.100 g•cm-2 (p=0.008) in the EXE group and decreased from 0.697±0.099 to 0.688±0.107 g•cm-2 in the SED group (p=0.038); the difference between the two groups was significant (p=0.001). Neither the pharmacological treatment nor the dietary intake of calories, macro- and micro-nutrients significantly affected the change in BMD. Also, the change in BMD among subjects in the higher tertile of PA was not different from that of those in the lower tertile (3.4±1.2 vs. 2.1±0.9%, p=0.09).

CONCLUSIONS: A physical exercise program was effective in improving BMD in postmenopausal women; this effect was not influenced by several modifiable factors.

3373 Board #94 June 2 9:30 AM - 11:00 AM Influence of Protective Clothing on Endurance Capacity, Thermoregulation and Fluid Balance in Fencers
Mario Weichenberger, Yuefei Lui, Martina Velders, Jürgen M. Steinacker, FACSM. University of Ulm, Ulm, Germany.
(No relationships reported)

Fencers wear special protective clothing to prevent injuries during fencing bouts consisting of jacket, breeches, glove and mask. This equipment may affect thermoregulatory processes and could therefore impact on the athlete’s performance.

PURPOSE: To analyze the influence of protective clothing on endurance capacity, thermoregulation and fluid balance in fencers.

METHODS: 9 German top-level fencers (16.9 ± 1.2 yrs) underwent two fencing-specific Endurance Tests (FET) in a cross-over study in random order with protective clothing (PC) or normal sportswear, respectively. FET was conducted with a weapon and fencing-specific footwork forwards and backwards on a fencing ground (planche). Subjects started at 3 km/h and speed was increased by 1 km/h every 3 minutes up to exhaustion (vmax). Heart rates [HR] and blood lactate [LAC] were determined during FET; hematocrit [HC], body weight [BW] and body temperature [TEMP] were measured before and after the tests.

RESULTS: Due to PC athletes lost more BW (Δ 0.62 ± 0.12kg vs. 0.42 ± 0.08kg, p<0.01) as a result of higher loss of water, had a greater increase of HC (Δ 0.9 ± 1.5% vs. 2.9 ± 1.1%, p<0.01) and a greater rise of TEMP (Δ 0.7 ± 0.3ºC vs. 0.4 ± 0.1ºC, p<0.01). Wearing PC resulted in lower vmax (7.4 ± 0.7 km/h vs. 8.1 ± 0.4 km/h, p<0.05) and lower performances at blood lactate concentrations of 2 mmol/l (5.2 ± 0.5 km/h vs. 5.7 ± 0.5 km/h, p<0.05) and 4 mmol/l (6.2 ± 0.5 km/h vs. 6.8 ± 0.6 km/h, p<0.01). HR were higher in athletes with PC during and 5 minutes after FET (p<0.05). Athletes with PC had a higher LAC concentration for movement speed higher than 6 km/h (3.7 ± 2.2 mmol/l vs. 2.8 ± 1.0 mmol/l, p<0.05).

CONCLUSIONS: Wearing protective clothing increases perspiration and body temperature and lowers endurance performance in fencers. These negative effects due to the protective clothing should be taken into consideration during a fencing tournament, where athletes have to perform 10 to 15 bouts. Whether the ingestion of cold beverages to regulate fluid balance and body temperature has a significant effect on counteracting performance decrements has to be verified in further studies.

3374 Board #95 June 2 9:30 AM - 11:00 AM Examination Of The Impact Of A Cooling Product On Cycling Performance In The Heat
Walter R. Bixby, FACSM, Amanda B. Mischo, Paul C. Miller, Stephen P. Bailey, Eric E. Hall, FACSM. Elon University, Elon, NC.
(/W.R. Bixby: Contracted Research - Including Principle Investigator; Dansile LLC.)

Exercising in the heat has adverse consequences for physical performance. Little evidence exists examining the impact of a cooling strategy during the event.

PURPOSE: To examine if a cooling strategy during an event in the heat can reduce the negative effects commonly seen and thus positively impact performance and perception.

METHODS: 7 experienced male cyclists performed a graded exercise test and two time trials (TT) on 3 separate days on a Velotron. Days two and three were identical with the exception of the treatment condition and were performed in an environmentally controlled chamber set to 30 degrees Celsius with 60% humidity. Participants were given 10 minutes to warm-up. Following
METHODS: consisted of four sets of 10 maximal isokinetic elbow flexion repetitions at 60°/s.

PURPOSE: treatment design with two experimental conditions consisting of: 1) compression sleeves (CS), and 2) placebo sleeve (PS) with no compression. Peak torque (PT) and total work (TW) testing test (WAnT) which was performed on a cycle ergometer (Monark 894E, Sweden) against a resistance of 0.075 kg kg body mass over design was used with subjects visited the lab twice for the placebo (PT) and experiment test (ET). Maximal anaerobic power parameters were determined through the wingate anaerobic power test (WAnT) which was performed on a bicycle ergometer (Monark 894E, Sweden) against a resistance of 0.075 kg body mass.

Table 1: No significant differences were found between the CS and PS conditions. However, PT and TW decreased significantly (p<0.05) between sets (1th > 2nd > 3rd > 4th) from both conditions.

| CS | 62.4±7.4* | 52.3±5.1† | 49.2±5.5‡ | 47.5±7.4 | 921.6±95.1* | 734.8±64.9† | 611.8±38.0‡ | 539.6±31.8 |
| PS | 51.99 (53.47) | 46.99 (47.99) | 43.99 (44.99) | 41.99 (42.99) | 909.49 (919.49) | 724.99 (724.99) | 609.99 (609.99) | 534.99 (534.99) |

CONCLUSIONS: These results indicate that compression sleeves commonly worn by athletes and fitness enthusiasts during training and competition do not contribute to improved elbow flexion muscle strength or work capacity during repetitive high-intensity resistance exercise tasks.

RESULTS: One way Repeated Measures ANOVAs were calculated for Average Watts, MPH, and Time across the two TT conditions. No significant results were found: Watts cooling 247.99 (245.99), non-cooling 244.49 (242.49); MPH cooling 24.43 (24.43), non-cooling 24.21 (24.21); and Time cooling 46:20 (46:20), non-cooling 46:32 (46:32). A two way (Condition x 2 Time) RM ANOVA was calculated for lactate and a significant Time main effect was found, F(1, 6) = 13.83, p < .05, pre 3.56 (4.94) post 11.50 (1.61). Two way (2 condition x 6 Time) RM ANOVA was calculated for HR and Affect. A significant time main effect was found for HR, F(5, 30) = 113.74, p < .01. Heart rate increased from baseline throughout the time trial and then rebounded to near baseline levels 15 minutes after the time trial.

CONCLUSIONS: The cooling product did not have a statistically significant impact on performance or affect during and following a time trial in the heat. Participants performed 13 seconds faster while wearing the cooling product which could have significant real world impact.

Supported by a grant from Daniele LLC.

3375 Board #96 June 2 9:30 AM - 11:00 AM Effects of Wearing Arm Progressive Compression Sleeves on Upper-body Muscular Performance in Trained Men Maria Claudia C. Pereira1, Diego Jesus1, Saulo R. Soares1, Rogério A. Guedes1, Carlos A. Vieira2, João B. Ferreira-Junior1, Lee E. Brown, FACSM1, Martim Bottaro1.

(No relationships reported)

Investigations have demonstrated that progressive lower-body compression garments (shorts and stockings) can enhance repetitive jump power and running economy. Recently, the use of upper-body compression garments, such as arm progressive compression sleeves, has become popular in sports that require muscular strength, endurance, and power (e.g., basketball, volleyball, tennis, standup paddle, etc.). However, the benefits of these garments on muscular performance still need to be investigated.

PURPOSE: To investigate the effects of wearing compression sleeves (CS) on force production and muscle fatigue of the elbow flexor in trained men.

METHODS: Eight healthy resistance trained young men (20.4 ± 3.1 yrs; 71.7 ± 6.0 kg) volunteered to take part in this study. Testing was conducted using a balanced and randomized treatment design with two experimental conditions consisting of: 1) compression sleeves (CS), and 2) placebo sleeve (PS) with no compression. Peak torque (PT) and total work (TW) testing consisted of four sets of 10 maximal isokinetic elbow flexion repetitions at 60°/s on a Biodex System 3 dynamometer.

RESULTS: PT and TW are presented in Table 1. No significant differences were found between the CS and PS conditions. However, PT and TW decreased significantly (p<0.05) between sets (1st > 2nd > 3rd > 4th) from both conditions.

<table>
<thead>
<tr>
<th>Total Work (Joules)</th>
<th>Peak Torque (N.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st set</td>
<td>2nd set</td>
</tr>
<tr>
<td>CS</td>
<td>62.4±7.4</td>
</tr>
<tr>
<td>PS</td>
<td>51.99 (53.47)</td>
</tr>
</tbody>
</table>

CONCLUSION: These results indicate that compression sleeves commonly worn by athletes and fitness enthusiasts during training and competition do not contribute to improved elbow flexion muscle strength or work capacity during repetitive high-intensity resistance exercise tasks.

3376 Board #97 June 2 9:30 AM - 11:00 AM Effects of Nanobionic Textile T-shirt on Maximal Anaerobic Power Evaggelos Roussopoulos, Georgios Paradisis, Elias Zacharogiannis, Nikolaos Dimitriadis. Track and Field Sector, University of Athens, Athens, Greece. (No relationships reported)

Nanobionic is a textile, made of bio-ceramic materials, that reflects back to human body the far-infrared rays that body emits. Although there are research data regarding the use of far infrared rays to speed up recovery from exercise, reports on their effect on the cardiorespiratory parameters are scarce.

PURPOSE: The aim of this study was to investigate the effects of a Nanobionic t-shirt on maximal anaerobic power during exercise.

METHODS: Twelve (7 men, 5 women) healthy active subjects (age 28.2 ± 5.7 years, body mass 71.2 ± 16.1 kg, height 173.9 ± 9.5 cm) agreed to participate in the study. A double blind cross over design was used with subjects visited the lab twice for the placebo (PT) and experiment test (ET). Maximal anaerobic power parameters were determined through the wingate anaerobic test (WAnT) which was performed on a cycle ergometer (Monark 894E, Sweden) against a resistance of 0.075 kg body mass. Mean power (PP) determined as the highest value of the power for the whole period of 30 s, % of Power Drop (%PD) as the difference of the average Power for the whole period of 30 s.

RESULTS: All anaerobic power parameters showed significant improvements (P < 0.05) in the ET condition compared to PT condition (Table). No significant improvements were found between the conditions for Cardiorespiratory parameters.

CONCLUSIONS: Nanobionic t-shirt improves anaerobic power parameters; however the triggering mechanisms that produce these changes should be subject of future research which could explain the physiological basis behind the outcome of the present study.

<table>
<thead>
<tr>
<th>Mean power (watt/kg)</th>
<th>% drop power</th>
<th>RPM max (rev/min)</th>
<th>Mean power (watt/kg)</th>
<th>Post WAnaT lactate (mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT</td>
<td>10.23±2.10</td>
<td>10.08±2.10</td>
<td>193.17±23.0</td>
<td>7.58±1.24</td>
</tr>
<tr>
<td>PT</td>
<td>10.64±2.00</td>
<td>10.68±2.00</td>
<td>199.08±23.25</td>
<td>7.28±1.17</td>
</tr>
<tr>
<td>Δdiff</td>
<td>0.41</td>
<td>0.60</td>
<td>6.90</td>
<td>0.70</td>
</tr>
</tbody>
</table>

CONCLUSION: These results indicate that compression sleeves commonly worn by athletes and fitness enthusiasts during training and competition do not contribute to improved elbow flexion muscle strength or work capacity during repetitive high-intensity resistance exercise tasks.

3377 Board #98 June 2 9:30 AM - 11:00 AM Nanobionic Textile T-shirt: Its Effect On The Parameters Of Cardiorespiratory Function Nikos Dimitriadis, Evaggelos Roussopoulos, Georgios Paradisis, Elias Zacharogiannis. Athens University, Athens, Greece. (No relationships reported)

Nanobionic is a high quality technological textile, made of bio-ceramic materials, that reflects back to our body the far infrared rays our body emits. The exposure of living organisms to far infrared radiation has been documented to induce an increase in temperature of the body tissues, dilate cutaneous blood vessels as well as arterioles and venules promoting blood circulation and thus promoting metabolic rate. Although there are published research data regarding the use of far infrared rays to speed up recovery from exercise, reports on their effect on the cardiorespiratory parameters are scarce.

986
Purpose: The aim of this study was to investigate the effects of a Nanobionic t-shirt on the parameters of cardiorespiratory function during exercise.

Methods: Twenty-two (11 men, 11 women) healthy active subjects (age 27.7 ± 4.4 years, body mass 68.3 ± 13.6 kg, body height 173.2 ± 8.7 cm) agreed to participate in the study. A double-blind cross over design was used. Cardiorespiratory parameters were determined by continuous exhaustive incremental testing with an open circuit spirometry. This protocol had steps of 2 min and increments of 1km.h-1. After the first evaluation with active t-shirt (ET) or with identical inactive t-shirt (PT) the subjects 7-14 days performed the second exhaustive trial.

Results: Mean values for the ET or PT of VO2max (51.76 ± 6.5 v 49.62 ±6.87 ml.kg-1.min-1) velocity at VO2max (14.61 ± 1.73 v 13.77 ± 1.72 km.h-1), the velocity at the ventilatory threshold (11.48 ± 10.2 ± 1.79 km.h-1), total treadmill time (789.5 k, maximal heart rate and maximal blood lactate concentration (12.19 ± 1.9 v 10.75 ± 1.75 mmol.l-1) and maximal heart rate (191.5 ± 7.9 v 188.9 ± 8.4 h.p.m) were significantly different (p < 0.01).

Conclusions: Nanobionic t-shirt improves cardiorespiratory parameters and endurance performance. The triggering of metabolism through its reflective properties on far infrared rays should be subject of future research and may explain the physiological basis behind the outcome of the present study.
CONCLUSION: indicated that significant differences existed for gait velocity, \( t(8) = -2.77 \), medicine ball bounces, and lifting a medicine ball from ground to standing position using weighted vest, medicine balls, and ankle weights. The exercises performed were standing hip flexion, standing hip extension, standing heel raises, chair stand, medicine ball slams, medicine ball bounces, and lifting a medicine ball from standing position.

METHODS: Eight older adults (5 F, 3 M) over the age of 65 completed the 12 week exercise intervention, and had an average (± SD) age at 82.25 ± 9.45 years. All participants completed an informed consent and received medical clearance from their physician. They were tested three times during the 12-week exercise intervention (pre-intervention, mid-intervention, and post-intervention) on stride length, gait velocity, 8-foot up-and-go, chair stand, and arm curl. The training program consisted of three days per week for 12 weeks, and all exercises were progressed using weighted vest, medicine balls, and ankle weights. The exercises performed were standing hip flexion, standing hip extension, standing heel raises, chair stand, medicine ball slams, medicine ball bounces, and lifting a medicine ball from standing position.

RESULTS: A paired samples t-test (n = .05) was used to analyze the data to see if within group differences existed between pre-and post-intervention on the aforementioned variables. Results indicated that significant differences existed for gait velocity, \( t(8) = -2.77, p = .03 \); chair stand, \( t(8) = 3.35, p = .01 \); and arm curl, \( t(8) = 2.58, p = .04 \).

CONCLUSION: Although significant differences were not observed in the stride length variable, gait velocity did improve suggesting that strength may have affected walking ability. This group may have increased their walking frequency enabling them to improve their walking time.

PURPOSE: The purpose of this study was to see if a high velocity training program can improve stride length in community dwelling older adults.

METHODS: Eight older adults (5 F, 3 M) over the age of 65 completed the 12 week exercise intervention, and had an average (± SD) age at 82.25 ± 9.45 years. All participants completed an informed consent and received medical clearance from their physician. They were tested three times during the 12-week exercise intervention (pre-intervention, mid-intervention, and post-intervention) on stride length, gait velocity, 8-foot up-and-go, chair stand, and arm curl. The training program consisted of three days per week for 12 weeks, and all exercises were progressed using weighted vest, medicine balls, and ankle weights. The exercises performed were standing hip flexion, standing hip extension, standing heel raises, chair stand, medicine ball slams, medicine ball bounces, and lifting a medicine ball from standing position.

RESULTS: A paired samples t-test (n = .05) was used to analyze the data to see if within group differences existed between pre-and post-intervention on the aforementioned variables. Results indicated that significant differences existed for gait velocity, \( t(8) = -2.77, p = .03 \); chair stand, \( t(8) = 3.35, p = .01 \); and arm curl, \( t(8) = 2.58, p = .04 \).

CONCLUSION: Although significant differences were not observed in the stride length variable, gait velocity did improve suggesting that strength may have affected walking ability. This group may have increased their walking frequency enabling them to improve their walking time.

PURPOSE: The purpose of this study was to compare regional body composition changes following high-velocity resistance training to those experienced following low-velocity training. The researchers hypothesized that no regional body composition differences would be seen between the two training methods, but that both protocols would improve body composition.

METHODS: Seventeen adults over the age of 75 completed one year of training. Participants were randomly assigned to either high-velocity, low-intensity (HV) or low-velocity, high-intensity (LV) training. HV participants completed 24 weeks of LV before transitioning to HV. Regional body composition was assessed using an iDXA total body scan which measured fat mass (FM) and lean tissue mass (LTM) of the gynoid and android regions. Appendicular FM and LTM as well as the ratio of appendicular LTM to appendicular FM were calculated. Assessments were taken at baseline, 24 weeks, and after one year of training. ANOVA with repeated measures was used to analyze interaction and main effects for each outcome (n = .007).

RESULTS: No significant interaction effects were observed. A time effect was seen for gynoid LTM, \( F = 7.72, p = .002 \). Post hoc tests reveal a significant loss of LTM from baseline to 24 weeks. Interestingly, univariate effect sizes indicate differing effect of training on gynoid LTM from 24 weeks through one year. In the gynoid region, the HV group lost LTM (d = 0.138), while the LV group experienced maintenance of LTM (d = 0.034).

CONCLUSION: Although not statistically significant, we observed a slight decrease in LTM following HV training, while the LV group experienced no change in LTM. This difference may be due to the intensity of training which was not consistent in this study. The HV group trained at a low intensity (50% of 1-repetition maximum), while the LV group trained at a high-intensity (80% of 1-repetition maximum). These results indicate the need for further study. It is recommended that this study be repeated with intensity held constant between the two training protocols.

PURPOSE: Recent physical activity guidelines for older adults have included recommendations for resistance training and intensity, whereas earlier versions focused solely on low intensity walking activities. We have previously collected longitudinal data on highly active seniors who have exclusively participated in running as a form of exercise to evaluate whether running alone was sufficient to prevent age-associated sarcopenia.

METHODS: Ninety-five very active older men (n = 59) and women (n = 36) were selected from a population of 237 master athletes participating in a longitudinal study at the University of Southern California. Subjects attend biannual comprehensive physiologic testing between May 1987 and December 2001. Isokinetic knee extension and isometric knee extension and flexion strengths were assessed using a Kin Com dynamometer (5000). Subjects self-reported training and performance data including 5 kilometer, 10 kilometer, and marathon distances.

RESULTS: Data were evaluated combined and by age tertiles (50-54 yr, 55-64 yr, & 65-80 yr). Average time between tests was 4.8 ± 2.0 years. VO2 max declined significantly in men (48.4 ± 9.9 to 44.9 ± 8.8 ml/kg/min; p = .001) and women (43.5 ± 8.0 to 40.6 ± 9.3 ml/kg/min; p = .009). Isometric flexion and extension strengths declined in both men and women at all angles measured (e.g., knee-extension at 60°: 251.2 ± 55.3 N to 199.8 ± 56.7 N; p = .001 men & 158.8 ± 34.0 N to 126.2 ± 32.5 N; p = .001 women), whereas isokinetic concentric and eccentric strength changes did not reach statistical significance due to large variability in our measures.

CONCLUSION(S): Older adults who use aerobic activity as their sole means of exercise demonstrate small losses in aerobic fitness but larger losses in muscle strength. Thus, running alone will not prevent sarcopenia. The largest declines in fitness and strength were associated with those adults who decreased their running volume.

PURPOSE: The aim of this study was to assess the impact of a weight loss diet (WL-D) or resistance training exercise (EX) on self-reported fatigue.
Sedentary obese (BMI ≥ 30.35 kg/m²) age matched women (n=31, 65.0±5.4 yr, range=59-80 yr) were randomized to a WL-D (n=17) or EX (n=14) intervention for 16 weeks. Weight status and body composition were determined from measures of height, weight and DXA. Fatigue was assessed using the Multidimensional Fatigue Inventory, in which higher scores indicate greater fatigue in the dimension of interest [general (GEN), physical (PHY), mental (MEN), reduced activity (R-.ACT), reduced motivation (R-MOT)].

RESULTS: Complete data were collected on 22 participants (WL-D n=10, EX n=12). No differences in %Fat, MFLM, physical activity level or any dimensions of fatigue were found between groups at baseline (all p>0.05). As expected, WL-D decreased body mass (3.64±3.4 kg, p=0.03), %Fat (1.0±1.6%, p=0.07) and MFLM (1.3±1.8 kg, p=0.04), while EX reduced %Fat (1.1±2.0%, p=0.01) with a concomitant increase in MFLM (0.75±0.2 kg, p=0.01). WL-D decreased PHY (p=0.045) and R-ACT (p=0.01), while EX reduced R-ACT only (p=0.02). Median splits of each group based on GEN were analyzed to determine if changes in fatigue responses were differentially affected by initial levels of fatigue. In WL-D with lower initial GEN, R-MOT decreased (p=0.02), while WL-D with higher levels of initial GEN reduced both PHY (p=0.03) and R-ACT (p=0.01) over the course of the intervention. When evaluated by initial fatigue level, EX groups demonstrated no significant changes in any dimension of fatigue.

CONCLUSION: Weight loss and exercise in obese sedentary older women may differentially attenuate perceptions of fatigue with the effects being impacted by initial level of fatigue. Behavioral interventions to reduce fatigue are warranted.

Support: NIH HL090455
Resistance Training Prevents Age-related Decline in Exercise Tolerance but not in VO2MAX of Older Runners: Preliminary Results of the Sao Silvestre Older Runners Cohort Study

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(No relationships reported)

PURPOSE: The purpose of present study was to investigate the effects of resistance training on maximal and submaximal parameters of cardiorespiratory fitness (CRF) of older runners.

METHODS: Twenty-four elderly male runners (age 69±0.9 years; time of training 21±7.2 years; training frequency 4.5±0.6 days·week−1; training volume 57.5±10.9 km·week−1) performed a graded exercise test before (T1) and after (T2) 8.9±0.2 years of follow-up. The subjects were divided into two different groups: resistance trained older runners (REG; subjects that continued endurance training and initiated a resistance training program 3.1±0.6 years before T2; n=11) and control older runners (CG; subjects that continued endurance training but did not performed resistance training; n=13). Submaximal and maximal parameters of CRF were compared between the two groups.

RESULTS: Data are displayed in Table 1. Both groups reduced similarly maximal oxygen consumption (VO2MAX) after follow-up (REG = 17.7±2.6%; CG = 23.1±4.9%). However, the reduction of VO2 at respiratory compensation point (VO2RCP) was lower in REG than CG (13.8±3.4% vs. 22.1±5.1%; p<0.05). Tolerance time to reach respiratory compensation point (TTRCP) and TT2MAX were reduced in CG after follow-up, but did not change significantly in REG. Maximal heart rate (HR) reduced similarly in both groups, but lower reduction of HRREG was observed in REG than CG (4.4±2.6% vs. 10.9±1.4%; p=0.03).

CONCLUSION: Lower reductions of VO2RCP, TT2REG, TT2MAX and HRREG (but not VO2MAX and HRMAX) were found in REG than CG. These results suggest that regular resistance training may have important implications for reducing age-related decline in CRF of older runners.

### Table 1: Graded exercise test parameters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Resistance Trained Runners</th>
<th>Control Runners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>HRRCP (bpm)</td>
<td>51.9±5.9</td>
<td>44±6.3 5*</td>
</tr>
<tr>
<td>HRMAX (bpm)</td>
<td>202±7.9</td>
<td>163±3.2*</td>
</tr>
<tr>
<td>TTRCP (min)</td>
<td>10.0±0.9</td>
<td>10.1±0.5</td>
</tr>
<tr>
<td>TT2MAX (min)</td>
<td>5.5±0.8</td>
<td>4.9±0.6</td>
</tr>
<tr>
<td>VO2RCP (ml·kg·min⁻¹)</td>
<td>18.4±1.4</td>
<td>17.8±1.7*</td>
</tr>
<tr>
<td>VO2MAX (ml·kg·min⁻¹)</td>
<td>5.6±1.5</td>
<td>6.6±1.4 5*</td>
</tr>
<tr>
<td>RER</td>
<td>15.9±0.2</td>
<td>17.4±0.2</td>
</tr>
</tbody>
</table>

* Different from before follow-up at same group (p<0.05). † Different from resistance trained runners at same period (p<0.05).

June 2 8:00 AM - 9:30 AM

Resistance Training Induces Positive Effects On Risk Of Falls, Muscle Strength, And Dual Task Performance In Oldest Old Institutionalized Frail Patients

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(No relationships reported)

The syndrome of frailty describes older people at a higher risk for adverse health outcomes. It is a condition with a complex etiology and pathophysiology. Exercise multicomponent programs and specifically resistance training are currently the most relevant interventions to slow down disability and other adverse outcomes. Limited information is available about its effects on balance, gait and falls in the oldest old frail population.

PURPOSE: To examine the effects of 12 weeks resistance program on muscle strength, balance, gait and decrease in number and risk of falls in oldest old frail institutionalized patients.

METHODS: Participants were included in the study using Fried Criteria. Measurements of upper and lower limb muscle strength (hand grip, flexor hip and knee extensor strength), gait speed (5 m walking test), dual task paradigm (verbal and arithmetic) balance performance (FICSIT-4 Tests of Static Balance: parallel, semi-tandem, tandem, and one-legged stance tests) as well as Time up and Go and rise from a chair tests were conducted before and after intervention. Before starting the program all participants received Individual medical evaluation and were assigned to a twice-weekly 12 weeks progressive resistance program (8-10 reps of 40-60% of 1RM) combined with balance retraining exercises progressing in difficulty.

RESULTS: Strength training significantly increased hip flexor (25% P<0.01), knee extensor strength (22%;P<0.01) and rise from a chair test (75%; P<0.01). Significant increases in semi-tandem static balance test (P<0.01) were also observed. Significant decrease of incidence (p<0.001) and risk of falls (P<0.01) were observed.

CONCLUSION: 12-weeks progressive resistance program combined with balance exercises have positive effects on incidence and risk of falls, muscle strength, dual task performance, gait velocity and balance performance in very elderly institutionalized frail patients. Supported in part by grants of Spanish Ministry of Health, Institute Carlos III, Department of Health of the Government of Navarra and Government of Spain (CSD) RD06/013/1003 and 87/2010 and 008/EPB10/11.

June 2 8:00 AM - 9:30 AM

Periodized Resistance Training and Supplementation: Effects on Body Composition and Muscular Performance in Older Men

Matthew G. Villanueva, Jiaxiu He, E. Todd Schroeder, FACSM. University of Southern California, Los Angeles, CA.

(No relationships reported)

Investigations examining the effects of non-linearly periodized resistance training (RT) programs designed to promote concurrent increases in lean mass, muscular strength, and functional performance in older men are limited.

PURPOSE: To examine the effects of a 12-week RT program with and without creatine and protein supplementation on changes in lean mass, muscular strength, and physical function in older men.

METHODS: 22 men, 68.1±6.1 years, 176.8±7.7 cm, 82.7±11.1 kg (mean±SD), were randomized to one of three groups: control (C; n=8); RT only (RT; n=7); and RT combined with supplementation (RTS; n=7). A progressive, total-body RT program was performed 3 days/week for 12 weeks, with supervision. Creatine supplementation (pill form): RTS participants consumed 0.3 g/kg body weight/day for 5 days and then 0.07 g/kg body weight/day until completion of the 12-week program. RTS participants also consumed a ready-to-drink whey protein supplement (35g) immediately post-training and on non-training days. Exercise testing occurred pre- and post-RT intervention to determine changes in body composition (dual-energy x-ray absorptiometry), 1-RM machine chest press (CP) and leg press (LP) strength, and dynamic power (Margaria power stair climb; DP).
RESULTS: ANOVA revealed no differences in baseline characteristics among the three treatment groups (p>0.05). Independent sample t-tests (C vs. mean of RT and RTS) revealed: RT and RTS groups experienced significantly greater increases in 1-RM CP (25.7±kg and 20.8±kg) and 1-RM LP (172.4±kg and 198.1±kg) (p=0.0001), notable increases in lean mass (0.78±1.83 kg and 1.33±1.67 kg; p=0.07), and notable decreases in fat mass (-1.36±1.93 kg and -0.95±1.78 kg; p=0.17) and percentage body fat (-1.36±2.11% and -1.63±1.49%; p=0.06); changes in DP were not significant (p>0.05). However, additional analyses revealed near significant differences in DP between the RT and RTS groups (+58±309 watts vs. +371±361 watts; p=0.06).

CONCLUSIONS: 12 weeks of periodized RT increased muscular strength in older men but did not significantly improve body composition or dynamic power performance. Furthermore, the addition of creatine and protein supplementation with RT provided no additional enhancements in body composition, muscular strength, or dynamic power performance.

3391 Board #112 June 2 8:00 AM - 9:30 AM

Resistance Training with or without Protein and Creatine Induces Comparable Aerobic Benefits in Older Men

Lindsey Jayne Anderson, Matthew Villanueva, E. Todd Schroeder, FACSM. University of Southern California, Los Angeles, CA. (No relationships reported)

PURPOSE: To examine the effects of a 12-week resistance training (RT) intervention alone or with creatine and whey protein supplementation ($) on bone mass and aerobic function in older men.

METHODS: 22 men 68±6yrs, 176.8±7cm, 82.7±11.9kg (meansD) were randomized into control (CON; N=9), RT (N=6), or RT with $ (RTS; N=7). After 12 weeks, some CON participants were further randomized into RT (N=3) or RTS (N=4) for 12 weeks of exercise. Bone mineral density (BMD) and content (BMC) were measured by dual energy x-ray absorptiometry and cardiorespiratory fitness assessed with a 4-minute walk test (estimated VO2max) and 400-meter walk time. Creatine doses: 0.3g/kg BW/day (days 1-5) then 0.07g/kg BW/day (day 6+). 35g whey protein drink was consumed daily; immediately after exercise or at home on non-training days. Periodized RT was performed 3 days/week. Some RT/RTS participants served as their own control (CON cross-overs) resulting in two distinct statistical analyses. CON vs. RT or RTS (3-group) compared the 1st randomization (N=9 vs. 6 or 7). RT vs. RTS (2-group) compared the 2nd randomization (N=9 vs. 11). Between-group baseline (BL) and 12-week change differences were determined by ANOVA with Bonferroni post-hoc (3-group) or independent t-tests (2-group). Within-group 12-week changes were determined by paired-sample t-tests (2 and 3-group).

RESULTS: BL characteristics were not different between groups (2 or 3-group; P>0.05). In the 3-group analysis, RT (N=6) significantly increased VO2max by 2.5±1.8 ml/kgXmin-1 (7.1±5.2%; P=0.02); however, 12-week changes were not different between groups at the adjusted 0.017 level (P=0.17). In the 2-group analysis, VO2max significantly increased by 2.4±1.6 ml/kgXmin-1 (6.3±4.7%; P=0.004) for RT (N=9) and 1.3±1.8 ml/kgXmin-1 (3.6±4.0%; P=0.04) for RTS (N=11). Both training groups significantly decreased mean 400-meter walk time by 24.4±21.1s (11.6±9.4%; P<0.018). Although participants in the walking group improved other measured components of functional capacity, the 3-group analysis did not provide additive effects.

CONCLUSIONS: 12 weeks of progressive total body RT did not affect bone mass but did improve cardiorespiratory fitness; however, RT with creatine and whey protein supplementation did not provide additive effects.

3392 Board #113 June 2 8:00 AM - 9:30 AM

Effects of a Comprehensive Exercise Program on Functional Capacity of Older Adults

Trinh D. Nguyen, Peggy A. Plato. San Jose State University, San Jose, CA. (Sponsor: Craig Cisar, FACSM) (No relationships reported)

Although lifespan is increasing, many older adults experience functional impairments and a loss of independence in their later years. An effective intervention for older adults should incorporate activities to enhance functional capacity, as well as being enjoyable to enhance compliance. There is limited research examining functional capacity in older adults following an exercise program that uses body weight as resistance.

PURPOSE: To compare the effects of a whole body exercise program (EXER) and a walking program (WALK) on functional capacity of older adults.

METHODS: Participants were randomly assigned to a 2 day per week EXER program, incorporating warm-up and stretching activities; upper and lower body, abdominal, and balance exercises; and perceptual-motor games (16 F, 6 M; 75.5 ± 1.6 years) or WALK program, walking for 30-45 min at a self-selected pace (13 F, 1 M, 65.8 ± 1.1 years). Upper body power (30 s arm curl test), lower body power (30 s sit-to-stand test), static balance (balancing on one foot with eyes open), and dynamic balance and agility (8-foot up-and-go test) were measured before and after the 8 week programs. Statistical significance was adjusted to p<0.005.

RESULTS: The EXER program enhanced functional capacity by increasing upper (15.2 ± 1.4 arm curls pre vs. 19.3 ± 1.6 post, p<0.001) and lower body power (12.8 ± 0.9 sit-to-stand reps pre vs. 15.4 ± 1.2 post, p<0.001), and improving agility and dynamic balance (7.55 ± 0.34 s for 8-foot up-and-go pre vs. 6.43 ± 0.27 s post, p<0.001). There were no significant differences in static balance as a result of the EXER program. In contrast, the WALK group significantly improved static balance in the right leg (15.87 ± 4.52 s pre vs. 7.90 ± 5.12 s post, p<0.004) and approached significance in the left leg (16.30 ± 4.50 s pre vs. 28.23 ± 6.61 s post, p=0.018). Although participants in the walking group improved other measured components of functional capacity, there were no significant differences due to low statistical power.

CONCLUSION: Older adults can improve components of functional capacity by exercising 2 days a week for 8 weeks using either a whole body exercise program or a self-paced walk. Participants reported that the EXER program, performed in a group setting without external weight, was enjoyable, as well as being physically and mentally stimulating.

3393 Board #114 June 2 8:00 AM - 9:30 AM

Strength Prior To Endurance Intra-session Exercise Sequence Optimizes Neuromuscular And Cardiovascular Gains In Elderly Men

Eduardo L. Cadore1, Mikel Izquierdo1, Cristina Lima Alberton1, Ronie Silveira Pinto1, Matheus Conceição1, Giovani Cunha1, Régis Radaelli1, Martin Bottaro2, Guilherme Treis Trindade1, Stephanie Santana Pinto1, Luiz Fernando Martins Knobel1, 1Federal University of Rio Grande do Sul, Porto Alegre - RS, Brazil. 2Public University of Navarre, Tudela - Navarre, Spain. 1University of Brasília, Brasília - DF, Brazil. (No relationships reported)

PURPOSE: To investigate the cardiorespiratory and neuromuscular adaptations to different intra-session exercise sequences during concurrent training in elderly.

METHODS: Twenty-six healthy elderly men (64.7 ± 4.1 years), were randomly placed into two concurrent training groups: strength prior to (SE, n=13) or after (ES, n=13) endurance training. Subjects trained strength and endurance training 3 times per week performing both exercise types in the same training session. The peak oxygen uptake (VO2peak), maximum aerobic workload (Wmax), absolute (VT1 and VT2) and relative (VT1% and VT2%) ventilatory thresholds, as well as workloads at VT1 and VT2 (WVT1 and WVT2) was evaluated during a maximal incremental test on a cycle ergometer before and after the training. In addition, force per unit of active muscle mass (i.e. muscle quality - MQ) was evaluated by the quotient between maximal dynamic strength (one repetition maximum test) of the knee extensors and the quadriceps femoris muscle thickness (sum of the muscle thickness of the four muscles) determined by ultrasonography. The training-related effects were assessed using a two-way analysis of Variance with Repeated measures (group x time).

RESULTS: There were no modifications after training in the VT1, VT2, VT1%, VT2%, There was significant increases on VT1 in only in SE (61.5 ± 13.0 watts vs. 75.0 ± 10.2, P<0.05), as well significant increases on WVT1 in both groups (SE: 94.2 ± 15.0 vs. 111.5 ± 16.5 watts; ES: 104.2 ± 27.9 vs. 122.9 ± 24.9 watts, P<0.001). There was significant increase on the VO2peak, with both groups showing increases (SE: 27.4 ± 6.1 vs. 29.5 ± 6.6 ml/kgXmin-1; ES: 26.6 ± 6.9 vs. 28.8 ± 6.6 ml/kgXmin-1; P<0.001), without difference between groups; as well significant increase on the VO2peak, with both groups showing increases (SE: 27.4 ± 6.1 vs. 29.5 ± 6.6 ml/kgXmin-1; ES: 26.6 ± 6.9 vs. 28.8 ± 6.6 ml/kgXmin-1; P<0.001), without difference between SE and ES. The quadriceps femoris force per unit of muscle mass increased in both groups (SE: 1.95 ± 0.32 vs. 2.47 ± 0.32 kg*mm-0.67; ES: 2.03 ± 0.26 vs. 2.33 ± 0.32 kg*mm-0.67, P<0.001), but the increase was significant higher in SE compared to ES (27.5 ± 12.7 vs. 15.2 ± 10.3%, P<0.02).

CONCLUSION: The intra-session exercise sequence had no influence in the maximal endurance power to concurrent training, but had influence in the magnitude of the muscle quality enhancements.
Deficits in balance and muscle strength/power have frequently been associated with an increased risk of falling in older adults. Traditionally, balance and/or resistance training were applied to counteract these intrinsic fall risk factors. Core instability training involves exercises that are challenging for both, trunk muscles and postural control and may thus have the potential to induce benefits on trunk strength/mobility and balance performance.

PURPOSE: The objective of this study was to investigate the effects of a core instability training on measures of core strength, trunk mobility, and dynamic postural control in healthy seniors.

METHODS: Thirty-two older adults were randomly assigned to an intervention group (INT; n = 16; age 70.8 ± 5.3 years; 8 females, 8 males) that conducted a 9 week progressive core instability training program (3 times/week) or a control group (CON; n = 16; age 70.2 ± 4.7 years; 9 females, 7 males). Maximal isometric strength (MIS) of the trunk flexors/extensors as well as trunk mobility in the sagittal (SAP) and frontal (FRP) plane were measured before and after the intervention program. Dynamic postural control was tested while walking 10 m on an opto-electric walkway.

RESULTS: Program compliance was excellent with participants of the INT group completing 92.4% of the training sessions. Significant Group x Test interactions were found for MIS of the trunk flexors (34%, p < 0.001) and trunk extensors (21%, p < 0.001), for trunk mobility in SAP (11%, p < 0.001) and FRP (11%, p = 0.06) directions, and for stride velocity (9%, p = 0.018), stride time (5%, p = 0.01), and stride length (5%, p = 0.05) in favor of the INT group.

CONCLUSION: Core instability training proved to be a safe and feasible exercise program for older adults accompanied with a high adherence rate. Age-related deficits in measures of core strength, trunk mobility, and walking performance can be mitigated by core instability training in older adults. Thus, this training regimen could be used as an alternative to traditional balance and/or resistance training.
RESULTS: Following the twelve-week training period, there were no significant improvements in either group for the Senior Fitness Test (Chair Stand (sec), P = 1.34+3.87, C = 1.45+2.44, p=0.32). Arm Curlis (n), P = 16.3+3.55, C = 15.64+3.17, p=0.58; Sit and Reach (cm), P = 2.84+3.55, C = 1.07+2.48, p=0.21; Back Scratch (cm), P = -2.51+4.21, C = -2.25+4.81, p=0.87; Eight-feet Up and Go (sec), P = 5.41+0.91, C = 5.41+1.20, p=0.98; Six Minute Walk (sec), P = 609.8+67.27, C = 647.5+104.9, p=0.25). The Sensory Organization Test was not significant for between the groups (P = 83.2+2.87, C = 82.24+1.02, p=0.46). C was also significantly younger (p<0.02) and were more recreationally active.

CONCLUSIONS: The results of this university-level exercise intervention program highlight the need to include additional training for flexibility, dynamic balance, and agility in the structured exercise program, since no differences were seen between groups in the performance measures.
RESULTS: BodyBugg overestimated caloric expenditure during treadmill exercise by 1.4 kCal/min (±1.6) for men and 0.6 kCal/min (±0.8) for women (p<0.05). Polar HR monitor underestimated during rowing exercise on average by 2.0 kCal/min (±1.2) for men only (p<0.05).

CONCLUSION: The BodyBugg may be more accurate for exercises requiring upper body emphasis while the Polar HR monitor may be more accurate for lower body exercises (especially for men). Consumers should consider their most common mode of exercise prior to purchasing either device.

3401  Board #122  June 2  9:30 AM - 11:00 AM  
The Benefits of Electrical Muscle Stimulation on Resting Metabolism  
Claudia Broeder, FACSM; Dimitra Vandarakis1; Amanda J. Salacinski2; Steven M. Mauk3; Laurie A. Schubert1; Richard Hickey, III1; 1Exercising Nutritionally, LLC, Naperville, IL. 2Northern Illinois University, DeKalb, IL. 3Adrian College, Adrian, MI.  

PURPOSE: Electrical muscle stimulation (EMS) use has shown improvements in muscle strength and endurance. Thus, EMS may have a positive effect on energy expenditure during EMS muscle activations. This study determined the effects of a FDA approved medical grade electrical muscle stimulator system on enhancing energy expenditure at rest in healthy, active adults.

METHODS: Thirty-eight subjects (males = 19; females = 19) participated. Each subject performed the following items: a Block short-form food frequency questionnaire, body composition assessment (Inbody 520), a free-living physical activity assessment (BodyMedia Armband), a maximal aerobic capacity treadmill test (VO2 max), practice resting metabolic rate (RMR) and EMS accommodation training, and two standardized RMR trials with and without Contour MX9 EMS activation. The resting trials with and without EMS were performed in duplicate. The EMS level was set to the strength setting at level 3 (Contraction Phase = 6-sec at 85Hz; Rest Phase = 4-sec at 10Hz).

RESULTS: Subject characteristics were age (27.9 ± 6.9 yrs), Wt (168.1 ± 37.4 lbs), BodyFat (21.2 ± 8.7%), VO2 max (44.0 ± 8.3 mI/kg/min), 24-hr energy expenditure (2.881 ± 637 kcal), Daily Steps (10,630 ± 4,687). Test-retest data showed that both the non-EMS (Delta: 1.2%; r-value: 0.93; SEE: 15 kcal; p-value 0.0001) and EMS trials (Delta: 0.8%; r-value: 0.94; SEE: 27 kcal; p-value 0.0001) were highly reliable. In men, EMS activation increased RMR 22% (p<0.001) and HR 13% (p<0.01). In women RMR and HR increased 16% (p = 0.0005) and 14% (p<0.001), respectively. Interestingly, when subjects were divided into low vs high EMS tolerance levels (% of max EMS unit activation output), both groups showed similar increases in RMR values; p-value 0.0001. Abdominal lean muscle mass showed the highest independent correlation to the EMS activation effect for all subjects (r-value: 0.89, p=0.0001). Compared to predicted RMR values, 47% of the subjects had non-EMS RMR values > predicted. In contrast, RMR with EMS, 76% of the subjects exceeded the predicted norm (Chi Square = 9.40, p=0.002).

CONCLUSIONS: These results indicate the Contour MX9 EMS system acutely increases a person’s RMR. Future studies need to determine the chronic effects of EMS on muscle metabolism including insulin sensitivity and glucose tolerance.

3402  Board #123  June 2  9:30 AM - 11:00 AM  
Effects Of Using Active Video Game On Body Weight And Fat Mass In Adults: A Randomized Intervention Trial  
Motokito Miyachi1, Haruka Murakami2, Ryoko Kawakami1, Yuko Gando2, Azusa Sasaki1, Satoshi Hanawa1, Aiko Hirotsuko1, Tatsuya Nishikata1; 1National Institute of Health and Nutrition, Tokyo, Japan. 2Waseda University, Tokorozawa, Japan.  

BACKGROUND: Active video game systems controlled through arm gestures and motions and force plate-controlled video games (Wii Fit Plus) are becoming increasingly popular. We previously revealed that time spent playing one-third of activities supplied by Wii Fit Plus can count toward the daily amount of exercise required according to the guidelines provided by the ACSM and AHA which focus on 30 minutes of moderate-intensity daily physical activity five days a week.

PURPOSE: To examine the effects of home-based intervention using Wii Fit Plus on body weight and composition.

METHODS: Randomized controlled trial conducted in 2010. A total of 40 adult men (n=6) and women (n=34) aged 21 to 50 yrs participated. Participants were randomly assigned to an intervention group (n=20) or a control group (n=20) after baseline measurements. The intervention group have played favorite games for 200 min per every week for one month. At baseline and after one month, height, weight, waist circumference, %fat, and lean body mass were measured.

RESULTS: One-month data were available for 39 men and women. The intervention group showed significant differences from controls in baseline to one-month changes in body weight (-2.0 kg, P<0.001), waist circumference (-1.8 cm, P<0.001), and body fat mass (-0.9 kg, P=0.01). There was no such between-group difference in %fat (-0.4%, NS) and lean body mass (-0.6 kg, NS).

CONCLUSIONS: The daily use of active video game systems controlled through arm gestures and motions and force plate-controlled video games (Wii Fit Plus) is efficacious for body weight and fat mass reductions in adults.

3403  Board #124  June 2  9:30 AM - 11:00 AM  
Comparing The Energy Cost Of Two Body Shaper Undergarments During Walking  
Claire Brady, Corey A. Rynders, Frank I. Katch, FACSM, Arthur Weltman, FACSM. University of Virginia, Charlottesville, VA.  

PURPOSE: We previously reported that wearing a body shaper undergarment with built in resistance bands increased the energy cost of walking by 3.5% compared to wearing usual undergarments. The present study compared the energy cost of wearing the resistance band body shaper undergarment (ShaToBu, Mayfair Tech Montreal Canada) to a commercially available shaper undergarment without resistance bands.

METHODS: Fifteen women completed testing (mean±SD; age=41.3 ±14.0 yr; BMI=28.4±3.4 kg/m2). Subjects completed two continuous 10-min treadmill walking tests separated by 15-min of seated rest. Treadmill percent grade was 5% over the first 5-min and increased to 10% over the last 5-min. The ShaToBu body shaper undergarment was worn during one of the walking tests and a commercially available shaper was worn during the other with order randomized. Indirect calorimetry assessed energy expenditure (EE) throughout the walk (Oxycon Mobile, Cardinal Health, Yorba Linda, CA).

RESULTS: Wearing the undergarment with resistance bands resulted in a 4.6% higher EE at 5% grade, 5.0±1.3 kcal vs. 5.6±1.2 kcal (p=0.001).

CONCLUSIONS: The body shaper with resistance bands increased the energy cost of walking uphill at 5% grade (typical of an activity of daily living) by 4.6%. This difference in EE is virtually identical to the differences reported previously with usual undergarments and suggests that the resistance bands, rather than the compressive nature of the garment, accounts for the increased EE. Wearing a body shaper during activities of daily living that increases EE may help to offset the small energy gap (~30 to 50 kcal daily) commonly associated with yearly weight gain.

Supported by an unrestricted gift to the University of Virginia from MayfairTech, Inc. F.I. Katch, and A. Weltman serve as scientific advisors to Mayfair Tech, Inc.

3404  Board #125  June 2  9:30 AM - 11:00 AM  
Energy Cost of Active and Sedentary Music Video Games: Drum and Handheld Gaming versus Walking  

PURPOSE: The purpose of this study was to compare energy expenditure during and after active and handheld video game drumming compared to walking on a treadmill.
METHODS: Eleven experienced college-aged men performed four protocols, one per week, after an overnight fast.Expired air was collected during (30min) and after (30min) active drumming on a drum pad (DRUM), visual drumming on a handheld gaming device (HANDHELD), walking on a treadmill at 35% of VO2max (WALK), and no-exercise seated control (CTRL). DRUM and HANDHELD song lists were identical.

RESULTS: Significant differences (p ≤ 0.05) among the average rates of energy expenditure (kcal/min−1) included WALK > DRUM > HANDHELD (see Table). There were no significant differences in the rates of energy expenditure among groups during recovery. Total energy expenditure was significantly greater (p ≤ 0.05) during WALK (231 ± 80.0 kcal) compared to DRUM (177 ± 31.0 kcal) and HANDHELD (112 ± 24.9 kcal), and greater during DRUM compared to HANDHELD.

CONCLUSIONS: Active video drumming significantly increased energy expenditure compared to handheld, but energy expenditure was greatest during walking. Thus, traditional aerobic exercise remains important for achieving the minimum amount and intensity of physical activity for health. Energy expenditure with handheld video game drumming was nearly identical to no-exercise control, demonstrating that handheld video game devices provide essentially no stimulus for increased metabolism.

3405  Board #126  June 2  9:30 AM - 11:00 AM
Multi-sensor Armband Quantification Of Energy Expenditure During Loaded Vs Unloaded Uphill Walking
Amine N. Issa, Nicole M. Herman, Micah W. Johnson, John W. Kelsey, Andrew D. Miller, Thomas P. Olson, Bruce D. Johnson. Mayo Clinic, Rochester, MN.

(Purpose) The BodyMedia® Sensewear armband measures movements (biulxial acelerometry), heat flux and galvanic skin response (GSR) to derive energy expenditure (EE) using customized algorithms. This EE estimation has compared favorably to doubly labeled water techniques, and thus, has been used in a growing number of clinical and non-clinical studies. However, quantifying EE during loaded vs. unloaded treadmill exercise is difficult due to the high reliance of algorithms on motion data. The purpose of the present study was to determine the ability of standard device algorithms for tracking EE during uphill walking with and without a backpack, and if inadequate, to determine how closely the measured physiological metrics tracked EE.

METHODS: Eight healthy males, (age=34±3 yrs, ht=180±8 cm, wt=78±4 kg) were recruited and performed 2 separate walking tests on a motor driven treadmill. The first included walking for 15 min at 2 mph followed by 15 min at 2 mph with 10, 17.5, and 25% grades. Subjects rested, re-hydrated and subsequently repeated the study with a 15% body weight backpack. Measures of metabolic rate were determined with the Sensewear device and compared with indirect calorimetry using a cardiopulmonary gas exchange system (Medical Graphics©).

RESULTS: The average metabolic rates (VO2) for walking without a backpack were 7.3, 18.7, 24.9 and 30.4 ml/kg/min at 0, 10, 17.5 and 25% grade, respectively. These values increased progressively using a backpack (8.4, 21.9, 30.8, 40.0 ml/kg/min, p<0.05). The EE estimation by the armband showed a poor but significant correlation with indirect calorimetry with or without the pack (r=0.49, and 0.45, p≤0.0001, respectively), but significantly underestimated EE under all conditions (p<0.0001). No single metric was found to accurately track energy expenditure. Heat flux (r=0.52, p=0.0005) and GSR (r=0.49, p=0.0041) were the best predictors of energy expenditure in the no pack trial, and GSR was the only variable with a significant correlation (r=0.62, p=0.0008) in the with-pack trials. Using a multiple linear regression model, GSR, heat flux, and biaxial acceleration could only account for 78% of the change in EE.

CONCLUSION: For uphill walking on a treadmill, improved algorithms and additional sensors, such as heart rate, may be necessary to adequately quantify metabolic rate.

3406  Board #127  June 2  9:30 AM - 11:00 AM
A Single-Bout of 30-Min Aerobic Exercise Increases Resting Metabolism and Fat Oxidation in Young Women
Lidia G. De Leon1, Belen Feriche2, Claudia E. Carrasco-Legleu1, Ofelia Urita1, Diana Espino1,1, University of Chihuahua, Chihuahua, Chih., Mexico. 2University of Granada, Granada, Spain.

(Purpose) Physical activity has demonstrated a consistent contribution to weight loss in men and women, but intensity and duration of exercise have different impact on the magnitude of changes in resting metabolism, so results can be very heterogeneous. Describing changes on resting energy expenditure and respiratory quotient is essential to understand their relationship with body weight and clarify the influence of physical activity on weight control.

METHODS: Twenty six sedentary healthy women, 18 to 35 years of age, 19 with normal weight (NW) and 7 overweight or obese (OW) were measured by height, weight and body mass index (BMI). Maximal oxygen uptake (VO2max) was obtained by an exercise stress testing before to perform a single-bout of 30-min treadmill walking at 50% of VO2max. Resting energy expenditure (REE) and respiratory quotient (RQ) were measured by indirect calorimetry before and after the workload. Descriptive statistics and paired t test at a p≤0.05 significance level were used.

RESULTS: Age, height and VO2max were similar in both groups. Body weight was 37% higher in OW than in NW (77.8 ± 10.3 kg VS 56.7 ± 5.6 kg respectively, p>0.001). OW had greater BMI than NW (29.4 ± 2.6 vs 22.1 ± 1.9 kg/m2, p<0.001). Absolute RER was higher in OW than in NW, before the exercise (1.502 ± 0.236 vs 1.260 ± 0.178 Kcal/day/kg, p=0.009) but this relationship was inverted when adjusted by body weight (1.4 ± 0.3 vs 22.2 ± 2.5 Kcal/day/kg respectively, p=0.049). NW increased RER/kg after 30-min workload from 22.2 ± 2.5 to 23.6 ± 2.7 Kcal/day/kg, p=0.050, while OW group had a wide-ranging response (from 19.4 ± 2.9 to 21.4 ± 4.8 Kcal/day/kg respectively, p=0.118). RQ showed a significant decrease after 30-min workload in NW from 0.74 ± 0.09 to 0.70 ± 0.07, p=0.006.

CONCLUSIONS: RER and RQ showed a reciprocal response to a short session of moderate-intensity exercise in NW, but, this level of physical activity was not able to produce effects in OW. It is possible that evident lower fat oxidation rate in OW group, may suppose important repercussions in body weight control.

3407  Board #128  June 2  9:30 AM - 11:00 AM
The Reliability and Validity of the COSMED Fitmate Canopy System for Assessing Resting Metabolic Rate
Dimitria Vandraakis1, Amanda J. Salacinski2, Craig E. Broder, FACSM,1 Exerciseing Nutritionally, Naperville, IL. 2Northern Illinois University, DeKalb, IL, IL.

(Purpose) This study’s purpose was to determine the reliability and validity of measuring resting metabolic rate (RMR) with COSMED’s FitMate™ metabolic system using a canopy dilution set-up compared to a previously validated research grade RMR system (COSMED Quark CPET) in 30 healthy adults (Age: 28.4 ± 7.0 yrs, Weight: 79.9 ± 20.2 lbs, Percent Body Fat: 22.5 ± 8.6 %). Significant differences (p ≤ 0.05) among the average rates of energy expenditure (kcal/min) included WALK > DRUM > HANDHELD (see Table). There were no significant differences in the rates of energy expenditure among groups during recovery. Total energy expenditure was significantly greater (p ≤ 0.05) during WALK (231 ± 80.0 kcal) compared to DRUM (177 ± 31.0 kcal) and HANDHELD (112 ± 24.9 kcal), and greater during DRUM compared to HANDHELD.

CONCLUSIONS: Active video drumming significantly increased energy expenditure compared to handheld, but energy expenditure was greatest during walking. Thus, traditional aerobic exercise remains important for achieving the minimum amount and intensity of physical activity for health. Energy expenditure with handheld video game drumming was nearly identical to no-exercise control, demonstrating that handheld video game devices provide essentially no stimulus for increased metabolism.
**3408 Board #129 June 2 9:30 AM - 11:00 AM**
The Relationship Between Resting Metabolic Rate, Cardiorespiratory Fitness, And Body Composition
Robin P. Shook, E. Patrick Crowley, John C. Sieverdes, Kelly Kavanaughs, Madison Dennylo, Vivek Prasad, Jason Jaggers, Gregory A. Hand, FACSM, Steven N. Blair, FACSM. University of South Carolina, COLUMBIA, SC. (Sponsor: Steven N. Blair, FACSM)

(Purpose not reported)

PURPOSE: Recent research has shown considerable variability of resting metabolic rate (RMR) across various populations, both in absolute values and those adjusted for body weight. This purpose of this study was to examine the relationships between RMR, cardiorespiratory fitness (CRF), body mass index (BMI), and body fat (BF).

METHODS: RMR was measured in healthy adults using a ventilated hood system. Participants arrived fasted for at least 12 hrs and having refrained from alcohol or exercise for at least 24 hrs. Participants rested in a supine position under a ventilated hood for 30 minutes, followed by a 30 minute RMR gas collection period. Height and weight were measured and BMI was calculated as body weight (kg)/height (meters)2. CRF was measured via a metabolic cart during a modified Bruce treadmill protocol. BF was calculated as the percentage of total weight identified as fat tissue by dual x-ray absorptionmetry.

RESULTS: Of the original sample of 55 healthy adults, 48 (22 males and 26 females; mean age 27±3 years) met the criteria for a successful exercise treadmill test (one of the following: plateau of VO2, plateau of heart rate, respiratory exchange ratio ≥1.15, or rating of perceived exertion ≥17). The mean±standard deviation BMI for the sample was 26.7±4.5 (men: 27.0±4.2; women: 26.4±4.7) with a mean percent BF of 30.2 (men: 24.7±7.3; women: 34.8±10.6). RMR ranged from 0.17 to 0.32 L/min (men: 0.25±0.037; women: 0.21±0.03) resulting in a mean relative RMR 2.97±0.34 ml/kg/min (men: 2.99±0.33; women: 2.94±0.35). Mean CRF was 37.6 ± 9.2 ml/kg/min (men: 42.1±7.9; women: 33.8±8.5). A statistically significant relationship was detected between CRF and RMR (r=0.61, p<0.0001) in an unadjusted analysis. After adjusting for BMI, a statistically significant relationship remained between RMR and CRF (p=0.0054). However, after replacing BMI with BF the association between RMR and CRF was no longer significant (p=0.0817).

CONCLUSIONS: The results of this study indicate that after controlling for BF percent, RMR was not associated with CRF in a sample of normal to obese young adults. These findings demonstrate the role of metabolically active fat free mass in RMR, which may be overlooked if BMI is the only indicator of body fatness examined.

This study was supported by the Coca Cola Corporation.

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**3409 Board #130 June 2 8:00 AM - 9:30 AM**
The Effect Of Combined Training On Immune Functioning, Metabolic Variables, And QoL In HIV-infected Individuals
Edward Tiozzo 1, John E. Lewis 1, Arlette Perry, FACSM 1, Allan Rodriguez 1, Dustyantha Jayaweera 1, Janet Konela 1, Angelica Melillo 1, Larry Chen 1, Evan Long 1. 1University of Miami Miller School of Medicine, Miami, FL. 2University of Miami, Coral Gables, FL.

(Purpose not reported)

Highly-active antiretroviral therapy (HAART) has improved the prognosis of HIV-infected individuals. Unfortunately it has also been associated with impaired functional capacity and development of metabolic perturbations which increases health risk.

PURPOSE: This study tested the hypothesis that a combined cardiorespiratory and resistance exercise training (CARET) intervention may result in significant health benefits in HIV-infected individuals receiving HAART.

METHODS: Thirty-seven HIV-infected men and women, predominantly of lower socioeconomic status (SES), were recruited and randomly assigned to: 1) a group of moderate-intensity CARET for three months or 2) a control group receiving no exercise intervention for three months. At baseline and following the intervention, physical characteristics (body weight, body mass index, waist circumference, and blood pressure), physical fitness variables (estimated VO2max), and metabolic variables (fasting glucose and serum lipids), immune functioning (CD4+ T Cell count, CD4/CD8 ratio, and HIV RNA viral load), and quality of life (SF-36 Health Survey) were measured.

RESULTS: Exercise participants evidenced increases in estimated VO2max (21%, p < 0.01), upper body strength (15%, p < 0.05), and lower body strength (22%, p < 0.05), while showing reductions in waist circumference (-2%, p < 0.05), and fasting glucose (-16%, p < 0.05). While the control group showed a significant decrease in CD4+ T cell count (-16%, p < 0.05) from baseline, the exercise group maintained a more stable count following training (-3%, p = 0.39). Finally, the exercise participants showed self-reported improvements in physical (11%, p < 0.03) and mental (10%, p < 0.02) quality of life.

CONCLUSIONS: Our study demonstrated that a three-month, supervised, and moderate intensity CARET program performed three times a week, can result in significant improvements in physical characteristics, physical fitness, metabolic variables, and physical and mental quality of life. Furthermore, the same intervention resulted in more favorable immunological responses following training in HIV-infected individuals of lower SES.

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**3410 Board #131 June 2 8:00 AM - 9:30 AM**
The Effect Of Exercise Intensity On Chemotherapy Completion Rate In Early-Stage Breast Cancer Patients
Lianne B. Dolan 1, Karen Gelmon 1, Donald C. McKenzie 1. 1University of British Columbia, Vancouver, BC, Canada. 2British Columbia Cancer Agency, Vancouver, BC, Canada.

(Purpose not reported)

The association between survival and the maintenance of chemotherapy dose intensity has been established in early-stage breast cancer (EBC) patients. However, the influence of exercise on the planned chemotherapy dose, (RDI), has been poorly documented.

PURPOSE: The purpose of this study is to investigate the effect of exercise intensity during a supervised exercise program on chemotherapy completion rate in women undergoing treatment for early-stage breast cancer.

METHODS: Women with EBC receiving adjuvant chemotherapy who participated in a personalized, thrice weekly, supervised exercise program (E), were matched with similar patients undergoing usual care (UC). Subjects were matched based on treatment (6 cycles of FEC-D between 2008-2010), age and body surface area (BSA). Relative dose intensity (RDI), and variables that may influence a reduction in chemotherapy dose (hospitalization days, neutrophil counts, and hemoglobin concentration) were compared between groups.

RESULTS: Baseline characteristics between each group of 30 women were similar (age: E= 49.1± 8.4 years, UC= 49.0± 8.6 years, P= 0.916, BSA; E= 17.5 ± 0.27 m2, UC= 17.5 ± 0.25 m2, P= 0.925), RDI for patients who chose to incorporate short bouts of high intensity exercise (80-90% VO2max) into their program received 91.9± 8.7% of their planned dose. RDI for UC was similar at 90.1± 9% (P= 0.42). Exercise did not have a negative impact on the myelosuppressive effects of chemotherapy (# of episodes where neutrophil counts dropped below 1.0gL, P= 0.53, decline in hemoglobin concentration, P=0.285), nor did it cause increased risk of hospitalization (P=0.67).

CONCLUSION: Women undergoing FEC-D treatment for EBC can incorporate bouts of higher intensity exercise without negatively impacting their treatment.

Supported by the Canadian Institute of Health Research
CONCLUSION: 0.729±0.4639% vs. 1.39±0.3439%, p=0.37; Ki-67: 24.4 6±4.726 vs 20.88±5.745, p=0.68).

Tumor burden was not different between groups (1.016±0.2082g/cm vs. 1.198±0.2102g/cm; p=0.55) . Tumors both groups showed comparable CD34 and Ki-67 labeling (CD34:

**METHODS:** Female C3(1)SV40Tag mice were assigned to either exercise (Ex) or sedentary (Sed) treatment (n=9/group). Beginning at 4wks of age C3(1)SV40Tag mice were either placed in a cage with a running wheel (Ex) or in a cage with a locked running wheel (Sed). Mice were examined weekly and at sacrifice (24 wks) for palpable tumors, and tumor number and volume was recorded. At 24wks of age mice were sacrificed and all visible tumors were counted, and measured. Heart weight was also recorded as an indicator of training status.

**RESULTS:** Voluntary wheel running significantly reduced average tumor volume by ~ 40% at sacrifice (24 wks) (P<0.05) but not tumor number. When Ex mice were grouped by average wheel running distance, a dose dependent effect of exercise on tumorigenesis was observed; mice running ≥ 3,000/md had a ~70% reduction in tumor volume at sacrifice. Heart weight expressed as a percentage of total body weight was increased following Ex (P<0.05), indicating that this mode of physical activity provides a sufficient training stimulus.

**CONCLUSIONS:** These data provide strong support for the beneficial effect of voluntary running on tumor progression in the C3(1)SV40Tag mouse model of breast cancer as well as preliminary evidence of a dose-dependent effect of this type of exercise on mammary tumorigenesis. However, further research is necessary to fully understand this relationship and the mechanisms involved.

**METHODS:** 6-week old Polyoma Middle T Oncoprotein (PyMT) mice were housed singly with access to freely rotating wheels (voluntary exercise) or locked wheels (sedentary) for one month. Mice were monitored weekly for tumor growth. Quantitative Magnetic Resonance was used to assess body composition. Mammary tumors were quantified for tumor burden, formalin-fixated, paraffin-embedded, and stained with Hematoxylin and Eosin (H&E). H&E stained tumors were histologically scored (grade 1-4); higher scores reflecting increased tumor invasion and poorer prognosis. Tumors were immunostained and digitally quantitated for CD34 and Ki-67. Outcomes were compared using Student’s t-test. Correlational analyses were assessed using Pearson’s correlation.

**RESULTS:** Mice ran a median distance of 17.49km daily. Running distance was not correlated with lean body mass (Pearson r=0.59, p=0.075), fat mass (Pearson r=0.28, p=0.46), heart weights (Pearson r=0.24, p=0.54) or tumor burden (Pearson r=0.28, p=0.47). Normalized lean body mass and fat mass were similar between exercised and sedentary mice (80.87±0.4794% vs. 80.74±0.4794%; p=0.25; 9.22±0.3213 vs. 9.63±0.4317%, p=0.44). Tumor grades were lower in the exercise group compared with the sedentary group (grade 2.0±0.2236 vs. 3.0±0.2946; p=0.01). Tumor burden was not different between groups (1.016±0.2082g/cm vs. 1.198±0.2102g/cm; p=0.55) . Tumors both groups showed comparable CD34 and Ki-67 labeling (CD34: 0.729±0.4639% vs. 1.39±0.3439%, p=0.37; Ki-67: 24.4 6±4.726 vs 20.88±5.745, p=0.68).

**CONCLUSIONS:** Voluntary exercise is associated with reduced tumor grade, suggesting that exercise attenuates tumor invasion and improves prognosis. The absence of effects on tumor burden, proliferation and vascularization may be due to the short duration of exercise training.

**METHODS:** Treatment in treadmill exercised (Ex/DSS, 8-12 m/mi n for 6 weeks- 5x/week) or sedentary (Sed/DSS) C57B l/6 male mice while control mice received water (Ex /H2O, Sed/H20) (n=13/group).

**RESULTS:** At 24wks of age mice were sacrificed and all visible tumors were counted, and measured. Heart weight was also recorded as an indicator of training status. Inflammatory bowel diseases, such as ulcerative colitis, significantly reduce physical functioning and decrease the quality of life in afflicted patients. Preliminary studies have shown that there is a positive correlation between physical activity, reduced inflammatory biomarkers and inflammatory-related disease activity indices.

**CONCLUSIONS:** The present study determined the extent to which exercise-induced alterations in the bone marrow microenvironment can increase success of bone marrow transplantation (BMT).

**METHODS:** In our BMT assay, recipient C57Bl/6 mice remained sedentary (SED) or were exercise trained on a treadmill (Ex; 3d/wk, 8 wks). Both groups of mice had their native marrow ablated prior to receiving GFP-labeled donor marrow. Successful BMT was established by recipient survival, and both donor-derived blood reconstitution, and total (donor- and recipient-derived) blood reconstitution measured by flow cytometry. One and 4 days post-BMT, donor cell homing, as well as apoptosis, determined by activated caspase-3/7 activity, were determined in the bone marrow cavity by flow cytometry.

**CONCLUSIONS:** Exercise training has profound systemic effects which ultimately induce positive adaptations in numerous body tissues. Recently, we have demonstrated increased bone marrow cell survival and proliferation in response to exercise training which may be attributable to increased quality of the niche.

**METHODS:** Voluntary exercise decreases tumor grade in a mouse model of metastatic breast cancer

**RESULTS:** Six weeks of exercise training caused intensified local colon inflammation in mice treated with DSS. While DSS-treated mice exhibited reductions in food and fluid intake, body weight (BW), and locomotor activity (LMA). Mice were euthanized and brains and colons were harvested at 3 days post cessation of DSS administration (Day 8) for analysis of inflammatory gene expression.

**CONCLUSIONS:** Immuno-modulatory Effects Of Aerobic Exercise Training In Dss - Induced Ulcerative Colitis

80.87±0.4794%, p=0.25; 9.22±0.3213 vs. 9.63±0.4317%, p=0.44). Tumor grades were lower in the exercise group compared with the sedentary group (grade 2.0±0.2236 vs. 3.0±0.2946; p=0.01). Tumor burden was not different between groups (1.016±0.2082g/cm vs. 1.198±0.2102g/cm; p=0.55) . Tumors both groups showed comparable CD34 and Ki-67 labeling (CD34: 0.729±0.4639% vs. 1.39±0.3439%, p=0.37; Ki-67: 24.4 6±4.726 vs 20.88±5.745, p=0.68).

**CONCLUSIONS:** Voluntary exercise is associated with reduced tumor grade, suggesting that exercise attenuates tumor invasion and improves prognosis. The absence of effects on tumor burden, proliferation and vascularization may be due to the short duration of exercise training.

**CONCLUSIONS:** Immuno-modulatory Effects Of Aerobic Exercise Training In Dss - Induced Ulcerative Colitis

Inflammatory bowel diseases, such as ulcerative colitis, significantly reduce physical functioning and decrease the quality of life in afflicted patients. Preliminary studies have shown that there is a positive correlation between physical activity, reduced inflammatory biomarkers and inflammatory-related disease activity indices.

**PURPOSE:** The purpose of this study was to determine whether 6 weeks of moderate exercise training reduces inflammation and sickness behavior associated with colitis in a mouse model.

**RESULTS:** Proinflammatory gene expression (2^CT) in the colon were as follows: IL-6 (Sed+H2O: 1.63±1.1; Sed+DSS: 16.44±34.3; Ex+DSS: 390.7±515.6; Ex+H2O:1.34±1.2); IL-1α (Sed+H2O: 1.55±1.3; Sed+DSS: 7.54±13.6; Ex+DSS: 115.22±154.3; Ex+H2O: 2.85±3.73; Sed+DSS: 3.64±0.6; Ex+DSS: 15.56±19.8; Ex+H2O: 1.59±2.1). Statistical analysis showed a significant intervention*treatment (Ex+DSS) effect for IL-6 (F1,32 = 6.83 ; p=0.012), IL-1β (F1,32 =6.33 ; p=0.015) & TNF-α (F1,32 =5.33 ; p=0.025). Sickness outcomes and brain cytokines were not different between groups.

**CONCLUSIONS:** Six weeks of exercise training caused intensified local colon inflammation in mice treated with DSS. While DSS-treated mice exhibited reductions in food and fluid intake, BW. LMA when compared to the water-only groups, prior exercise training did not exacerbate these symptoms associated with colitis. These data demonstrate that exercise can modulate local inflammation in response to DSS-induced acute ulcerative colitis. Further investigation is essential to characterize these effects and elucidate the mechanism that drives this exacerbated immune response in the colon.
CONCLUSION. Exercise training increases recipient survival post-BMT with increased total blood cell reconstitution. Donor-derived reconstitution was not improved, possibly due to enhanced competition for niche availability created by the inhibition of apoptosis with exercise.

3415 Board #136 June 2 8:00 AM - 9:30 AM
Effects of Tai Chi Exercise on T-lymphocyte Subgroups of Non-small Cell Lung Cancer Post-surgery Survivors
Zhang Yajun1, Ru Wang1, Bei bei Luo1, Peijie Chen1, Dinghai Yu2, 1School of Kinesiology, Shanghai University of Sport, Shanghai, China, 2School of Wu Shu, Shanghai University of Sport, Shanghai, China. (No relationships reported)

PURPOSE: T-lymphocyte mediating immunoreactions plays a vital role on immunosuppression. CD4+/CD8+ lymphocytes make main effects on killing cancer cells, and the Th helper to suppressor cell ratio (CD4+/CD8+) implies T cellular immunity balance. Many researches proved that post-6 week tai chi exercise could improve cellular immunity, so we hypothesize that a 16-week tai chi exercise may have positive effect on variations of total T cell (CD3+T lymphocytes) and T-lymphocyte subgroups.

METHODS: Thirty-two post-surgical NSCLC survivors were randomized into two groups, the tai chi exercise group (TCC) and the control group (CON). Among them, 27 (84.38%) completed the study (TCC: n=14, CON: n=13). Subjects in TCC performed 24 type standardized movement every other day for 16 weeks and lasted 45 to 60 minutes every time, and the control group maintained daily lifestyle. Before and after tai chi exercise, peripheral blood sample was collected to isolate lymphocytes, then use flow cytometer to analyze percentage of CD3+/T lymphocyte and CD4+/CD8+ T-lymphocyte subpopulation.

RESULTS: There were significant changes in CD3+/T lymphocyte, CD4+/CD8+ lymphocyte, and the ratio of Th helper to suppressor cells (CD4+/CD8+) in post-surgical NSCLC survivors over a 16-week tai chi exercise. Percentage of CD3+/T lymphocyte (60.26±12.38% vs 55.26±12.44%, P<0.05) and CD4+/CD8+ lymphocyte (35.62±9.83% vs 32.97±8.27%, P<0.05) significantly declined compared to pre-training in TCC. CD4+/CD8+ ratio significantly (1.62±0.78 vs 1.88±0.80, P<0.05) increased compared to pre-training in TCC, but there was no significant change in the control group.

CONCLUSIONS: A 16-week tai chi exercise program enhances T cellular immunity via elevating the ratio of Th helper to suppressor cells.

3416 Board #137 June 2 8:00 AM - 9:30 AM
Regular Tai Chi Chuan Exercise Decreases the Number Of Type 2 Cytokine-producing Cells In Post-surgical Non-small Cell Lung Cancer Survivors
Ru Wang1, Jing Liu2, Yajun Zhang1, Beibei Luo1, Peijie Chen1, Dinghai Yu2. 1School of Kinesiology, Shanghai University of Sport, Shanghai, China, 2School of Wu Shu, Shanghai University of Sport, Shanghai, China. (No relationships reported)

PURPOSE: Tai Chi Chuan (TCC) exercise is beneficial for treatment of diseases such as cardiovascular malignancies and rheumatoid arthritis. Its possible benefits to lung cancer survivors, however, remain to be determined. The effect of a 16-week TCC exercise intervention on CD4+ T helper cells (Th1 and Th2) and CD8+ cytotoxic T cells (Tc1 and Tc2) in post-surgical non-small cell lung cancer survivors was investigated.

METHODS: A controlled study was performed in 13 lung cancer survivors who practiced TCC and 14 control lung cancer survivors who did not practice TCC. The whole blood count, main hormone levels (cortisol, catecholamine, IL-4, IFN-γ, IL-6) of Th1/Th2 and Tc1/Tc2 reaction were measured before (t = 0) and after (t = 16 weeks) a 16-week TCC exercise intervention.

RESULTS: Th2 and Tc2 levels at t = 16 weeks in the TCC group remained unchanged (1.55 ± 0.47 vs 1.1 ± 0.89, P>0.05) and significantly decreased (22.41 ± 8.94 vs18.82 ± 6.7, P<0.05), respectively, while a significant increase in both the Th2 (1.1 ± 0.75 vs2.92 ± 1.26, P<0.05) and Tc2 (17.65 ± 6.19 vs19.13 ± 5.78, P<0.05) levels was observed in the control group at t = 16 weeks. No significant changes in the Th1 and Tc1 levels were observed, except for a significant decrease in the Tc1 level (24.20 ± 10.43 vs20.74 ± 7.74, P<0.05) at t = 16 weeks in the control group. The IFN-γ (Type 1 cytokines including Th1 and Tc1) significantly declined (37.90 ± 11.99 vs34.43 ± 9.05, P<0.05) in the control group and decreased, but not significantly (42.53 ± 11.07 vs40.58 ± 13.16, P>0.05), in the TCC group at t = 16 weeks. The IL-4 level (Type 2 cytokines including Th2 and Tc2) significantly increased (19.08 ± 6.45 vs21.69 ± 6.41, P<0.05) in the control group, but significantly decreased (23.95 ± 8.80 vs20.61 ± 7.13, P<0.05) in the TCC group at t = 16 weeks. A significant increase in the cortisol level was observed at t = 16 weeks in the control group and a significant decrease in the level of catecholamine was observed at t = 16 weeks in the TCC group.

CONCLUSIONS: A 16-week TCC exercise intervention prevented the increase of circulating Th2 and Tc2 cell levels, but not of Th1 and Tc1 cells, in nonsmall cell lung cancer survivors, suggesting that TCC may have a role in ameliorating the balance of humoral and cellular immunity and possibly potentiating human immunity against tumors.

3417 Board #138 June 2 8:00 AM - 9:30 AM
A Muscle-Secreted Protein SPARC Suppresses Colon Tumorigenesis via Apoptotic Effect
Wataru Aoi1, Yuii Naito2, Tomohisa Takagi1, Yuko Tanimura1, Yoshikazu Takanami1, Yukari Kawai1, Hiroshi Ichikawa1, Toshikazu Yoshikawa2, 1Kyoto Prefectural University, Kyoto, Japan, 2Kyoto Prefectural University of Medicine, Kyoto, Japan. (No relationships reported)

Several epidemiological studies have shown that regular exercise can prevent the onset of colon cancer, although the mechanism involved is unclear. Recently, we identified a muscle-secreted hormone levels (cortisol, catecholamine, IL-4) of Th1/Th2 and Tc1/Tc2 reaction were measured before (t = 0) and after (t = 16 weeks) a 16-week TCC exercise intervention.

RESULTS: Whereas only 25% of SED survived, 82% of EX recipients survived the BMT. Homing of donor-derived marrow cells to the recipients’ marrow cavity acutely post-BMT was not altered in EX, but EX mice displayed decreased levels (10%, P<0.05) of activated caspase-3/7 1 day following BMT. The acute inhibition of marrow cell apoptosis in EX resulted in increased total blood cell reconstitution at 3.5 months post-BMT in EX (37%, P<0.05), but did not improve donor-derived reconstitution.

CONCLUSION. Exercise training increases recipient survival post-BMT with increased total blood cell reconstitution. Donor-derived reconstitution was not improved, possibly due to enhanced competition for niche availability created by the inhibition of apoptosis with exercise.

3418 Board #139 June 2 8:00 AM - 9:30 AM
Effect Of Resistance Training On Vcam-1 And Cortisol In Hiv+ Men Recovering From Substance Abuse
John H. Curtis1, Jakob L. Vingren1, Anthony A. Duplanty1, Cariannne M. Cregur1, Julius F. Cantu2, David W. Hill, FACSM1. 1University of North Texas, Denton, TX, 2Homeward Bound, Inc, Dallas, TX. (No relationships reported)

Human immunodeficiency virus (HIV) and substance abuse (drug and/or alcohol) independently impair the cardiovascular and immune systems; importantly, the combination of HIV infection and substance abuse might produce more than an additive effect on these systems. An elevated concentration of vascular cell adhesion molecule 1 (VCAM-1) is a novel risk factor for cardiovascular disease and an elevated concentration of cortisol can influence immune function. HIV infection and substance abuse can cause elevations in VCAM-1 and cortisol.

908
A six-week resistance training program does not elicit changes in VCAM-1 or cortisol concentrations in men infected with HIV who are undergoing an intensive in-patient substance addiction/abuse treatment program.

G-36  Free Communication/Poster - Exercise Immunology and Nutrition

June 2, 2012 7:30 AM - 11:00 AM

Room: Exhibit Hall

3419  Board #140  June 2 9:30 AM - 11:00 AM

Effect of Branched-chain Amino Acids Supplementation on Moderate Exercise Induced Changes In Circulating Lymphocyte Subsets

Koito Matsu, 1 Xiaomin Zhang, 1 Farawati Aria, Jiro Kikuchi, Shiizuka Ogawa, Akira Motokawa, Izumi Tabata, FACSM, 1 Ryoichi Nagatomi, FACSM. 1

1Ritsumeikan University, Kusatsu, Japan. 2Jilin University, Changchun, China. 3Tohoku University School of Medicine, Sendai, Japan.

(Purpose) Intense long-duration exercise could alter basal immune parameter probably due to a significant decrease in the circulating level of plasma glutamine. The decrease in plasma glutamine concentration as a consequence of intense long-duration exercise was shown to be reversed by BCAA supplementation. Moderate exercise induces remarkable changes in circulating number of lymphocyte subsets such as NK, NKT and T cells. However, less is known whether administration of high-dose BCAA would modulate the immune parameters to a single bout of moderate exercise. The aim of the present study is to investigate the effect of BCAA supplementation on the number of circulating immune cells during and after moderate exercise.

Methods: Ten healthy, young male triathletes of age 21.8 ± 1.5 yr participated in the present double-blind, placebo-controlled study. Each subject performed four trial conditions in a random order with at least a seven-day interval: exercise + BCAA (14 g), exercise + placebo, sedentary + BCAA, and sedentary + placebo. Exercise was performed on a bicycle ergometer for 1 h at 60% VO2max. BCAA or placebo supplements were given orally 30 min before exercise. Blood samples were collected 30 min before exercise, immediately after and 2 h post-exercise. Plasma catecholamines (epinephrine, norepinephrine and dopamine) were measured by high-performance liquid chromatography. Plasma cortisol concentrations were determined by radioimmunoassay. Complete blood count analysis was performed using an automated hematology analyzer. Lymphocyte subsets were determined by flow cytometry.

Results: Exercise induced significant elevations in the concentrations of plasma catecholamines. Plasma catecholamines were remarkably increased immediately after exercise. However, no significant change was observed in plasma cortisol. BCAA did not modify the stress hormone responses to exercise. Exercise led to significant increases in numbers of leukocytes and lymphocytes including NK cells, NKT cells, CD8+ and CD8+CD45RO+ T cells. However, no significant modification effect of BCAA was observed on these basal immune parameters to exercise.

Conclusions: BCAA had no modification effect on the hormonal and immune parameter changes in response to moderate exercise.

3420  Board #141  June 2 9:30 AM - 11:00 AM

Endurance-training Effects On Intracellular Calcium And Iron In Cd4+ Lymphocytes In Young And Old Men

Suzanne Broadbent, Dr. Southern Cross University, Lismore NSW, Australia.

(Purpose) Intracellular calcium (Ca2+) and iron (Fe2+) are critically involved in intracellular signalling within CD4+ cells yet little is known of long-term exercise effects on these variables in relation to CD4+ activation and function. We investigated the effects of 12 months of aerobic/endurance exercise on Ca2+ and Fe2+ within CD4+ lymphocytes in old and young men compared to sedentary controls.

Methods: We compared young (30±5 yr) trained (TRY, n=14) and sedentary (UTY, n=12) men to older (69±5) trained (TRO, n=14) and sedentary (UTO, n=10) men for 12 months. The TRY group completed three 60 min sessions per week (60-80% VO2max) while the TRO group cycled for 30 min sessions per week (60-75% VO2max). Venous blood was analysed every month for resting lymphocyte counts. CD4+ cells were separated and stimulated with thapsigargin to quantify Ca2+ using Fluo-3 AM and flow cytometry. Further CD4+ lymphocytes were incubated with Calcium AM to assess Fe2+ (flow cytometry).

Results: The TRY group had a significantly higher Ca2+ concentration than UTY for 4 months (37±7%, p<0.05); no CD4+ count difference between TRY and UTO. Ca2+ was significantly higher in January for all groups (TRY=298±5 nM; UTY=260±15 nM; TRO=160 nM; UTO=210 nM) with significant increases also in September and July. TRY and UTY had significantly higher peak Ca2+ (706±4%, 203±3%) compared to TRO and UTO. Ca2+ was significantly higher in September A but lower in January compared to TRO; TRY was higher in November compared to UTY. There was an inverse relationship between Ca2+ and Fe2+ with significantly lower Fe2+ in January-February (all groups), July (TRY, UTO) and September A (TRY, UTY). TRY and UTY (January) had less Fe2+ (66±6%, 65±6%, p<0.05) than TRY and UTO (February). TRY had significantly higher Fe2+ than UTY in November; UTO had higher Fe2+ than TRO in May.

Conclusions: Training had little effect on Ca2+ and Fe2+ although CD4+ increased in the TRY group. Significant spikes in Ca2+ and Fe2+ may relate to increased intracellular signalling and/or transcription, and seasonal changes in CD4+ function, during January, July and September. Age-related differences in Ca2+ and Fe2+ may be due to changes in intracellular Ca2+/Fe2+ storage and signalling with ageing.

3421  Board #142  June 2 9:30 AM - 11:00 AM

Dietary Nucleotide Supplementation Improves The Immune Response After Strenuous Exercise In A Cold Environment

Daniel Martinez-Puig, Joel Riera, Victoria Pons, Carles Cherit, 1 BIOBERICA S.A., Palafolls, Spain. 2Centre d’AII Rendiment (GIRSANE), Sant Cugat del Vallés, Spain.

(D. Martinez-Puig: Contracted Research - Including Principle Investigator; BIOBERICA S.A.)

Strenuous exercise has been classically associated to immune-suppression and consequently to an increased risk of infections, especially at the upper respiratory tract.

(Purpose) The aim of the present study was to test the impact of a specific nucleotide formulation (Immuneactive, Bioberica, Spain) on the immune function of athletes after a heavy exercise bout in cold conditions.

Methods: Twenty male taekwondo athletes with a mean (±SD) age, height, weight, percent body fat, of 21.46±3 years, 178.1±8.5 cm, 73.86±12.6 kg, 12.5±3.2% were included in a double-blind placebo-controlled trial. Two weeks before the test, all the subjects performed a cycling maximal incremental test to determine his maximal oxygen uptake (VO2max), and the corresponding Watts at 60% (W1) 70% (W2) and 90% (W3) of VO2max were calculated by linear interpolation. The subjects were randomly divided into two groups of 10 subjects and were supplemented with placebo or Immuneactive at 600mg/day during a period of 30 days. On day 0 and on each day the subjects underwent an exhaustion exercise test using a cycleoergometer at work corresponding to W1 for 10 min, W2 for 20 min and W3 until fatigue. Skin temperature (Tsk), core temperature (Tc), heart rate (HR), lactate [La] and rating of perceived exertion (RPE) was recorded during the test. Immediately before, 30 minutes, 150 minutes and 24 hours after the test, blood and saliva samples were obtained for determination of blood cell concentrations, index of total lymphocyte proliferation (LTP) and salivary immunoglobulin A (MgA).

909

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CONCLUSIONS: These findings suggest that supplementation with a nucleotide-based product for 4 weeks could counteract the impairment of immune function after heavy exercise.

### G-37 Free Communication/Poster - Exercise Training and Adaptations

**Board #143**  
**June 2**  
**9:30 AM - 11:00 AM**

**The Effect Of Docosahexaenoic-rich Fish Oil Supplementation On Cytokines Production By Neutrophils And Lymphocytes Before And After A Marathon Race**

Vinicius Concligian Santos, Adriana Cristina Levada-Pires, Samia Rocha Alves, Tânia Cristina Pithon-Curi, Rui Curi, Maria Fernanda Cury-Boaventura.

**1Universidade de São Paulo, São Paulo, Brazil. 2Universidade Cruzeiro do Sul, São Paulo, Brazil.**

(No relationships reported)

PURPOSE: Prolonged intense exercise such as marathon race is associated with transient suppression of immune function and alterations on neutrophils and lymphocytes function.

OBJECTIVE: The aim of this study was to investigate the effect of docosahexaenoic (DHA)-rich fish oil (FO) supplementation on cytokines production by neutrophils and lymphocytes before and after a marathon race.

METHODS: Twenty one athletes participated in this study, eight marathon runners were supplemented with 3 g of FO daily for 60 days (FO group) and thirteen athletes were not supplemented (C group). The cytokines (IL-1ra, IL-2, IL-10 and TNF-α) production by lymphocytes and neutrophils (2 x 10⁶) were determined in the culture supernatant before and after race.

RESULTS: In the C group, marathon race decreased IL-2, TNF-α and IL-10 production by lymphocytes (by 55%, 95% and 50 %, respectively) and IL-1ra (by 80%) production by neutrophils. The FO supplementation decreased IL-1ra (by 48%) and increased IL-10 (by 82%) production by neutrophils but not altered cytokines production by lymphocytes before and after the marathon race.

CONCLUSION: DHA-rich FO supplementation prevented the decrease in cytokine production by lymphocytes and had a partial anti-inflammatory effect on cytokines production by neutrophils.

Rowing is an aerobic-dominated sport with approximate 80% of aerobic energy supply. Therefore, a huge amount of training is required to be emphasized on aerobic endurance. For training practice it is also important to know the load structure of different intensity categories.

**Board #144**  
**June 2**  
**8:00 AM - 9:30 AM**

**Training Of A Female World-elite Rower In Pre-olympic Year**

Yongming Li, Wei Ze, Chunmei Cao, Xiaoping Chen, Ulrich Hartmann.

1Faculty of Sport Science, University of Leipzig, Leipzig, Germany. 2Faculty of Sport Science, Henan University, Kaifeng, China. 3Department of Physical Education, Tsinghua University, Beijing, China. 4Faculty of Sport Science, Ningbo University, Ningbo, China. (Sponsor: Ralph Beneke, FACSM)

(No relationships reported)

Rowing is an aerobic-dominated sport with approximate 80% of aerobic energy supply. Therefore, a huge amount of training is required to be emphasized on aerobic endurance. For training practice it is also important to know the load structure of different intensity categories.

PURPOSE: This study aims to analyze the training intensity distribution of a Chinese women single scull (W1x) in pre-Olympic year, who was successful several times in world championships and Olympic Games (OG).

METHODS: The training load of a W1x sculler (32yrs, 177cm, 71kg, 18yrs of training experience as rower) in pre-Olympic year was analyzed according to the recording of actual training. All the rowing on water and ergometer, as well as cross-training (running and cycling) from October, 2007 to OG in 2008 was documented in minutes. As established by Seiler et al., three zones of intensity were divided by lactate threshold 1 (LT1, approximate 2 mM) and lactate threshold 2 (LT2, approximate 4 mM).

RESULTS: In the observed period, 5827km (127km/week) were covered by the W1x, including 4202km on water, 910km on ergometer, and 715km in running and cycling. When divided by intensity zones, 75.2% of the distance was distributed in zone 1. The percentage of zone 2 and zone 3 was 22.4% and 2.4%, respectively. After dividing the training year into preparatory period (October to middle of March) and competition period (middle of March to OG), it was found that the training at or around lactate threshold (zone 2) decreased significantly from 34.4% in the competition to 24.8% in the preparatory period.

CONCLUSIONS: Compared with the so-called polarized-training model on the basis of diary record of training session, the training of the studied subject on the basis of recording every actual training minute is, otherwise, pyramid-like. This is not in line to the findings of Seiler et al. Quantification of training load based on training sessions can overestimate the high intensity volume (zone 3), which deviates from the physiological background of training in endurance sports.

**Board #145**  
**June 2**  
**8:00 AM - 9:30 AM**

**The Effect Of 8 Weeks Of Race Walk Training On Maximum Oxygen Capacity**

Erika R. Shaver, Anthony Caterisano, FACSM, Ian Whatley, Raymond F. Moss.

Furman University, Greenville, SC.

(No relationships reported)

Race walking is a competitive sport that has somewhat limited popularity in the US despite its inclusion as an Olympic event. Little research has been done on the fitness benefits of this low-impact form of aerobic training compared to other higher impact aerobic activities.

PURPOSE: To test the efficacy of an 8-week race walking program on maximum oxygen uptake (VO₂max) among untrained women.

METHODS: Ten untrained women (mean age = 26.3 ± 1.8 yr.) volunteered to participate in the study. All subjects were tested for VO₂max via open circuit spirometry on a motorized treadmill using a modified Astrand graded exercise protocol pre- and post-training. Over the 8-week training period subjects were instructed on proper race walking technique and individually trained by a coach 2-3 days per week for 20-30 minutes per day, starting with 20 minutes per day but progressing each week until each was training 30 minutes per day 3 days per week. Data were analyzed using a T-test.

RESULTS: Subjects showed a significant increase in VO₂max from 36.73±1.22 ml/kg/min to 39.03±1.28 ml/kg/min (P<0.01), which represents a 6.26% improvement.

CONCLUSIONS: The improvement in VO₂max of 6.26% is in line with similar training results found in studies using the same time frame but different higher impact training modes. These results suggest that race walking is a viable alternative to other high impact modes of aerobic training with the potential for less injury risk associated with these traditional modes.
Board #146  June 2  8:00 AM - 9:30 AM
Change in Aerobic Efficiency Among Novice Female Race Walkers Following 8 Weeks of Training
Anthony Caterisano, FACSM, Erika R. Shaver, Ian Whatley, Raymond F. Moss. Furman University, Greenville, SC.
(No relationships reported)

Race walking is an Olympic track and field event that requires strict adherence to rules on proper walking form. Novice race walkers must master specific techniques for legal race walking or face disqualification for breaking form during a race.

PURPOSE: To measure the aerobic efficiency of novice race walkers and see how it changes during a 4 week and 8 week period of training.

METHODS: Ten untrained, females (mean age = 26.3 ± 1.8 yr) volunteered and were tested for baseline VO2max via open circuit spirometry on a motorized treadmill, using a modified Astrand graded exercise test. Following an orientation day in which subjects learned proper race walking technique, they returned to the lab and were tested for VO2 while race walking at 14 MPH on a motorized treadmill. Subjects were individually trained 2.5 days per week for 20-30 minutes per workout, with a gradual progression from 20 min/workout, 2 days/wk, to 30 min/workout 3 days/wk. The 14 MPH race walking testing protocol was performed after week 4 of training. After week 8 of training the VO2max and the 14 MPH race walking test were repeated. The VO2 data were expressed as a % of VO2max for each testing interval. In addition, stride length and frequency were monitored during the 14 MPH trials using a Dartfish™ analysis. An ANOVA with a Tukey post hoc test was used to analyze differences between means.

RESULTS: As training progressed from week 1 through week 8 the subjects showed a significant decrease in the % of VO2max needed to maintain the 14 MPH race walk. Statistical analysis showed a significant difference between % of VO2max as follows: Week 1 (67.26 ± 2.90%) week 2 (66.54 ± 2.69%) and week 8 (63.01 ± 2.12%, p = 0.05). This was accompanied by a significant increase in stride rate as follows: week 1 (141.85 ± 7.16 strides/min.) week 4 (142.85 ± 8.62 strides/min.) and week 8 (145.38 ± 9.16 strides/min., p = 0.05).

CONCLUSIONS: The results of this study suggest that aerobic efficiency among novice race walkers can be improved in 8 weeks of training and that the improvements appear to be related to increased stride frequency.

Board #147  June 2  8:00 AM - 9:30 AM
Effect Of Different Dose Of Exercise Volume And Intensity On Peak O2 Consumption In Adult Men
jiashi Lin, Yi Yan, Hao Su, Yueqin Yang, Xiang Guo, Yan Zhao, Minhao Xie. Beijing Sports University, Beijing, China. (Sponsor: LiLij, FACSM)
(No relationships reported)

PURPOSE: To determine whether exercise prescriptions differing in volume or intensity also differ in their CRF. The exercise prescription required for the optimal enhancement is not known, moreover, the mechanisms for the different effects of volume or intensity on peak O2 consumption (VO2peak) remain sparse. This study was to determine whether exercise prescriptions differing in volume or intensity also differ in their CRF after 12 weeks training, and investigate the mechanisms for increases in VO2peak with different dose.

METHODS: A total of 67 sedentary subjects aged 40-49yr were assigned to participate for 12 weeks in a control group or in one of three exercise groups: 1) low volume/moderate intensity (LVMI, equivalent of ~19km/wk, 1200kcal/wk at 65-80%VO2peak) and 2) high volume/vigorous intensity (HVVI, ~32km/wk, 2000kcal/wk at 65-80%VO2peak). Participants were instructed to not change their usual diet throughout the study. The 47 subjects who completed with these guidelines served as the basis for the main analysis. VO2peak was measured and time to exhaustion (TTE) were tested before and after 12 weeks training. Maximal cardiac output (Q) and stroke volume (SV) were calculated from the equation: a-vO2diff = VO2peak (L/min)/Q(L/min)×100. Cardiac output (Q) and stroke volume (SV) were measured using echocardiography, maximal arterial-venous O2 difference (a-vO2diff) was calculated from the equation: a-vO2diff = VO2peak (L/min)/Q(L/min)×100.

RESULTS: All exercise groups increased VO2peak and TTE compared to the baseline. VO2peak increased significantly (p<0.05) in both LVVI (29.36 ± 4.18ml/kg/min vs 34.33±4.18ml/kg/min) and HVVI (32.11±7.67ml/kg/min vs 37.35±5.80ml/kg/min ) groups, 16.9% and 16.4% respectively; the LVVI resulted in greater improvement than the HVVI(29.36 ± 4.18ml/kg/min vs 37.35±5.80ml/kg/min, p<0.05).

CONCLUSIONS: Although exercising at level of 19km/wk at 40-55%VO2peak is sufficient to increase VO2peak, the vigorous intensity is more variable for increase VO2peak duration. The improvement of Q and SV are better than a-vO2diff for enhanced VO2peak.

Board #148  June 2  8:00 AM - 9:30 AM
ACSM Recommended Exercise Reduces Intrahepatic Triglyceride And VLDL-TG Secretion Rate In Obese Individuals With Nafld
Erik Kirk1, Shelby Sullivan2, Bettina Mittendorfer2, Bruce Patterson2, Samuel Klein3, Southern Illinois University Edwardsville, Edwardsville, IL. Washington University in St. Louis School of Medicine, Saint Louis, MO.
(No relationships reported)

Nonalcoholic fatty liver disease (NAFLD) and alterations in hepatic lipoprotein kinetics are common metabolic complications associated with obesity. Caloric restriction is often advocated for treating NAFLD; however, the effects of exercise alone on intrahepatic triglyceride (IHTG) content and VLDL-triglyceride (VLDL-TG) secretion rate is unknown.

PURPOSE: The aim of this study was to evaluate the effect of the American College of Sports Medicine physical activity guidelines for adults on IHTG content and VLDL kinetics in obese persons with NAFLD.

METHODS: Eighteen obese people BMl=38.1±4.6 kg/m2 with NAFLD were randomized to 16 weeks of verified exercise training (45-55% VO2peak, 30-60 min x 5 days/week; n=12) or observation (control; n=6). Liquid formula dietary supplements were provided to prevent exercise-induced weight loss. Magnetic resonance spectroscopy and stable isotope tracer infusions in conjunction with compartmental modeling were used to evaluate IHTG content and hepatic VLDL-TG secretion rates.

RESULTS: Exercise training resulted in a 10.3±4.6% decrease in IHTG content (p<0.05), but did not change total body weight (103.1±4.2 kg and 102.9±4.2 kg before and after training) or percent body fat (38.9±2.1% and 39.2±2.1% before and after training). Although not significant (p=0.07), exercise training did show a 5% reduction in VLDL-TG secretion rate (17.7±3.9 µmol/min and 16.8±5.4 µmol/min before and after training).

CONCLUSIONS: Performing physical activity as recommended by the ACSM reduces IHTG content and hepatic lipoprotein kinetics in obese persons with NAFLD.

Board #149  June 2  8:00 AM - 9:30 AM
Recumbent Cross-Training is a Viable Exercise Option for Overweight Adults
Heidi B. IglesReger, Timothy A. Muth, Christine A. Robert, Mark D. Peterson, Paul M. Gordon, FACSM. University of Michigan, Ann Arbor, MI.
(No relationships reported)

Though recumbent fitness equipment is a valuable exercise and rehabilitation tool, particularly for older or physically disabled populations, it is an underutilized modality in other populations. Overweight individuals often gravitate towards recumbent equipment, as these low-impact modalities are better tolerated. However, the metabolic cost of recumbent exercise is not clearly defined in this population, precluding its endorsement by health care professionals.

PURPOSE: To assess the metabolic cost of recumbent cross-training (RXT) and recumbent bicycling (RBT) in overweight adults at prescribed and self-selected intensities.

METHODS: Subjects performed exercise on a recumbent cross-trainer (utilized arms and legs) and a recumbent bicycle at 60% of treadmill VO2 max (intensity) and at a self-selected intensity (iintensity). The orders of these testing days and intensities were counterbalanced. Resistance was varied to achieve these intensities while cadence remained constant (80 rpm). Subjects were blinded from workloads. VO2 and VE dynamics (k=82, Cosmed, Rome, Italy), heart rate (Polar Team2, Polar Electro, New Hyde Park, NY), blood pressure and ratings of perceived exertion (RPE) were measured throughout exercise. Subjects completed a questionnaire after both intensities of exercise on each piece of equipment (4 total) to assess overall ratings of the exercise equipment. Differences between conditions were assessed via paired t-tests. Data presented as mean±SE.

RESULTS: Sixteen (n=8 female) overweight (BMI 31±1 kg/m2) adults (40±3y, range 20-54y) completed this study. Both objective (HR and VO2) and subjective (RPE) exertion were higher
3429 Board #150 June 2 8:00 AM - 9:30 AM
The Effect Of Rubber Tube Harness Training Device On Selected Physiological Variables In Young Male Subjects
Anita Haudum, Jürgen Birklbauer, Roland Sieghartsleitner, Christoph Gonaus, Serge P. von Duvillard, FACSM, Erich Müller. University of Salzburg, Hallein-Rif, Austria.

PURPOSE: We investigated the effect of rubber tube harness training device where the rubber tubes were attached between the ankle and the lower back on selected physiological and metabolic variables during constant running speed of 30 min in healthy male subject (mean±SD: age 26.3±8.4 yrs; Wt: 74.4±2.5 kg; Ht: 178.0±8.7 cm; BMI: 23.3±1.6 kg.m-2).

METHODOLOGY: 18 subjects were divided into 2 groups. One group (N=10) served as experimental (EG) and the other (N=8) as comparison group (CG). Both groups underwent the same tests of 30min at constant speed of 10.5 km.h-1. Test 1 (T-1) was conducted in the beginning with and without rubber tube harness in both groups, followed by Test 2 (T-2) after 7 wk, and again 7 wk after the last test (T-3). Both groups trained for a total of 18 training sessions for 7 wk for 45 min during first wk, increasing time to 50 min (at wk 2) and 55 min at wk 4-7; however, the CG group trained without rubber tube harness throughout 7 wk and conducted the same constant running training sessions.

RESULTS: Statistical analysis, repeated measure analysis of variance revealed no statistically significant difference for oxygen uptake, minute ventilation, breathing frequency, tidal volume, volumetric and calorific unit cost (P>0.05). The only metabolic variable that was significant was blood lactate (LA) (P<0.05). There were statistically significant differences in blood LA in T-1 between both groups running with and without rubber tube only (P<0.05). At T-2, there was a significant reduction in blood LA for EG with rubber tube harness running from T-1 to T-2 (P<0.006) and for CG between T-1 and T-2 for running without the tube s (P<0.05). There were no statistical differences at T-3.

CONCLUSIONS: Our results suggest that the use of this training device does not appear to yield additional training benefits but the use of rubber tube harness device may be useful as a training modality. However, changes in testing protocol, intensity of training, duration and frequency may also alter the test results as well as better control of the comparison group.

3430 Board #151 June 2 8:00 AM - 9:30 AM
Comparison of Alter-G Treadmill Run Training to Land Treadmill Training
Dustin P. Joubert1, Brad S. Lambert1, Nicholas P. Greene2, Stephen F. Crouse, FACSM1. 1Texas A&M University, College Station, TX. 2University of Virginia, Charlottesville, VA.

PURPOSE: We investigated the effect of Alter-G (AG) treadmill utilizes a lower-body inflation chamber to decrease an individual’s body weight and impact while running. There is little research investigating the long-term training effects of this device, particularly in comparison to land treadmill (LT) training.

METHODOLOGY: Ten subjects (5 male, 5 female; 37 ± 12 yrs; 83 ± 29 kg) performed a Bruce treadmill protocol to determine VO2max at the beginning and end of 12 weeks of AG training at 70% body weight. Subjects trained 3 days/week progressing from 60-85% VO2max and from 250-500 kcal/session. DEXA body composition was also assessed. AG subjects were then matched with 10 subjects (5 male, 5 female; 41 ± 11 yrs; 86 ± 18 kg) who had previously completed the same training prescription for LT at full body weight and underwent the same physiological testing. For all independent variables, the change (End - Beginning) was calculated for each group. The change data were analyzed using a 2 (group) x 1 (change) SAS mixed model ANOVA with a Tukey's post hoc test for group. The main effect for group was used to determine between group significance. Within group significance was determined using p-values for least square means estimates for each group’s change scores.

RESULTS: See table.

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<tr>
<th></th>
<th>Body Mass (kg)</th>
<th>% Fat</th>
<th>Fat Mass (g)</th>
<th>Lean Mass (g)</th>
<th>PM Atms (g)</th>
<th>PM Track (g)</th>
<th>Brake Time (min)</th>
<th>VO2max (ml/min)</th>
<th>VO2max (ml/kg/min)</th>
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<tr>
<td>AG (n=5)</td>
<td>70.4 ± 2.5</td>
<td>21.8 ± 2.0</td>
<td>24.3 ± 1842</td>
<td>1068 ± 1855</td>
<td>27 ± 192</td>
<td>498 ± 1247</td>
<td>15.5 ± 0.85</td>
<td>460.5 ± 160.4</td>
<td>22 ± 2.0</td>
</tr>
<tr>
<td>LT (n=5)</td>
<td>72.2 ± 2.3</td>
<td>25.5 ± 1.3</td>
<td>248 ± 1423</td>
<td>324 ± 1712</td>
<td>13.2 ± 225</td>
<td>636 ± 1256</td>
<td>15.8 ± 0.77</td>
<td>272 ± 200.8</td>
<td>37 ± 3.6</td>
</tr>
<tr>
<td>Between groups</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>Mean±SD</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>101.7</td>
<td>3.93</td>
<td>1.154</td>
<td>0.091</td>
<td>1.467</td>
<td>0.055</td>
<td>1.313</td>
<td>1.281</td>
<td></td>
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<tr>
<td>Values mean change ± SD</td>
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</tbody>
</table>

Values mean change ± SD.

CONCLUSIONS: AG training did equally well in improving VO2max but achieved lower gains in Brake time compared to LT. AG increased lean mass, while LT decreased fat mass in more regions. This was in line with the overall tendency towards slight body mass increases in AG and slight weight loss in LT. Overall, AG had a positive effect on fitness markers, but was less specific at improving run performance.

Partial support from HydroWorx International, Inc. and AlterG, Inc.

3431 Board #152 June 2 8:00 AM - 9:30 AM
Metabolic Cost Comparison Of Running On An Aquatic Treadmill With Water Jets And Land Treadmill With Incline
Ryan Porter, Sarah Blackwell, Gerald Smith, FACSM, Dale Wagner, Dennis Dolny. Utah State University, Logan, UT.

PURPOSE: This study investigated whether running on a land treadmill (TM) at specific inclines provides a comparable energy expenditure (EE, oxygen consumption).

METHODOLOGY: Sixteen participants completed two trials on separate days on a TM and ATM. For each trial subjects performed eight, 3- min submaximal runs at three self selected speeds (slow, medium, and fast) with either water jet resistances of 0-100% of maximum jet flow capacity in 20% increments during ATM or inclines of 0-10% in 2% increments during TM. Trials were separated by at least 48 hours. Oxygen consumption (VO2), heart rate (HR), and rate of perceived exertion (RPE) were recorded during each trial. Repeated Measures ANOVA (GLM) with post hoc analysis identified location of significant differences.

RESULTS: VO2 increased (p<0.001) in linear fashion during TM with each increase in incline. When running at similar speeds with no resistance (jets or incline) or with 20% jets ATM yielded lower (p<0.001) VO2 than TM. ATM with 40% jets matched EE during TM at 0% incline. ATM with 60% jets EE was similar to TM with 4% incline while EE was greater (p<0.01) during ATM 80% and 100% jets compared to TM with 8% and 10% incline. Comparable relationships were observed for HR while RPE was similar for ATM and TM except at 80 and 100% jets in ATM that were greater (p<0.01) compared to TM 8 and 10%.

CONCLUSIONS: While TM yields a linear increase in EE in increasing incline, ATM with jet flows yield a non-linear increase with little change in EE with jet resistance changes from 0-20%, linear increase in EE from 20-60% with an exponential increase in EE from 60-100%. This relationship may be a result of non-linear application of drag forces on the torso created by the velocities of the water jets. With appropriate selection jet resistances in ATM can be used to mimic EE during inclined TM running on land.
Comparing with breathing normoxia, hypoxia improves exercise performance and decreases blood lactate concentrations in steady-state and hypoxia enhances responses of cardiac output, heart rate, ventilation, and sympathoadrenergic activity during exercise. High-intensity interval training (HIT) provides an up-regulated contribution on both of aerobic and anaerobic metabolism which enables the availability of ATP and improves the energy status in working muscle. Breathing intermittent hypoxia or hypoxia during HIT may provide different effects in endurance determinants.

PURPOSE: To compare the effects of inspiring hypoxia, normoxia or hypoxia in recovery intervals during HIT on VO2max, ventilatory threshold (VT) and time to fatigue (Tlim).

METHODS: Twenty four healthy male participants were randomly assigned to hypoxia (N=8, 22.3±3.5 yrs, 16% O2), normoxia (N=8, 22.3±1.9 yrs, 20.9% O2) or hypoxia (N=8, 21.9±3.3 yrs, 60% O2) groups and assessed by continuous incremental run test on treadmill before and after training. Participants performed HIT (7 bouts, 4-min interval at 90% VO2max, 2-min rest between intervals) with different oxygen concentration provided in recovery intervals in 2 weeks (3 x wk^-1).

RESULTS: There was no significant difference among all variables before training (p>0.05). After training, the hypoxia and normoxia groups significantly improved VT (hypoxia: 2.73±0.22 vs. 2.94±0.13 m/s; normoxia: 2.56±0.3 vs 2.82±0.41 m/s, p<0.05) and Tlim (hypoxia: 1094.4±50.5 vs. 1140.0±78.5 seconds; 1090.0±52.1 vs. 1121.9±41.6 seconds, p<0.05). The hypoxia group also increased the VO2max (3.63±0.71 vs. 3.90±0.66 L/min, p<0.05). However, there was no significant difference in VO2max, VT and Tlim in hypoxia group after training.

CONCLUSIONS: Intermittent hypoxia during HIT may improve more aerobic capacity than breathing normoxia in the recovery intervals. However, breathing higher oxygen concentration in recovery intervals during HIT may inhibit the improvement of aerobic capacity.

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**Hyperventilation-induced Alkalosis as a Strategy for Improved Intermittent Sprint Performance**

Akihiro Sakamoto, Hisashi Naito. Juntendo University, Chiba, Japan.

Durin high-intensity exercise, a fall in intra- and extracellular pH is a major cause of muscle fatigue. Induced alkalosis by ingesting sodium bicarbonate has been shown to improve performance when the exercise task is repeated and incurs a substantial metabolic challenge. Hyperventilation can provide similar effects on blood pH however its effect on exercise performance has been studied using low intensities or a single bout of exercise (unsuitable exercise for maximally eliciting buffering effects), thus producing no ergonomic effect.

PURPOSE: To investigate the effect of hyperventilation performed during recovery separating repeated maximal pedaling.

METHODS: This was a randomized, crossover, counter-balanced study, where subjects performed both control and hyperventilation conditions on two occasions. Ten power-trained males (age: 21±1 years) performed a 10 x 10 s maximal pedaling on a bicycle ergometer (7.5% body mass, kg) with 60 s recovery between sets. Spontaneous breathing was performed during recovery for the control. For the hyperventilation condition, subjects breathed at 60 breaths/min during the last 30 s of recovery, with expired breaths being monitored breath-by-breath and the tidal volume adjusted so that the end-tidal PCO2 was below 25 mmHg before each sprint. Peak and mean power outputs, blood pH, PCO2 and [La-] were measured during the exercise.

RESULTS: Blood pH was elevated and PCO2 was lowered by hyperventilation at any time points measured (p<0.001). Condition effect was not significant for both peak and mean power outputs. A significant condition x time interaction (peak power: p = 0.035, mean power: p = 0.021) however meant that the progressive reduction of power output was attenuated by hyperventilation. [La-] had been expected to become higher for hyperventilation, associated with greater H^+ efflux and sustained glycolytic energy supply, but were similar between conditions. Increased activity of respiratory muscles may have accelerated [La-] clearance and countered the anticipated increase of [La-], although the exact mechanism remains unknown.

CONCLUSION: Hyperventilation-induced alkalosis enhanced performance recovery during repeated maximal pedaling in the later exercise bouts. No grant for this study.

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**Endurance Performance, Total Haemoglobin Mass and Blood Volume Post Recombinant Human Erythropoietin Use in Trained Individuals**

Jérôme Durussel, Tushar Chatterji, Evangelia Duskalaki, Ditesibachew Haile, Zenn Bekele, Neal Padmanabhan, Sandosh Padmanabhan, Rajan K. Patel, Timothy D. Noakes, Günter Gmeiner, John D. McClure, Yannis P.itsiladis, FACSIM, 1 University of Glasgow, Glasgow, United Kingdom. 2 Addis Ababa University, Addis Ababa, Ethiopia. 3 University of Cape Town, Cape, South Africa. 4 Seibersdorf Labor GmbH, Seibersdorf, Austria.

Recombinant human erythropoietin (r-HuEpo) increases total haemoglobin mass (Hb), induces heamconcentration and enhances exercise performance. Less is known about the time course of these mechanisms post r-HuEpo administration.

PURPOSE: To determine the effects of r-HuEpo during and post administration on Hb and related haematological profiles, plasma (PV) and blood (BV) volume and running performance.

METHODS: 10 endurance trained subjects (age: 26 ± 4.4 yrs, body mass: 68.8 ± 3.0 kg, height: 179.0 ± 5.9 cm) received r-HuEpo injections of 50 IU kg^-1 body mass every two days for 4 weeks. Hb, PV and BV were weekly determined using the optimized CO-rebreathing method before 4 weeks after administration. 3,000 m time trials were performed pre, post administration and at the end of the study. Changes over time in Hb, PV and BV were assessed. Data were analyzed using t-test or repeated measures ANOVA as appropriate.

RESULTS: During r-HuEpo administration, Hb increased significantly by 0.59 g kg^-1 wk^-1 (95% confidence interval (CI) 0.45 to 0.73, p<0.001) from 13.2 ± 0.8 to 15.6 ± 1.2 g kg^-1. PV significantly decreased by 1.91 ml kg^-1 wk^-1 (CI -2.64 to -1.17, p<0.001) from 57.5 ± 4.1 to 51.2 ± 2.9 ml kg^-1 and BV remained unchanged (-0.13 ml kg^-1 wk^-1 95% CI -1.21 to 0.95, p = 0.78). From week 1 to week 4 post r-HuEpo administration, the rate of decrease in BV was similar to that of the increase during administration (-0.70 g kg^-1 wk^-1, CI -0.91 to -0.49, p<0.001) but Hb was still significantly elevated at 4 weeks post administration compared to baseline (14.0 ± 0.9 vs. 13.2 ± 0.8; p = 0.030). PV remained decreased post administration (0.06 ml kg^-1 wk^-1, CI -1.30 to 1.43, p = 0.92), while a significant decrease in BV was observed from 96.6 ± 7.1 to 90.4 ± 5.0 ml kg^-1 (-1.88 ml kg^-1 wk^-1, CI -3.68 to -0.07, p = 0.043). Running performance improved by 5.5 ± 2.2% post administration (9.99 ± 0.87 min vs. 10.59 ± 1.04 min; p<0.001) and remained enhanced by 3.5 ± 2.5% 4 weeks after r-HuEpo compared to baseline (10.24 ± 1.01 min vs. 10.59 ± 1.04 min; p = 0.014).

CONCLUSION: Running performance was improved following 4 weeks of r-HuEpo administration and remained elevated 4 weeks post administration compared to baseline. These performance effects coincided with r-HuEpo-induced elevated Hb and reduced PV compared to baseline.

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**High Volume Rowing Training Increases Serum Hepcidin And Ferritin**

Burkhardt Schleipen, Martina Velders, Katja Machus, Gunnar Trefl, Constantin Mayer, Carola Wagner, Jürgen M. Steinacker, FACSIM. University of Ulm, Ulm, Germany.

Hepcidin is a central regulator of iron metabolism through its ability to bind to the iron transporter ferroportin. Hepcidin is produced in the liver and suppresses intestinal iron absorption and stimulates iron retention in the reticuloendothelial system. Hepcidin expression increases in response to chronic infections. We hypothesized that a high intensity and high volume training increases hepcidin production.

PURPOSE: To analyze the effects of an intense rowing training with high volume on iron metabolism and hepcidin levels.
Methods: 8 male rowers (17.8±0.4 years, 84.3±8.3 kg, 191.1±4.4 cm) of the German Junior National Team were examined 5 times during a 4 week training camp in preparation for the world championships. Training intensity and volume were increased in the first two weeks followed by a tapering phase. Hepcidin, ferritin, transferrin (Tf) and soluble transferrin receptor (sTfR) were analyzed in serum samples by ELISA.

Results: Hepcidin increased significantly during the intense phase of the training camp (11.5 ± 3.9 - 25.5 ± 13.5 μg/l, p<.05). Ferritin, with its double role as an acute phase protein and iron store, increased non-significantly in the early phase of the training camp (68.5 ± 16.9 - 90.4 ± 28.5 μg/l/μl). Both ferritin and hepcidin levels decreased during the later phase of the training camp and returned to baseline levels at the end. Tf and sTfR remained at baseline levels at all time points. Iron increased significantly during the initial phase of intense training and remained at elevated levels throughout the training camp (11.7 ± 3.2 - 19.2 ± 8.7 μmol/l).

Discussion: The significant rise of hepcidin and the increase of ferritin in the beginning of the high volume/intensity training is most likely an acute phase reaction to the unaccustomed training load. With training adaptation and during tapering ferritin and hepcidin levels decreased to baseline levels after 3 weeks. Iron stores were not changed according to unchanged Tf and sTfR levels. However, the increased iron levels indicate a disturbance in iron metabolism. Our results show that high volume/intensity training leads to increased hepcidin levels. Further research is required to investigate the regulation of hepcidin through different training regimes and its impact on iron metabolism.
Effect Of Ultra-endurance Swimming In Open Water On Autonomic And Hormonal Responses: A Case Study

Giuseppe Cibelli 1, Mario De Rosas 1, Maria L. Roselli 1, Antonio I. Triggiani 2, Anna A. Valenzano 1, Giulia De Ioannou 1, Maria F. Piacentini 2, Laura Capranica 2.

1University of Foggia, Foggia, Italy. 2University of Roma Foro Italico, Roma, Italy. (Sponsor: Carl Foster, FACSM) (No relationships reported)

PURPOSE: To investigate the effect of ultra-endurance swimming on the autonomic nervous system (ANS), the hypothalamic pituitary adrenocortical (HPA) axis, and sympathetic-adrenomedullary (SAM) responses.

METHODS: A male athlete (48 years, 68 kg, 172 cm, BMI 23.2 kg/m2) performed an ultra-endurance swimming in open water (42.2 m; 78.154 Km). Salivary cortisol (sC), alpha-amylase (sAA) and heart rate variability (HRV) were monitored at rest, 15 minutes before the start, at 90 min and 18 hrs of the recovery phase. Salivary biomarkers were analyzed using commercial kits. The HRV was measured in 5-min segments of paced breathing and quantified by time and frequency domain analysis and the Poincaré plot analysis. Intervals between heartbeats (R-R intervals), square root of the mean squared successive differences between normal-to-normal RR intervals (RMSSD), the ratio (%) of successive R-R interval differences >50ms (pNN50), low-frequency power (LF) (from 0.04 to 0.15 Hz), high frequency power (HF) (from 0.16 to 0.40 Hz), instantaneous beat-to-beat variability (SD1) and continuous beat-to-beat variability (SD2) of the data were considered.

RESULTS: The athlete finished the ultra-endurance swimming in 23:44 hr:min. During the swimming, heart rate ranged between 120-125 beats.min⁻¹. At 90 min after arrival, marked sAA (58.1 to 117.7 U/ml) and sC (3.5 to 81.0 nmol/l) increases were observed, which returned to pre-swimming levels at 18 hrs of recovery. Compared to rest, lower R-R intervals (925.7 to 695.8 ms), RMSSD (23.1 to 14.6 ms), pNN50 (2.0 to 0.0 %), LF (824 to 197 ms²), HF (174 to 47 ms²), and SD1 (19.0 to 10.3 ms²) values were observed at 90 min after arrival, which persisted at 18 hrs of recovery.

CONCLUSION: Low-intensity long-duration swimming elicits a relevant ANS, HPA and SAM responses. In particular, HRV analysis evidenced a strong decrease of HRV parameters, thus reflecting short- and long-term variability, while the sympathovagal balance remained unchanged. Interestingly, hormonal markers returned to pre-swimming levels after 18 hrs of recovery, while HRV variables did not turn back, suggesting that the cardiac response to low-intensity long-duration workload could be differently influenced by both adaptive central and peripheral autonomic and hormonal patterns.

Intramuscular Temperature Responses of 4 Lower Extremity Muscles to Whole Body Vibration Training

Cameron Shumway, Kevin Myers, J. Brent Feland, Kent Crosseley, A. Wayne Johnson, Dennis Eggett. Brigham Young University, provo, UT. (Sponsor: J. Ty Hopkins, FACSM) (No relationships reported)

Prior research, although very limited, has reported that whole body vibration training (WBV) can increase arterial blood flow and increase quadriceps temperature. The current popularity and widespread use of WBV platforms has suggested they are good for a warm-up effect, but only two studies exist which have only observed quadriceps temperature changes.

PURPOSE: The purpose of this study was to investigate the effect of WBV training on intramuscular temperature (IMT) changes in the vastus lateralis (VL), medial gastrocnemius (MG), tibialis anterior (TA), and the semitendinosus (ST) - and to compare these results to a non-vibrating control condition.

METHODS: 40 male subjects (avg age 22.6 ± 2.4 yrs) with ±1 cm or less subcutaneous fat over each muscle of interest completed this study. Subjects were randomized into one of the 4 different muscle groups (10 per subject). Subjects then completed two treatment periods (control and vibration). Treatment orders were balanced. Resting baseline IMT of the muscles were made using intramuscular thermistors ( VL and ST (1.5 cm depth) , TA and MG (.5 cm depth)). IMT’s were measured two more times: immediately following 5 60-second bouts of standing in a semisquat position (40 degrees of knee flexion and 30-seconds between bouts), and then immediately following a second set of similar bouts. The vibration condition differed from the control by imposing oscillating WBV at 26Hz/4mm amplitude during the semisquat bouts.

RESULTS: Data were analyzed using a mixed models analysis of covariance blocking on individual subjects, with baseline temperature being the covariate. Tukey post hoc comparisons used where needed. A significant increase in all 4 muscles occurred with vibration (p<0.0001). In the control condition, the ST did not increase (p=0.3890) and the MG significantly decreased in temperature (p=0.0001). Main effect of condition did not significantly change from 1st to 2nd bout of semisquats.

CONCLUSIONS: WBV produced greater temperature gains than the control condition for all muscles, with the greatest change seen in the VL (2.06 C). WBV training in standard static semisquat position is effective for increasing IMT of these 4 muscles, but how this compares to other forms of traditional warm-up remains unknown.
CONCLUSION: The evidence provided by this study supports the notion that walking with poles has an increased effect on lowering BP, and reducing weight and girth measurements, which may contribute towards a reduction in MeI Syn risk.

G-38 Free Communication/Poster - Fitness
JUNE 2, 2012 7:30 AM - 11:00 AM
ROOM: Exhibit Hall

3443 Board #164 June 2 9:30 AM - 11:00 AM
Get Fit Together Intervention: Group Fitness Participation Produces Positive Health Benefits
Jinger S. Gottschall1, Justin L. Jones1, Jackie Mills2, Bryce Hastings2, The Pennsylvania State University, University Park, PA. 1Les Mills International, Auckland City, New Zealand. (Sponsor: W. Larry Kenney, FACSM)

It is no longer surprising to hear the alarming statistics regarding the rise of obesity without a parallel surge in physical activity within the United States. In response to this troubling trend, multiple federal agencies, including the American College of Sports Medicine, recommend 60 minutes of cardiovascular activity 3-5 days per week and 8-10 muscular strength as well as flexibility exercises 2 days per week. Numerous studies have quantified how these established guidelines improve cardiovascular function, augment bone density, reduce total body fat, and enhance daily living performance. These previous findings are based upon the utilization of a singular exercise modality or the quantification of lifestyle physical activity. Group fitness is one method presently promoted to meet exercise recommendations but the effectiveness of a comprehensive program has never been experimentally tested.

PURPOSE: To evaluate if a multimodal group fitness intervention can singularly produce physiological and musculoskeletal health benefits by utilizing the established physical activity prescription.

METHODS: 29 sedentary, but otherwise healthy, adults (11 men and 18 women) between the ages of 25-40 years completed the midpoint testing of a 30-week group exercise program based upon the recommended guidelines. The protocol started with a 6-week familiarization period, continued with a 12-week block of 6 group fitness classes per week (3 cardiovascular, 2 strength, 1 flexibility), and concluded with a final 12-week block of 7 classes per week (4 cardiovascular, 2 strength, 1 flexibility). We completed a submaximal oxygen consumption treadmill test, fasting blood draw and DEXA scan for each participant at 3 time points (baseline, midpoint, conclusion) and analyzed the data using a paired t-test (p < 0.05).

RESULTS: Compared to the baseline measurements, the midpoint measurements demonstrated that the participants mean oxygen consumption increased by 34%, triglycerides decreased by 11%, LDL decreased by 6%, pelvic bone mineral density increased by 8%, and total body fat mass decreased by 4% (all values p < 0.01). CONCLUSIONS: Group fitness can be utilized as a modality to meet the physical activity prescription while producing optimal physiological and musculoskeletal health benefits.

3444 Board #165 June 2 9:30 AM - 11:00 AM
Online Fitness Course Effectiveness in Increasing Physical Activity, Improving Fitness Scores, and Encouraging Healthy Choices
Karen K. Dennis, Cheri A. Toledo. Illinois State University, Normal, IL. (Sponsor: Dale D. Brown, FACSM)

The clinical relevance of achieving and keeping fitness is nowadays well understood. The connection between cardiovascular risk factors and impaired cognitive function has become more and more apparent. While randomized controlled trials have shown the potential of regular aerobic exercise in preserving cognitive function, the role of cardiorespiratory fitness in this regard is less well understood.

PURPOSE: To study the impact of cardiorespiratory fitness on specific cognitive domains in older individuals.

METHODS: A population sample of 1346 men and women aged 57-78 years who participated in the Dose-Responses to Exercise Training Study (DR’s EXTRA). Cardiorespiratory fitness was assessed as maximal oxygen uptake (VO2max; ml • kg-1 • min-1) by a respiratory gas analysis in an electrically braked bicycle ergometer. Cognitive function was evaluated using the Consortium to Establish a Registry for Alzheimer’s disease (CERAD) neuropsychological test battery. Sum scores for immediate memory, delayed memory, verbal performance, visual performance and Mini-Mental State Examination were calculated. Logistic regression analysis was used to analyze the relative risk of cognitive impairment during four years across baseline VO2max tertiles. Linear mixed model analysis was applied to find out the impact of cardiorespiratory fitness on cognitive change.

RESULTS Individuals in the highest gender specific VO2max tertile at baseline had 53% lower risk for incident poor immediate memory (P=0.022) and 45% lower risk for incident poor delayed memory (P=0.038) compared to those in the lowest VO2max tertile during four years. One unit increase in VO2max was associated with improved immediate memory (β=0.06, P=0.001), delayed memory (β=0.06, P=0.001), verbal performance (β=0.09, P=0.001) and Mini-Mental State Examination (β=0.02, P=0.059), after adjustment for potential confounders.

CONCLUSIONS: Higher levels of cardiorespiratory fitness associate favourably with cognition, especially with preserving memory function. The present results are an additional proof of the clinical importance of achieving and keeping fitness.
3446 Board #167 June 2 9:30 AM - 11:00 AM
Cardiorespiratory Fitness Among Adults with Severe Mental Illness
Gerard J. Jeroine1, Deborah Rohm Young, FACSM2, Kerry J. Stewart, FACSM3, Bernadette A. Cullen1, Arlene T. Dalcin1, Carl Latkin1, Lawrence J. Appel1, Gail L. Daumit1. 1Towson University, Towson, MD. 2University of Maryland, College Park, MD. 3Johns Hopkins School of Medicine, Baltimore, MD. 4Bloomberg School of Public Health, Baltimore, MD.

(No relationships reported)

PURPOSE: The feasibility of maximal and submaximal assessment of cardiopulmonary fitness (CRF) among adults with severe mental illness (SMI) was examined and their fitness levels were compared with national data. The association of CRF with psychological factors (diagnosis, severity of psychiatric symptoms, depression) and traditional cardiovascular disease risk predictors (BMI, adiposity, blood pressure, cholesterol, lipids) were also examined.

METHODS: The Activating Consumers to Exercise through Peer Support (ACE) trial was designed to examine the effectiveness of peer support on adherence to a 4 month pilot exercise program for adults with SMI (N = 107). Study measures included maximal (treadmill test) and submaximal (six-minute-walk) assessment of CRF; standardized measurements of height, weight and blood pressure; percent body fat assessed by dual-energy X-ray absorptiometry; fasting blood test; and self-report measures of depression and severity of psychiatric symptoms.

RESULTS: The average age was 47 years (SD = 10) with 78% females and 76% African-American. Compared to a national sample from the Cooper Center Longitudinal Study, 95% of the current sample had below average fitness levels as measured on the graded treadmill test with average MET levels of 5.9 (SD = 2.2) for participants and 6.2 (SD = 2.3) for peer leaders. There was a significant association between MET levels from the treadmill test and distance walked in the six-minute-walk (r = 0.36, p < 0.001). Lower MET levels were associated with higher BMI (r = -0.34, p < 0.001) and percent body fat (r = -0.37, p < 0.001), but were not associated with blood pressure, cholesterol, or lipids. There was no association between MET levels and primary psychiatric diagnosis, depression, or severity of symptoms.

CONCLUSION: Both maximal and submaximal assessment of CRF was feasible among adults with severe mental illness. The uniformly low baseline CRF and the association of fitness with BMI and adiposity indicated programs to increase physical activity were warranted among adults with SMI. Supported by a National Institute of Mental Health Grant 5R34MH0078613.

3447 Board #168 June 2 9:30 AM - 11:00 AM
Effects of 10 wk Commuter Cycling on Cardiovascular Fitness, Lipids, Insulin Sensitivity and Body Composition
B James Novis, Elaine A. Hargreaves, Nancy J. Rehner, FACSM. 1University of Otago, Dunedin, New Zealand.

(No relationships reported)

Commuter cycling interventions have resulted in mixed effects on body composition and blood lipid profiles, whereas insulin sensitivity has not been investigated.

METHODS: The purpose of this study was to examine effects of commuter cycling on body composition and health parameters.

METHODS: Male and female employees were recruited and completed a questionnaire regarding present physical activity and completed a graded cycle ergometry test (VO2peak). Group assignment was randomised and matched for sex and fitness. The intervention group (IG) (n=14, age 39 ± 7 yr, body mass 77 ± 11 kg, VO2peak 2.8 ± 0.8 l•min-1) was given bicycles and asked to cycle commute for 100+ min / wk for 10 wk. The control group (CG) (n=14, age 34 ± 8 yr, body mass 70 ± 7 kg, VO2peak 2.6 ± 0.7 l•min-1) was to continue using motorised transport. Baseline (T0) testing included cholesterol fractions, triglycerides, C-reactive protein, fasting insulin and glucose (HOMA-IR) and body composition (mass, waist-to-hip ratio (WHR), skin folds) and was repeated wk10 (T10). Data were analysed using a two-factor (group x time) repeated measures ANOVA.

RESULTS: Analyses included 13 participants per group. IG cycled 152 ± 60 min / wk. No change in body fat over time (P=0.910) or between groups (Interaction P=0.554) was observed (IG T0: 19.7 ± 3.0, T10: 22.3 ± 4.3; CG T0: 27.4 ± 3.4, CG T10: 26.7 ± 3.1). There were no significant changes within or between groups for blood parameters.

CONCLUSION: There were no significant changes within or between groups for body parameters.

3448 Board #169 June 2 9:30 AM - 11:00 AM
Effects of Physical Educational Class On Improving Physical Fitness In Stroke Out-patients
Pei Jhen Lee1, Hsuei Chen Lee1, Ku Chou Chang2, Jin Jong Chen1. 1National Yang-Ming University, Taiwan. 2Chang-Gung Memorial Hospital, Kaohsiung, Kaohsiung, Taiwan.

(No relationships reported)

Stroke survivors tend to have a sedentary lifestyle due to the sequelae, hence, it may increase the chance of recurrent stroke and cardiovascular diseases. Previous studies have shown that moderate intensity physical activity could improve physical fitness. Even the physicians recommend them to have more exercises to promote the fitness, the stroke out-patients still claim that the details about the exercise prescription are not clear.

METHODS: This study aimed to investigate the possibility to implement the physical education class for the mild stroke outpatients while waiting for the regular OPD consultation and to see its effects on improving the physical fitness.

METHODS: This was a quasi-experimental study. Exercise group received 3 sessions of supervised exercise class during the visit of the OPD(1session/month) and 12-week home-based exercise program. Each physical educational class contained the warm-up, cardiopulmonary fitness training, strengthening and balance training for 40 minutes. Between two sessions, the patients were instructed to do the home program through phone visit. Group control received only one exercise consultation session during the first visit. Outcome measures include body composition, muscle strength, 6-minute walk test (6MWT), gait speed, flexibility and Berg balance scale (BBS). Measurements were conducted at baseline and 12th week.

RESULTS: Eighty five mild stroke patients were recruited: 42 in exercise group and 43 in control group. There were 71 males and 14 females; with mean age 62.8±5.9yrs. After 12 weeks, the exercise group demonstrated greater improvements than the control group on most physical fitness measures, including the 6MWT (73.6 vs.72.7 meters, p<0.001), 10 meter walk time (1.81vs.1.73, p=0.004), upper limb muscle strength index (IGkg: 10.31 vs. 10.15, p=0.001), lower limb muscle strength index (IGkg: 70.55 vs. 70.25, p=0.003) and balance function (BBS ↑ 1.64 vs. ↑ 0.05, p=0.003).

CONCLUSIONS: Physical educational class combined with home exercise program potentially improved physical fitness for those mild stroke outpatients. From the result of this study, physical educational class is a practical and low cost strategy that gives a positive effect for mild stroke outpatients.

3449 Board #170 June 2 9:30 AM - 11:00 AM
Effects Of Hospital-based Intervention On Physical Fitness,quality Of Life For Sedentary Care-giving Housewives
Wen-Hui Huang, Jin-Jong Chen, Hsuei Chen Lee. Yang-ming Exercise Health Science Institute, Taipei, Taiwan.

(No relationships reported)

BACKGROUND: Due to heavy housework and many other barriers, care-giving housewives lead a sedentary lifestyle. They tend to get overweight, low back pain, poor physical fitness, and have lower quality of life and mental health. So, we developed the eight-week hospital-based intervention (HEI) using day-care treatment duration of their children twice per week to provide an accessible exercise time for them to promote their physical fitness, self-efficacy and quality of life.

PURPOSE: To investigate the effects of HEI on physical fitness and quality of life for sedentary care-giving housewives

METHODS: Sixty-six sedentary care-giving housewives were recruited as volunteers and assigned into two groups: HEI group (n=31) and control group (CG, n=35). HEI program consisted of 16 sessions including 8 walking sessions and 8 yogalates sessions. Yogalates class focused on training their core muscle groups including abdominal, back and pelvic muscles. Control group
received one exercise consultation session during the first visit. Outcome measures comprised: 1) Questionnaires: personal characteristics, self-efficacy and quality of life (SF-36); 2) Health-related physical fitness: BMI, muscle endurance, flexibility, sit-up and cardiopulmonary endurance. Measurement was conducted at baseline and 9th week.

RESULTS: After 8 weeks exercise intervention, the HEI had significant improvements on all physical fitness items, such as upper and lower extremity muscle endurance (from 19.8 ± 5.5 to 24.7 ± 5.2, p<0.01), sit up (from 13.7 ± 8.1 to 19.0 ± 8.5, p<0.01), flexibility (from 22.3 ± 10.4 to 27.3 ± 9.8, p<0.01) and cardiopulmonary endurance (from 53.0 ± 13.6 to 59.3 ± 11.5, p<0.05).

The quality of life had significant improvement, especially on mental health (from 55.0 ± 16.8 to 66.8 ± 17.2, p<0.01) and self-efficacy score had elevated significantly too. (from 19.7 ± 3.7 to 23.3 ± 3.6, p=0.01). However, the CG had no significant improvement on physical fitness, self-efficacy and quality of life (p>0.05).

CONCLUSION: The small-group hospital-based and caregiver-focused intervention model made housewives more active and satisfied from exercise. Truly, the intervention program improved their physical fitness, self-efficacy and quality of life significantly.

3450  Board #171  June 2 9:30 AM - 11:00 AM
Exercise Behaviors, Quality Of Life, And Burnout Among Physician Trainees: The Effect Of An Incentivized Fitness Program
Jacob L. Sellon, Christopher J. Weight, Collette R. Lessard, Edward R. Laskowski, FACSM, Susan C. Karpinski, Fred M. Green, Steven H. Rose, Kerry D. Olsen, Tait D. Sunafelt. Mayo Clinic, Rochester, MN.

PURPOSE: Resident well-being is important for providing an optimal learning environment and high quality patient care. According to the American Medical Association Code of Medical Ethics, “Residents and fellows are obligated, as are all physicians, to monitor their own health and level of alertness so that these factors do not compromise their ability to care for patients safely.” Previous studies have indicated that graduate medical trainees have low overall wellness and high rates of burnout. We studied the effects of a prospective, incentivized fitness program on exercise habits, quality of life, and burnout among physician trainees in a large single institution cohort.

METHODS: All graduate medical trainees at Mayo Clinic Rochester (n=1159) were invited to complete a baseline survey. Questions included demographics, fitness behavior (Department of Health and Human Services [HHS] 2008 Physical Activity Guidelines for Americans), quality of life (100-point visual analog scale), and burnout (abbreviated Maslach Burnout Inventory). All residents were then invited to participate in an incentivized fitness challenge. This consisted of 12 weeks of self-directed exercise for which points were awarded for various exercise activities. After the contest, both participating and non-participants were asked to complete a follow-up survey.

RESULTS: 628 trainees participated in the baseline survey (54%), and 242 (21%) enrolled in the fitness program. At baseline, there were no significant differences between program participants and non-participants with regard to demographics, medical training level, exercise habits, quality of life and burnout. 532 (46%) residents completed the follow-up survey. Following the program, participants were much more likely to meet current HHS Physical Activity Guidelines (OR 3.2 95% CI 2.2-4.8) and had a higher overall quality of life (72.4 vs 62.2, p<0.0001) compared to non-participants. There was a trend toward lower burnout measures in program participants compared to non-participants, but this was not statistically significant.

CONCLUSIONS: An incentivized fitness program significantly improved exercise behavior and quality of life ratings among physician trainees. Promoting healthy exercise behaviors among physician trainees may also decrease physician burnout.

3451  Board #172  June 2 9:30 AM - 11:00 AM
Alcohol Intake is an Independent Predictor of Metabolic Syndrome Risk as well as Cardiorespiratory Fitness
Meiko Asaka, Hiroshi Kawano, Tomoko Aoyama, Shizuo Sakamoto, Mitsuru Higuchi, FACSM. Waseda University, Tokorozawa, Saitama, Japan.

PURPOSE: To examine the association of CRF and alcohol intake with MS in Japanese adults.

METHODS: Participants included 227 Japanese men (n = 110) and women (n = 117) aged 20-70 years. Alcohol intake was assessed by a self-administered diet history questionnaire. CRF was assessed by measuring VO2max. The visceral fat cross-sectional area was evaluated by MRI, and blood pressure, fasting HDL-cholesterol, triglyceride, glucose were measured as indices of MS risk factors. MS risk score was calculated by a number of the risk factors from criteria value of MS. Participants were classified into three alcohol intake status categories (Non: 0g/day, Moderate: < 22g/day, and Heavy: > 22g/day) and two CRF categories (Low and High based on reference values established in “Exercise and Physical Activity Reference for Health Promotion 2006”).

RESULTS: VO2max and alcohol intake were significantly correlated with MS risk score (r = 0.256 and 0.284, p<0.001, respectively) after adjusting for sex, age and smoking status. Multiple linear regression analysis revealed that both VO2max and alcohol intake were independently correlated with MS risk score (β = -0.26 and 0.24, p<0.001, respectively) after adjusting for sex, age, smoking status, energy intake and step-counts. The MS risk score of Healthy alcohol intake group (MS risk score:1.4±0.2) was significantly higher than that of Moderate group (0.9±0.1, p = 0.001). MS risk score of High CRF group (0.9±0.1) was lower than that of Low CRF group (1.3±0.9, p = 0.021). High CRF group had significantly and slightly lower MS risk score than Low CRF group in Non- (p = 0.028) and Moderate (p = 0.059) alcohol intake groups. However, there was no significant difference of MS risk score between High and Low CRF group in Heavy alcohol intake group.

CONCLUSIONS: These results suggested that alcohol intake is an independent risk factor of MS as well as CRF in Japanese people, and heavy alcohol intake has higher risk of MS even with high CRF.

3452  Board #173  June 2 9:30 AM - 11:00 AM
Body Composition, Physical Activity, Aerobic Fitness, And Metabolic Profile In High-fit High-fat 18-Year-olds
Sigurbjörn Á. Arngrímsson, Erlingur B. Richardsson, Anna S. Ólafsdóttir. University of Iceland, Laugarvatn, Iceland. (Sponsor: Ellen M. Evans, FACSM)

PURPOSE: The purpose of the study was to examine metabolic risk factors among 18-year-old high-school students and to compare students attending vocational vs. traditional high-schools.

METHODS: The participants (147 boys and 130 girls) were randomly selected from three high-schools in Reykjavik, Iceland. Physical activity (PA) was assessed with pedometers and aerobic fitness (fitness) with a maximal oxygen uptake test on a treadmill. Height, weight, waist circumference (WC), and body mass index (BMI) were determined and percentage body fat (%Fat) assessed with dual energy X-ray absorptiometry. Resting blood pressure (BP) and fasting serum lipids and glucose were measured.

RESULTS: According to BMI, 23.3% of the students were overweight/obese, 20.4% had elevated WC, and 50.8% had higher %Fat than recommended. In addition, 11.2% of the participants had lower high-density lipoprotein, 8.4% higher low-density lipoprotein, and 8.8% higher triglycerides than advised and 10.2% had borderline or high systolic BP. In contrast, 84.4% of the students had average or higher levels of fitness. Regardless, only 34.4% of the participants reached the recommended levels of daily PA. Only a handful of the students had increased fasting glucose levels. Higher proportion of boys than girls were classified as obese (%Fat p=0.042, BMI p=0.049) and with borderline or high systolic BP (p>0.001), but relatively more boys had also very good fitness level (p=0.001). No gender differences were found in the proportions across PA (p=0.706), diastolic BP (p=0.139), glucose (p=0.357), or serum lipids (p=0.293-0.901) classifications except that higher fraction of girls had elevated total cholesterol (p=0.014). Students in vocational schools had lower levels of fitness and PA, and higher %Fat, WC, and BP (p<0.05).

CONCLUSION: Although fitness among Icelandic 18-year-olds seems generally good, their PA is low and %Fat greatly elevated. Serum lipids and systolic BP are also raised in about 10% of the teenagers. Students in vocational schools measure worse on fitness, PA, BP and most body composition variables. Interventions aiming at increasing PA and decreasing adiposity are needed in this age group.
Association between Age and Fitness among Men and Women Entering Basic Combat Training

Shamala Greene, Joseph J. Knupik, FACSM, Andrea Harris, Bria Graham, Ryan Steelman, Keith Hauret, Bruce H. Jones, FACSM. U. S. Army Institute of Public Health, Aberdeen, MD.

Purposes: This was a cross-sectional examination of age-related differences in physical fitness among men and women entering BCT.

Methods: The Army Physical Fitness Test (APFT) consists of a 2-minute maximal effort push-up (PU) event, a 2-minute maximal effort sit-up (SU) event, and a 2 mile run for time (RUN). The Resident Individual Training Management System (RITMS) was queried for age and entry level APFT scores of Soldiers entering BCT from 1 October 2009 to 30 September 2010. There were a total of 53,574 men and 9,885 women who had these values. PU, SU, and RUN data was plotted by age and each event was analyzed using two-way analysis of variance (age by gender). Average yearly performance changes were estimated from the slope of the linear regression of age on PU, SU, or RUN.

Results: The mean ± standard deviation (SD) PU, SU, and RUN for men were 41±15 repetitions (reps), 48 ± 14 reps, and 19.1 ± 2.3 minutes; for women these values were 19 ± 13 reps, 42 ± 16 reps, and 19.9 ± 2.9 minutes. The age range was 17 to 42 years with a mean SD of 22 ± 4.53. PUs declined very slightly by age (p < 0.01) but the difference was small between age groups amounting to no more than 2 reps; there was no gender by age interaction (p = 0.96). SUs and RUN declined with age (p<0.01 for both), and there was a gender by age interaction (p<0.01 for both).

Conclusion: Among BCT recruits, and within the age groups examined here, there was little change in PU performance across the age groups. SU and RUN performance declined with age and the pattern differed slightly for men and women.

A Twenty Year Epidemiological Analysis of Fitness and Medical Trends in College Students

Meagan Bevers, Megan Jones, Silas Peareman. Furman University, Greenville, SC.

Introduction: College students from a private liberal arts college from 1990 to 2010 (N=1413). Over the twenty year period, there was an increase in the counter and prescription drug use, and other health issues in college students from a private liberal arts college from 1990 to 2010 (N=1413).

Methods: This cross sectional study was designed to assess medication and orthopedic trends in college age students. A Physical Activity Readiness Questionnaires (PAR-Q) analyzed trends with regards to medical conditions, over the counter and prescription drug use, and other health issues in college students from a private liberal arts college from 1990 to 2010 (N=1413).

Results: Specific drugs with increased usage included digestive, ADD/ADHD, oral contraceptives, acne, anti-depressants, allergy, and medications. Women took more allergy, acne, anti-depressants, and all other medications (p < .01) while men took more medications for ADD/ADHD (p < .01). Overall, a total of 46% of students were on at least one medication with an additional 5% of students on two or more medications. In addition, the data showed the 5% of students who had heart murmurs, 10% of students had asthma, and 12% of students reported orthopedic issues, with women students reporting more orthopedic conditions (p < .01).

Conclusion: Over the twenty year period, there was a significant increase in the counter and prescription drug usage as well as an increase in asthma and orthopedic conditions. These trends reflect the increased use of prescription drugs as well as possible sports specialization connected to orthopedic injuries.
CONCLUSION: Compared to men normal on all 3 adiposity exposures, men with an increasing number of adiposity exposures had greater risk of all-cause mortality. Mortality risk was attenuated in all 4 adiposity groups by achieving at least a moderate level of CRF. Utilizing various adiposity exposures to determine risk of all-cause mortality in men may be misleading unless CRF is also considered.

3457 Board #178 June 2 9:30 AM - 11:00 AM
The Combined Influence Of Sedentary Behavior And Physical Activity On Cardiorespiratory Fitness
Rute Santos\textsuperscript{1}, Michele Prati\textsuperscript{2}, Anthony D. Okely\textsuperscript{3}, Jorge Mota\textsuperscript{1}, Carla Moreira\textsuperscript{1}, Manuel J. Coelho-e-Silva\textsuperscript{1}, Susana Vale\textsuperscript{1}, Luis B. Sardinha\textsuperscript{4}. \textsuperscript{1}Research Centre in Physical Activity, Health and Leisure. Faculty of Sport - University of Porto, Porto, Portugal. \textsuperscript{2}National Center for Chronic Disease Prevention and Health Promotion, CDC, Atlanta, United States of America, Atlanta, GA. \textsuperscript{3}Interdisciplinary Educational Research Institute, University of Wollongong, NSW, Australia., Wollongong, Australia. \textsuperscript{4}Research Centre of Anthropology and Health. Faculty of Sport Sciences and Physical Education, University of Coimbra, Portugal, Coimbra, Portugal. Exercise and Health Laboratory, Faculty of Human Movement-Technical University of Lisbon, Portugal., Lisbon, Portugal.

(PURPOSE) The aim of this study was to analyze the combined influence of objectively measured sedentary behavior and physical activity (PA) on cardiorespiratory fitness (CRF) in 2,506 Portuguese children and adolescents aged 10 to 18 years.

(METHODS) CRF was assessed with the Fitnessgram 20m-shuttle-run test. PA and sedentary behaviour were assessed with accelerometry. Participants were classified as meeting current PA guidelines for youth vs not meeting; and as low vs High sedentary (according to the median value of sedentary time/day by age and gender); and then grouped as follows: Low Active - High Sedentary; Low Active - Low Sedentary; High Active - High Sedentary; High Active - Low Sedentary. Binary logistic regression models were constructed to verify the relationship between high CRF and the combined influence of PA/sedentary behavior, adjusting for age, gender and body mass index.

(RESULTS) Participants classified as high active/low sedentary (OR=1.849; 95%CI:1.246-2.744), as well as those classified as low active/low sedentary (OR=1.297; 95%CI:1.034-1.626) were more likely to be fit, compared with those from the low active/high sedentary group.

(CONCLUSIONS) These findings suggest that PA levels may not overcome the deleterious influence of high sedentary time. Our data stress the importance of promoting PA and discouraging sedentary behavior.

3458 Board #179 June 2 9:30 AM - 11:00 AM
Sarcopenic-obesity Is Associated With Physical Fitness Independently Physical Activity
Junghoon Kim\textsuperscript{1}, Kai Tanabe\textsuperscript{1}, Noriko Yokoyama\textsuperscript{1}, Suga Yoko\textsuperscript{2}, Shinya Kuno\textsuperscript{1}.\textsuperscript{1}University of Tsukuba, Ibaraki, Japan. \textsuperscript{2}Tsukuba Wellness Research Co., Ltd., Ibaraki, Japan.

(PURPOSE) The primary aim of this study was to investigate the prevalence of sarcopenic-obesity from a large cohort of Japanese. We also examined whether sarcopenic-obesity contribute to decrease physical fitness independently level of physical activity.

(METHODS) This cross-sectional observational study including total 7915 healthy Japanese men and women 20-80 years of age who recruited between 2006 and 2010. We measured muscle mass and body fat mass using bioelectrical impedance. Physical activity was measured using a pedometer with an accelerometer for 7 days. The physical fitness test was based on the method of the Japan Fitness Test that comprised five items, and total scores of the test were calculated (scores of each item: 1-10). Lowest gender-specific quartile in total score was defined as poor physical fitness. Sarcopenia was defined as skeletal muscle mass index of two SD below the sex-specific mean value for a younger reference group (<40 years, n=1494) from the entire study population. We also defined obesity based on criteria of the Japan Society for the Study of Obesity.

(RESULTS) The prevalence of sarcopenic-obesity was significantly increased with aging (P<0.05). The odds ratio for poor physical fitness was 3.7 (95%CI; 2.65-5.32) and 3.6 (95%CI; 2.70-4.83) for individuals with sarcopenic-obesity, compared with healthy body composition group in men and women, respectively (P<0.001), after adjusted for age, BMI, and physical activity. These trends were similar across level of physical activity.

(CONCLUSIONS) The results of this cross-sectional observational study suggest that sarcopenic-obesity is associated with poor physical fitness independently physical activity using measured a pedometer with an accelerometer.

3459 Board #180 June 2 9:30 AM - 11:00 AM
Associations between Cardiorespiratory Fitness Level and Health-Related Quality of Life: A Cross-Sectional Study of Apparently Healthy Adult Females.
Robert A. Sloan\textsuperscript{1}, Susummu S. Sawada, FACSM\textsuperscript{2}, Corby K. Martin, FACSM\textsuperscript{3}, Robert R. Kraemer, FACSM\textsuperscript{4}, Steven N. Blair, FACSM\textsuperscript{5}. \textsuperscript{1}Health Promotion Board, Singapore, Singapore. \textsuperscript{2}Tokyo Gas, Tokyo, Japan. \textsuperscript{3}Pennington Biomedical Research Center, Baton Rouge, LA. \textsuperscript{4}Southeastern Louisiana University, Hammond, LA. \textsuperscript{5}University of South Carolina, Columbia, SC. (Sponsor: Susummu Sawada, FACSM)

(PURPOSE) To investigate the relationship between CRF level and HRQoL, in apparently healthy adult females.

(METHODS) We evaluated the association of CRF and HRQoL of 634 U.S. Navy and civilian (Age: 18-49 yr) females who were given a submaximal exercise test and health risk appraisal which included the Short Form-12v2 (SF-12v2) from 2005-2007. CRF was measured by using the Balke-Ware submaximal treadmill test; women were assigned to low (referent), moderate, and high CRF categories based on tertiles. Physical component summary (PCS) and mental components summary (MCS) scores were considered to be above the norm if summary scores were ≥50 respectively.

(RESULTS) Odds Ratios (ORs) and 95% confidence intervals (95% CIs) for CRF versus MCS-12 and PCS-12 scores were obtained by using a logistic regression model. Taking into consideration age, systolic blood pressure, BMI, cigarette smoking, and alcohol intake, the table shows the associations between CRF with PCS and MCS scores.
the lowest quartile as reference, the odds ratios and 95% CI for the 2nd through 4th quartiles were 0.74 (0.50-1.11), 0.69 (0.45-1.05), and 0.48 (0.29-0.78), respectively (P = 0.004 for trend).

CONCLUSIONS:

METHODS: Participants were given a submaximal exercise test at least four times over seven years (1979-1985). We modeled the trend in fitness over seven years for each man using simple linear regression. Participants were then divided into quartiles based on the regression coefficient (slope) from the model. During the follow-up period 1985-2004, 227 men developed dyslipidemia. The development of dyslipidemia was based on self-report of current drug therapy for dyslipidemia at a subsequent medical examination in 2004. Odds ratios and 95% confidence intervals (95% CI) for the incidence of dyslipidemia were obtained using the logistic regression model.

CONCLUSIONS: These results suggest that the long-term trend in cardiorespiratory fitness is a predictor of the incidence of dyslipidemia in Japanese males.

3460  Board #181  June 2  9:30 AM - 11:00 AM  
Long-term Trends In Cardiorespiratory Fitness And The Incidence Of Dyslipidemia.
Sussuru S. Sawada, FACSM1, I-Min Lee, FACSM2, Hisashi Naito1, Takashi Okamoto1, Koji Tsukamoto1, Takashi Muto2, Yasuki Higaki2, Hinaaki Tanaka3, Steven N. Blair, FACSM4, Tokyo Gas Health Promotion Ctr., Tokyo, Japan. 1Harvard Medical School, Boston, MA. 2Juntendo University, Chiba, Japan. 3Dokkyo Medical University School of Medicine, Tochigi, Japan. 4Fukuoka University, Fukuoka, Japan. 5University of South Carolina, Columbia, SC. (No relationships reported)

PURPOSE: Cardiorespiratory fitness is associated with a lower risk of dyslipidemia. However, there are no cohort studies that have assessed the relationship between long-term trends in cardiorespiratory fitness and the incidence of dyslipidemia. Thus, we investigated this issue in Japanese males.

METHODS: We evaluated the long-term trends in cardiorespiratory fitness and incidence of dyslipidemia among 3,650 Japanese men (age: 22-40) who were free of dyslipidemia at baseline. Participants were given a submaximal exercise test at least four times over seven years (1979-1985). We modeled the trend in fitness over seven years for each man using simple linear regression. Participants were then divided into quartiles based on the regression coefficient (slope) from the model. During the follow-up period 1985-2004, 227 men developed dyslipidemia. The development of dyslipidemia was based on self-report of current drug therapy for dyslipidemia at a subsequent medical examination in 2004. Odds ratios and 95% confidence intervals (95% CI) for the incidence of dyslipidemia were obtained using the logistic regression model.

RESULTS: Men in the lowest quartile of the distribution decreased in cardiorespiratory fitness over the seven years (median slope, -1.26 ml/kg/min), while men in the highest quartile increased in fitness (median slope, 1.31 ml/kg/min). Adjustment for age, initial fitness level, body mass index, cigarette smoking, alcohol intake, and a family history of dyslipidemia, and using the lowest quartile as reference, the odds ratios and 95% CI for the 2nd through 4th quartiles were 0.74 (0.50-1.11), 0.69 (0.45-1.05), and 0.48 (0.29-0.78), respectively (P = 0.004 for trend).

CONCLUSIONS: These results suggest that the long-term trend in cardiorespiratory fitness is associated with a lower risk of dyslipidemia. However, there are no cohort studies that have assessed the relationship between long-term trends in cardiorespiratory fitness and the incidence of dyslipidemia. Thus, we investigated this issue in Japanese males.

3461  Board #182  June 2  9:30 AM - 11:00 AM  
Cardiorespiratory Fitness And Subclinical Atherosclerosis In Men With Type 2 Diabetes
Sae Young Jae1, Kevin S. Heffernan2, Yoon-Ho Choi3, Bo Fernhall, FACSM1, 1University of Seoul, Seoul, Korea, Republic of, 2Syracuse University, Syracuse, NY. 3Samsung Medical Center, Seoul, Korea, Republic of. 4University of Illinois, Chicago, IL. (No relationships reported)

Type 2 diabetes is a major risk factor for the development of atherosclerosis and cardiovascular disease mortality. Conversely, high levels of cardiorespiratory fitness have a strong protective effect against cardiovascular disease mortality in patients with type 2 diabetes.

PURPOSE: We tested the hypothesis that higher levels of cardiorespiratory fitness are inversely associated with subclinical atherosclerosis in 746 (age 53±7 yrs) men with type 2 diabetes.

METHODS: We measured brachial ankle pulse wave velocity (PWV) and common carotid intima media thickness (CIMT) as indexes of subclinical atherosclerosis. Carotid atherosclerosis was defined by carotid intima media thickness >1.0mm. Cardiorespiratory fitness (CRF) was directly measured by peak oxygen uptake using expired gases analysis during a standard treadmill test.

RESULTS: Peak oxygen uptake was inversely correlated with PWV (r=-0.27, p<0.05) and CIMT (r=-0.24, p<0.05). Peak oxygen uptake was independently associated with CIMT (β=0.15, p<0.05), but not PWV (p=0.12), in multivariable regression models that adjusted for age, BMI, waist girth, TC/HDL-C and CRP. After adjusting for established risk factors, high and moderate cardiorespiratory fitness were associated with lower odds ratios for having carotid atherosclerosis 0.49 (95% CI, 0.30 - 0.81), and 0.59 (95% CI, 0.38 - 0.92), respectively, as compared with low cardiorespiratory fitness. Each one metabolic equivalent increment higher cardiorespiratory fitness was associated with 27% (OR = 0.73; 95% CI, 0.61 - 0.87) lower prevalence of carotid atherosclerosis.

CONCLUSIONS: These results suggest that high cardiorespiratory fitness is inversely associated with common carotid intima media thickness independent of established risk factors in men with type 2 diabetes.

3462  Board #183  June 2  9:30 AM - 11:00 AM  
Fitness, Physical Activity And Aortic Intima-media Thickness In Adolescents
Katja Pahkala1, Olli J. Heinonen1, Olli Simell1, Jorma S.A. Viikari1, Tapani Rönnemaa2, Harri Helajärvi1, Harri Niinikoski2, Olli T. Raitakari2, 1Paavo Nurmi Centre, Turku, Finland. 2University of Turku, Turku, Finland. (Sponsor: Raija Laukkanen, FACSM) (No relationships reported)

PURPOSE: We recently reported a favorable association between leisure-time physical activity and a surrogate marker of atherosclerosis, aortic intima-media thickness (aIMT), in adolescents (1). The aim of this study was to investigate whether cardiorespiratory fitness is associated with aIMT independently of physical activity.

METHODS: Cardiorespiratory fitness was measured with maximal cycle ergometer test in 17-year-old adolescents (n=378) participating in an atherosclerosis prevention study (STRIP). To describe the data, the adolescents were divided into three groups according to tertile cut-off points for fitness. Physical activity was assessed using a self-administered standardized questionnaire. A physical activity index (MET h/wk) was calculated by multiplying weekly mean leisure-time exercise intensity, duration and frequency. Ultrasoundography was used to examine aIMT. Four measurements of aIMT covering the far wall segment were taken and the mean of these measurements was used. Complete data on fitness, physical activity, aIMT and covariates used for adjustment were available among 312 adolescents. A linear regression model was used for the analyses.
RESULTS: Fitness was inversely associated with aIMT (β(SED) = -0.0036 (0.0011), p=0.0012; adjusted for gender, body mass index, HOMA-IR, and HDL/total cholesterol, triglyceride and C-reactive protein concentration. Mean (SD) aIMT was 0.49 (0.10) mm in high fit girls and 0.54 (0.11) mm in low fit girls. In boys, the corresponding values were 0.53 (0.01) mm and 0.58 (0.13) mm. The inverse association between fitness and aIMT remained after further adjustment for physical activity (β(SED) = -0.0030 (0.0013), p=0.026).

CONCLUSIONS: In adolescents, cardiovascular fitness is favorably associated with aIMT independently of physical activity. Since fitness can be improved only by exercise, a physically active lifestyle should be encouraged to support cardiovascular health.

Supported by the Finnish Ministry of Education and Culture, the Finnish Cultural Foundation and the Juhon Vainio Foundation.

RESULTS: Muscular fitness was negatively associated with single and clustered cardiometabolic biomarkers (standardized β from -0.393 to -0.116, all P values < 0.01). Additional adjustments for cardiorespiratory fitness and HOMA-IR weakened the associations, but they still remained significant. The association was no longer significant when adjusting for sum of skinfolds. The odds ratios (OR) for having a high clustered risk (above or equal 1 SD) was 5.0 [95% confidence interval (CI) = 2.3-11.1] in the lowest quartile of muscular fitness compared with the highest quartile, after adjusting for basic confounders plus cardiorespiratory fitness and HOMA-IR. When adjusting also for sum of skinfolds, the OR decreased to 1.8 [95%CI=0.7-4.4]. Decreasing values of clustered cardiometabolic risk were observed across incremental levels of muscular fitness in both non-overweight (P = 0.002) and overweight adolescents (P < 0.001).

CONCLUSIONS: Muscular fitness is inversely associated with nontraditional cardiometabolic biomarkers in adolescence, and the association seems to be at least partly mediated by adiposity. Preventive strategies for youth should focus not only on decreasing adiposity and increasing cardiorespiratory fitness, but also on enhancing muscular fitness.

### Board #187 June 2 9:30 AM - 11:00 AM
**Associations Of Physical Activity And Fitness With Cognitive Status In Community-dwelling Older Adults**
Kenji Narazaki1, Eri Matsuo1, TakanoriHonda1, Yu Nofuji1, Koji Yonemoto2, Shuzo Kumagai3, Kyushu University, Fukuoka, Japan; 2Kurume University, Fukuoka, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

(No relationships reported)

Physical activity is a promising intervention candidate for preventing or delaying cognitive decline often emerged in the aging process. However, association between physical activity and cognitive status has been still unclear in community-dwelling older people. Furthermore, there have been limited findings regarding the association between physical fitness and cognitive status in the population.

PURPOSE: To examine whether physical activity and fitness are associated with cognitive status in community-dwelling older adults.

METHODS: As part of a community-based cohort study for a Japanese local town, 2,629 participants older than 65 years were involved in this study (74±6 yrs, male: 41.9%). A tri-axial accelerometer device was employed to quantify daily physical activity level (PAL). Hand-grip strength (HGS) and gait speed (GAS) were measured with conventional methods as indices of physical fitness. Cognitive status (COS) was determined as a score using the Japanese version of the Montreal Cognitive Assessment (MoCA). The associations of the PAL, HGS, and GAS with the COS were tested by 3 linear regression models for respective pairs, each involving the adjustment for age, sex, and years of education. Additional one-way ANCOVA (covarying for age and education) was performed to compare the COS among sex-adjusted quintile groups formed in each physical index.

RESULTS: The HGS (27.0±8.1 kg) and GAS (1.7±0.4 m/s) were associated with the COS (β=0.301 and β=0.193, respectively, p<0.001). Only weak association was found between the PAL (2.6±2.2 METs/hour/day) and COS (β=0.070, p<0.001). Being consistent with the results of the regression analyses, the ANCOVAs showed significant main effects for the HGS (F=18.11, p<0.001) and GAS (F=18.24, p<0.001) but not for the PAL (F=2.32, p=0.0548).

CONCLUSION: Hand-grip strength and gait speed were associated with the cognitive status quantified by the MoCA score in community-dwelling older adults after adjusting for age, sex, and education. In contrast, the device-based physical activity level demonstrated only weak association with the cognitive status. Further investigations are needed to examine associations of other indices regarding physical activity and fitness with cognitive status in the population. Supported by a grant from Sasaguri town, Japan to SK.

### Board #188 June 2 9:30 AM - 11:00 AM
**The Joint Association Of Fitness And Fatness To All-cause Mortality: A Meta-analysis**
Vaughn Barry1, Meghan Baruth2, Michael Beets2, Steven Blair, FACSM3, Middle Tennessee State University, Murfreesboro, TN; 3University of South Carolina, Columbia, SC.

(No relationships reported)

PURPOSE: Two recent systematic review articles concluded cardiorespiratory fitness (CRF) has a stronger effect than weight status on all-cause mortality. The purpose of this study was to quantify the joint association of these variables (i.e. CRF and weight status) on mortality from all causes using quantitative meta-analytical methodology.

METHODS: A systematic literature search was performed using PubMed (1980 to June 2010) and an assessment of recent review articles. Studies were included if they were 1) prospective studies, 2) jointly assessed CRF and body mass index (BMI) with all-cause mortality, and 3) objectively measured CRF and BMI. Articles were excluded from the analysis if the referent group was not normal weight, fit individuals. Seven articles and were included in the final analysis. CRF and BMI levels were reported as fit vs. unfit and fat vs. normal weight. Individuals were considered unfit if they were in the lowest 20% of the study cohort or had a maximal aerobic capacity of < 5 METs. BMI categories were > 18.5 kg/m² to < 25.0 kg/m² (normal weight) and ≥ 25.0 kg/m² (fat).

RESULTS: Compared to fit-normal weight individuals, unfit individuals had twice the mortality risk regardless of fatness level (unfit-normal weight, 2.07, 95% CI, 1.66-2.59; unfit-fat, 2.08, 95% CI, 1.70-2.55). Fit individuals had similar mortality risks (1.10, 95% CI, 0.95-1.27) to fit-normal weight individuals.

CONCLUSIONS: Individuals with low CRF have twice the risk of death from all causes regardless of BMI categorization. Moderate to high CRF levels significantly reduces the all-cause mortality risk associated with excess weight. Therefore, maintaining moderate to high CRF levels is important for normal weight, overweight and obese individuals.

### Board #189 June 2 9:30 AM - 11:00 AM
**Environment Perception For PA And Nutrition: Relationship With Health-related Fitness**

(No relationships reported)

A shift in eating habits, patterns and levels of physical activity during the last decades, may explain the dramatic increase in the prevalence of overweight and obesity. Understanding how those changes continue to occur, and which factors may play different roles in different populations, is necessary for developing better strategies.

PURPOSE: The objectives of this study were to compare health-related indicators, sports participation, eating habits and perception of physical environment between adolescents from two different islands in Portugal, as well as to identify the best predictors of a high and very high percent body fat (%BF).

METHODS: Participants in this study were 326 boys and girls. Prevalences of overweight and obesity were determined according to Cole et al. (2000), %BF was estimated according to Slaughter et al. (1998), and participants classified in health risk categories according to Lohman (1987). Aerobic fitness was assessed with the Fitnessgram 20 m pacer test (The Cooper Institute for Aerobics Research, 2007). Sports participation, eating habits (Wilson et al., 2008) and perception of the physical environment (Evenson et al., 2006) were assessed by self-report questionnaire.

RESULTS: 29% of the participants were overweight or obese, 30.4% were in the high or very high categories for %BF, 61.4% were below the healthy zone for aerobic fitness, and 64.7% indicated Physical Education as the only structured physical activity they regularly participated in. There were significant differences between the two islands in prevalence of sport participation and perception of the physical environment. It was found that the perception of fruits’ and vegetables’ availability (OR: 0.854; 95%CI 0.746 - 0.977) and identifying geographic barriers in the physical environment (OR: 1.127; 95%CI 1.023-1.240) were both predictors of a high or very high %BF.

CONCLUSION: The development of intervention strategies aimed at reducing adiposity should have in mind the physical, social and cultural environment in which the participant is inserted. Supported by the Research Center of Sport, Health and Human Development (CIDESD) and the Department of Education in Madeira Autonomous Region.
A recent meta-analysis revealed exercise was strongly related to body image (Hausenblas & Fallon, 2006). An individual with higher level of self-assessments toward her/his body, particularly appearance, tended to increase physical activity and maintain a healthy body composition. However, the previous research rarely utilized a quantitative measure of fitness to analyze how body image contributed to physical fitness development in large sample sizes, especially in different cultural settings.

**PURPOSE:** To determine the relationship between physical fitness and body image to locate which dimensional body-self relations was related to fitness tests in a large sample size of college students in China.

**METHODS:** Participants (n=563, aged at 17-21) were randomly selected from three urban universities in China. A standardized fitness test battery was adopted to assess cardiovascular endurance, speed, flexibility, and strength. A Chinese version of the Multidimensional Body-Self Relations Questionnaire (MBSRQ) was distributed to the students for body image assessments after the completion of fitness tests. Fitness and body images relation was analyzed by forward stepwise regression and Pearson’s correlation.

**RESULTS:** Forward stepwise regression revealed only fitness subsets of MBSRQ including self-reported fitness evaluation and orientation reliably predicted total physical fitness scores (R² = .23). Pearson’s correlation analysis demonstrated that self fitness evaluation or orientation had a strong relationship with cardiovascular endurance performance (r=.13, p<.01) and speed performance (r=.21, p<.01). The other subsets including appearance and health were not related to the fitness scores.

**CONCLUSION:** The findings indicated that fitness test performance could be predicted by self-evaluation of fitness and attitude toward fitness. Unlike previous studies with participants in the North America, the present research failed to detect a relationship between fitness performance and appearance and health evaluations in Chinese students. It suggested different cultural settings might regulate the effects of behavioral factors on fitness development.

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**3470 Board #191 June 2 9:30 AM - 11:00 AM**

**Peak Oxygen Uptake And Leisurte Time Physical Activity In 4427 Healthy Adults: The Hunt Study**

Bjarne M. Nes, Imre Janszky, Lars J. Vatten, Ulrik Wisløff. Norwegian University of Science and Technology, Trondheim, Norway.

Leisure time physical activity (LTPA) of a sufficient dose to increase cardiorespiratory fitness (VO\textsubscript{2peak}) may yield numerous health benefits. Current guidelines suggest that adults should perform moderate intensity activity at least 150 minutes per week, or high intensity activity at least 75 minutes per week.

**PURPOSE:** The aim of the study was to examine how self-reported LTPA at different levels of weekly duration and relative intensity associates with VO\textsubscript{2peak} and estimated weekly energy expenditure in a large population.

**METHODS:** A total of 4427 adults, 19-89 yrs, and free from cardiovascular disease (2158 men; mean age 48.4, BMI 26.6, and 2269 women; mean age 48.0, BMI 25.4), were tested for directly measured VO\textsubscript{2peak}(mean 44.3 and 35.9 mL·kg\textsuperscript{-1}·min\textsuperscript{-1} for men and women, respectively). Information on LTPA was collected through a detailed questionnaire containing questions on frequency, duration and relative intensity (Borg 6-20 scale). Subjects were grouped according to gender, total LTPA (min/week) and low (Borg scale 6-11), moderate (Borg scale 12-13) or high (Borg scale 14-20) relative intensity. Weekly LTPA energy expenditure was estimated by multiplying the subject’s oxygen uptake in litres per minute (L·min\textsuperscript{-1}) at their reported Borg scale rating by 5 kcal·min\textsuperscript{-1} and further multiplying by minutes per week. A general linear model was applied adjusting for age, BMI, education, occupational physical activity and smoking.

**RESULTS:** Both men and women reporting <90 min/week (group mean, 47 min/week) and high intensity had considerably higher VO\textsubscript{2peak} than the inactive groups (45.1 vs. 41.0 and 35.1 vs. 32.9 mL·kg\textsuperscript{-1}·min\textsuperscript{-1} for men and women, respectively, both p-values <0.001). A comparable VO\textsubscript{2peak} were observed among men and women reporting >150 min/week (group mean, 217 min/week) and moderate intensity (44.5 and 36.3 mL·kg\textsuperscript{-1}·min\textsuperscript{-1} for men and women, respectively). Estimated weekly energy expenditure, however, were more than 4 times higher in the moderate intensity - high duration groups compared to the high intensity-low duration groups (2988 vs. 713 kcal/week in men and 1964 vs. 429 kcal/week in women, both p<0.001).

**CONCLUSION:** LTPA patterns of high duration - moderate intensity and low duration - high intensity were associated with similar VO\textsubscript{2peak}, despite large differences in weekly energy expenditure.

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**3471 Board #192 June 2 9:30 AM - 11:00 AM**

**Running and All-cause Mortality Risk - Is More Better**

Duck-chul Lee\textsuperscript{1}, Russell R. Pate, FACSM\textsuperscript{1}, Carl J. Lavie\textsuperscript{2}, Steven N. Blair, FACSM\textsuperscript{1}. \textsuperscript{1}University of South Carolina, Columbia, SC. \textsuperscript{2}Ochsner Health System, New Orleans, LA.

We examined the association between running and all-cause mortality in 52,656 adults (26% women) aged 20-100 years (mean age 43) who had a medical examination during 1971-2002 in the Aerobics Center Longitudinal Study.

**METHODS:** Participants were free of cardiovascular disease (CVD), cancer, abnormal resting or exercise electrocardiogram, and diabetes at baseline, and had >1 year of follow-up. Running and other physical activities were assessed on the medical history questionnaire by self-reported leisure-time activities during the past 3 months. Mortality follow-up was through 2003 using the National Death Index. Cox regression was used to quantify the association between running and mortality after adjusting for baseline age, sex, examination year, body mass index, current smoking, heavy alcohol drinking, hypertension, hypercholesterolemia, parental CVD, and levels of other physical activities.

**RESULTS:** During an average follow-up of 15 years, 2,984 deaths occurred. Approximately 27% of adults participated in leisure-time running. Runners had 19% lower risk of all-cause mortality compared with non-runners, with U-shaped mortality curves for distance, speed, and frequency. The hazard ratios (95% confidence intervals) of all-cause mortality were 0.78 (0.64-0.96), 0.85 (0.73-0.99), 0.73 (0.60-0.89), 0.75 (0.57-0.97), 0.90 (0.67-1.22), and 0.95 (0.73-1.24) in 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-19.9, 20.0-24.9, and ≥25.0 miles/week of running distance; 0.90 (0.75-1.08), 0.79 (0.68-0.91), 0.73 (0.61-0.86), and 0.93 (0.73-1.19) in 1-5, 6, 7, and ≥8 miles/hour of running speed; and 0.81 (0.49-1.32), 0.65 (0.46-0.92), 0.81 (0.65-0.97), 0.82 (0.71-0.94), 0.81 (0.66-0.99), 0.86 (0.65-1.14), and 0.95 (0.69-1.33) in 1, 2, 3, 4, 5, 6, and 7days/week of running frequency, respectively, compared with no running after adjusting for confounders including levels of other physical activities.

**CONCLUSIONS:** Running distances of 0.1-19.9 miles/week, speeds of 6-7 miles/hour, or frequencies of 2-5 days/week were associated with a lower risk of all-cause mortality, whereas higher mileage, faster paces, and more frequent running were not associated with better survival. Supported by NIH Grant AG06945, HL62508, DK088195, and an unrestricted research grant from the Coca-Cola Company.
Free Communication/Poster - Fitness and Performance Testing V
JUNE 2, 2012 7:30 AM - 11:00 AM
ROOM: Exhibit Hall

3472  Board #193  June 2  8:00 AM - 9:30 AM
Relationships Between Specific Back-Fitness Tests and the Occurrence of Back Injuries in Firefighters
Karlie J. Moore, Salvador Jaimes, Katherine B. Gunter. Oregon State University, Corvallis, OR.
(No relationships reported)

Firefighters (FFs) experience a high incidence of back injuries; near 50% of FFs have experienced at least one back injury throughout their career and the primary reason for early retirement from disability is back injury. An assumption exists that fit FFs experience fewer back injuries, yet the true relationship between FF’s fitness level and incidence of back injury is understudied. It is not clear what specific aspects of fitness are related to the occurrence of back injuries or what tests may be conducted to better understand a FF’s risk of experiencing a back injury.

PURPOSE: To investigate the relationships between specific back-fitness tests and the occurrence of back injuries in firefighters.

METHODS: 118 FFs from three fire departments completed a back injury survey and eight back-fitness tests: A modified Schober test for lumbar flexion (LF) and lumbar extension (LE), a trunk rotation flexibility test to the right (RR) and left (RL), a back endurance “row” test with 20 lb weights (BE), a back strength test using dynamometry (BS), a hamstring endurance “kickback” test (HE) and a prone chin-up test (PC). The survey asked if FFs had experienced 0.1, 1, 3 or 4+ back injuries throughout their careers along with other relevant parameters. A zero-inflated poisson regression was utilized to 1) identify the variables that predict injury rate, and 2) identify the variables that predict the FFs who never experience back injuries. To account for exposure time, # of years as a FF was included in the model.

RESULTS: 59 FFs reported 0 back injuries, 24 FFs reported 1, 14 FFs reported 2, and 21 FFs reported 3+ back injuries. The # of injuries was significantly related to LE (p<.01) and BS (p=.05). For FFs who reported ≥ 1 back injury, improving LE capability by one cm lowers the expected # of back injuries during a career by 34.4%. For every standard deviation increase in BS (27.6 kgs), a FF’s odds of never having a back injury improve tenfold. There was no association between # of back injuries and LF, RR, RL, BE, HE and PC.

CONCLUSION: Possessing an adequate level of back strength and lumbar flexibility appears to reduce the risk for back injuries among FFs. An intervention needs to be conducted to confirm that improving/preserving these aspects of fitness lowers the occurrence of back injuries for FF’s.

3473  Board #194  June 2  8:00 AM - 9:30 AM
Physiological Measurement Comparison From A Portable Sensor System And Standard Laboratory Equipment During Graded Exercise
Jeffrey B. Powell, Aitor Coca, Kim Jung-Hyun, W. Jon Williams, Raymon J. Roberge. NIOSH/CDC/NPPTL, Pittsburgh, PA.
(No relationships reported)

Physiological monitoring in real time can offer valuable information on the biomedical status of workers engaged in strenuous activities.

PURPOSE: This study compares the accuracy of a commercially available portable sensor system to standard laboratory physiological monitoring equipment for real-time monitoring of heart rate (HR) and respiratory rate (RR) responses during treadmill exercise.

METHODS: Six healthy subjects completed a maximal graded exercise test (GXT) wearing the portable sensor system and a standard laboratory physiological monitoring system. The treadmill protocol consisted of stages in which workload increased every 30 seconds starting at 1.7mph/0% incline and ending at 3.5mph/25% incline. The study variables, HR and RR, were recorded simultaneously breathe by breathe using the two systems. The variables were then summarized at time points of rest and workloads (O). Paired sample t-tests and Spearman correlation coefficients (r) were calculated to compare the variables.

RESULTS:

<table>
<thead>
<tr>
<th>VO2</th>
<th>Heart rate (beats/min)</th>
<th>Respiratory rate (breaths/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
<td>Portable</td>
</tr>
<tr>
<td>Rest</td>
<td>72.0 (7.3)</td>
<td>76.5 (7.2)</td>
</tr>
<tr>
<td>30%</td>
<td>93.0 (3.6)</td>
<td>109.3 (14.5)</td>
</tr>
<tr>
<td>50%</td>
<td>128.7 (13.5)</td>
<td>130.3 (10.7)</td>
</tr>
<tr>
<td>70%</td>
<td>146.3 (6.9)</td>
<td>146.9 (6.5)</td>
</tr>
<tr>
<td>90%</td>
<td>171.3 (9.3)</td>
<td>171.7 (8.4)</td>
</tr>
<tr>
<td>MAX</td>
<td>202.9 (9.9)</td>
<td>201.2 (8.3)</td>
</tr>
</tbody>
</table>

Values are mean (SD) (n=6), VO2max: 50.8 (4.3) ml/kg/min. p-value: Paired sample t-test

CONCLUSION: The results of this study show HR and RR measurements by portable sensor system in subjects performing GXT are comparable to those from a standard physiological monitoring system. However, there was a greater HR measurement variability during rest and exercise less than 50% VO2max, while HR and RR measurement accuracy increased at higher exercise intensities. This study demonstrates the accuracy of the portable sensor system for real-time monitoring of physiological parameters and suggests usefulness for physiological research in the field.

3474  Board #195  June 2  8:00 AM - 9:30 AM
Self Reported Exercise during Deployment Correlates with Measured Fitness Outcomes
Bradley J. Warr, Brent A. Alvar, Marilyn A. Sharp. 1U.S. Army Research Institute of Environmental Medicine, Natick, MA; 2Rocky Mountain University of Health Profession, Provo, UT.
(No relationships reported)

There is currently little data evaluating soldiers’ physical activity levels and exercise programs or the accuracy of surveys to characterize fitness training during deployment. The typical deployed unit conducts 24 hr operations, making unit level physical fitness training difficult to conduct; most soldiers maintain their fitness by completing training in an autonomous manner.

PURPOSE: To determine the validity of survey questions regarding frequency and duration of purposeful exercise in deployed soldiers.

METHODS: Seventeen male infantry soldiers (age=26±5.7 y/o, ht=178.5±6.2 cm, wt=83.9±11.8 kg) from the Arizona National Guard completed a VO2 peak test (V02). 1RM bench-press (BP), 1RM back-squat (BS), and survey questions pertaining to frequency and duration of aerobic exercise, strength training, and sports participation. Fitness testing and surveys were completed both prior to deployment and within 10 days of returning from deployment. Spearman Rho correlations were used to determine significant relationships between survey questions and measured physical fitness variables, with p<.05.
RESULTS: Soldiers’ reported activity for the 12 months prior to deployment did not correlate with the measured pre-deployment VO₂, BP, and BS. However, reported activity levels during deployment did correlate with measured VO₂, BP, and BS post-deployment. More than 47% of the soldiers performed aerobic activity at least 3 days per week, while 53% trained for 30 min or more per session. Frequency of aerobic activity was significantly correlated to VO₂ (r=.68), but duration was not. More than 64% performed strength training 3 or more days per week, while 76% conducted 30 min or more per session. Frequency and duration of strength training were both significantly correlated to BP (r=.69, r=.63) and BS (r=.55, r=.69). Only 18% of the soldiers participated in sports activities at least one day per week for more than 30 min per session. Frequency and duration of sports activities were both significantly correlated to VO₂ (r=.54 r=.55).

CONCLUSION: Based on the measured physical fitness variables, the survey questions utilized pertaining to purposeful exercise provide reasonable indices of the frequency and duration soldiers are exercising during deployment.

3475  Board #196  June 2  8:00 AM - 9:30 AM
The Effects Of Football Equipment On 20-year Agility In High School Seniors
Katie C. Morgan, Brian J. Campbell, Torie M. Guidry, Cole M. Thompson, Lauren E. Miller, Stefan L. Bergeron, Brittany S. Richard. University of Louisiana at Lafayette, Lafayette, LA.

(No relationships reported)

Senior high school football players are more physically developed than most underclassmen. The majority have experienced a minimum of four years of a regulated strength and conditioning program. Previous studies have suggested football equipment decreases high school football players’ pro-agility (20-yd shuttle run), however four-year seniors may have a different profile than underclassmen.

PURPOSE: To assess the effects of football equipment on 20 yard Pro-agility times in senior football players.

METHODS: 15 high school football players (weight= 79.42 ± 7.17 kg) served as participants. Players were timed in the 20 yard Pro-agility test with (AE) and without (AN) standard football equipment. Testing was administered by experienced hand held timers on a natural grass field. Participants were randomly assigned to perform two trials under each condition and the faster of the two trials for each condition was recorded and used for analysis. A paired samples t-Test was utilized to compare AE and AN conditions.

RESULTS: No significant difference was noted between AE and AN (t=1.967, p > .05).

DISCUSSION: The results support investigating football equipment effects on different levels of high school football. Senior high school football players are more likely physically developed than most underclassmen, have more experience with the presence of football equipment, and a majority have undergone four years of a regulated strength and conditioning program. Since the 20-yr agility times of seniors were not significantly affected by football equipment, the 3 levels of underclassmen must be studied further to assess where equipment starts to significantly hinder agility.

3476  Board #197  June 2  8:00 AM - 9:30 AM
Comparison Between Two Gps System Device To Asses Speed And Acceleration
Fernando Pareja-Blanco1, Pedro Jiménez-Reyes2, Luis Suárez-Arones1. 1Faculty of Sport, Pablo de Olavide University, Sevilla, Spain. 2Catholic University of San Antonio, Murcia, Spain.

(No relationships reported)

Recently, GPS tracking systems have been used to assess the physical demands in some sports. The validity of GPS devices for measuring distance traveled in team sport and endurance athletes have been investigated and there have been studies for assessing speed in active subjects, but none so far has used GPS of 15 Hz.

PURPOSE: To analyze and compare two GPS system device to assess speed and acceleration in sprint races.

METHODS: Ten physically active male subjects (age: 19.3 ± 2.3 years, stature: 1.77 ± 0.07 m, body mass: 72.7 ± 9.6 kg) randomly chosen from a population of physically active students and sport team athletes were selected. The correlations between peak acceleration and peak speed obtained from a GPS 1 Hz and 15 Hz with sprint time (at 5, 10 and 30-m) measured with timing lights were determined. Forty-three individual sprints were recorded concurrently with timing lights (Microgate, Bolzano, Italy), a GPSports SPC Elite (1 Hz) and GPSports SPC PRO X (15 Hz) (GPSports System, Canberra, Australia). The light sensors were set at 0, 5, 10 and 15-m for the sprints of 15-m and at 0, 30, 40 and 50-m for the sprints of 50-m. From a standing start 40-cm behind the starting gates, the subjects performed a maximal effort sprint over 15m and 50-m. The subjects were instructed before the sprint to produce maximal efforts for the sprint. To determine the test-retest reliability of the GPS device, each subject completed at least two sprints of each distance on two separate. Pearson’s correlation coefficients and 90% confidence intervals (90% CI) were calculated according to the methods of Hopkins.

RESULTS: The correlation coefficients between measures of GPS 1 Hz and GPS 15 Hz in sprints of 15m and 50m were 0.02 in acceleration, and for peak speed were significant for 15m (r=.68) and 0.50m (r=.80). Correlations coefficients between times 5, 10 and 15m measured with timing lights and maximum acceleration and speed measured with GPS were highly significant (r=.95 r=.98).

CONCLUSIONS: The results of this study demonstrated a close correlation between peak speeds measured with GPS (1 and 15 Hz) and sprint time in 30, 40 and 50m. The use of GPS may be an alternative to timing lights for assessing sprint performance in 30m and longer distances, however the low sampling rate (1 and 15 Hz) reduce the sensitivity of these measures, especially over shorter distances.

3477  Board #198  June 2  8:00 AM - 9:30 AM
A Comparison Of The Physiological Demands Of Rowing On The Rowperfect And Concept II Rowing Ergometer
Níamh Ni Cheilleachair1, Andrew Harrison1, Giles Warrington, FACSM2. 1University of Limerick, Limerick, Ireland. 2Dublin City University, Dublin, Ireland.

(No relationships reported)

Ergometer rowing is a popular method of optimizing dry-land training. Rowing ergometers are widely used in the assessment of rowing performance and in national selections.

PURPOSE: The purpose of this study was to compare the physiological demands of rowing on the Rowperfect and Concept II rowing ergometers.

METHODS: Thirteen trained male rowers participated in the study. Selected physiological responses to an incremental test and a 4-minute maximal test were investigated on the Rowperfect and Concept II. The submaximal incremental test consisted of 3-minute stages at a fixed exercise intensity and predetermined stroke rate followed by 30 seconds recovery. The test commenced at 170 W with 30 W increments until a clear inflection point on the workload-lactate curve was observed, after which one additional increment was completed. During each 30 seconds recovery an earlobe blood sample was taken to determine blood lactate concentration (BLa) and RPE was recorded. Heart rate (HR) (bpm) was measured continuously during the test. On completion of the final incremental stage there was a 2 minute recovery before the 4 minute maximal performance test. This test was to establish the maximal distance which could be covered and to examine the mean power output (MPO) obtained on the 2 rowing ergometers. During the test, time and stroke rate were the only variables visible to the subjects, to ensure any pacing effect was minimised. Each subjects power output and stroke rate were recorded throughout the test. A post-exercise blood lactate sample was obtained after 5 minutes to establish lactate concentrations.

RESULTS: Blood lactate was significantly higher on the Concept II for all exercise intensities from 170 to 290 W (P<0.05). In contrast no significant difference was found with HR and RPE. During the 4 minute maximal performance test MPO was significantly higher on the Rowperfect (P<0.05) while distance was significantly higher on the Concept II (P<0.05) but no significant difference in peak blood lactate was observed.

CONCLUSION: These results indicate that the Concept II places greater physiological demands on rowers than the Rowperfect at fixed exercise intensities. These differences may be due to the different dynamics and mechanics of the two rowing ergometers or inter-ergometer variation in displayed power output.
An Evaluation of Army Physical Fitness Scores across Classes among Reserve Officer Training Cadets

Keith Leiting, Jake Reed, David Land, Michael H. Stone, Mike W. Ramsey, East Tennessee State University, Johnson City, TN.

Abstract

PURPOSE: The goal of the study was to compare standard military physical fitness scores among Reserve Officer Training Core (ROTC) cadets of varying years of involvement.

METHODS: Forty four male and female cadets (38 male, 6 female) performed a scheduled APFT test at the beginning of the fall collegiate semester. Instruction and demonstration of proper technique for push-up and sit-up events was provided prior to the test. Each cadet was given two minutes to perform as many push-ups and two minutes to perform as many sit-ups as possible, followed by the two mile run for shortest time conducted on a 400 meter rubber track. All raw scores and times were recorded on the Army Physical Fitness Scorecard as per FM 21-20. Following which differences were obtained using the 4x4 multivariate analysis of variance (MANOVA) (Training, 1992). Tukey’s HSD post hoc test were completed to determine differences between classes once significance was found.

RESULTS: Significant differences were noted for push up score, sit up scores and total scores (p < 0.05; Table 1), however 2 mile run score was not significant (p > 0.05; Table 1). MSI cadets scored significantly lower than MSII, MSIII, MSIV in all categories (p < 0.05; Table 1). There were no significant differences found between MSII, MSIII, and MSIV for any of the scores (p > 0.05; Table 1).

CONCLUSION: MSI cadets are less physically fit as determined by the APFT scores. Interestingly the MSII, MSIII, and MSIII do not seem to increase their physical fitness levels despite their continued involvement with the FM 21-20 training protocol.

<table>
<thead>
<tr>
<th>Test</th>
<th>MSI</th>
<th>MSII</th>
<th>MSIII</th>
<th>MSIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push Up Score</td>
<td>56.6±13.00</td>
<td>87.5±9.18*</td>
<td>87.6±12.12*</td>
<td>81.6±13.13*</td>
</tr>
<tr>
<td>Sit Up Score</td>
<td>60.75±9.11</td>
<td>87.13±11.84*</td>
<td>85.7±15.02*</td>
<td>86.7±14.10*</td>
</tr>
<tr>
<td>Two Mile Score</td>
<td>51.75±41.13</td>
<td>84.8±47.11</td>
<td>75.06±27.39</td>
<td>82.9±10.00</td>
</tr>
<tr>
<td>Total Score</td>
<td>169.13±69.67</td>
<td>259.50±34.81*</td>
<td>250.43±45.77*</td>
<td>255.50±25.95*</td>
</tr>
</tbody>
</table>

Table 1: Data is means ± SD. * denotes sig. dif. (p<0.05) from MSI.
The regular practice of physical exercise reduces the decline of functional fitness and tennis practice is a possibility for this

**PURPOSE:** To assess the relationship between behaviour, as reflected by physical fitness markers: maximal aerobic capacity () and muscular strength, health status and CV risk.

**METHODS:** This is the first phase of a study to examine the effects of fitness centre based exercise on CV health and wellbeing. Participants were then randomly assigned to either a structured gym based exercise or unstructured gym based exercise. A control group receiving physical activity counselling was also included.

**RESULTS:** Initial baseline findings show moderate correlations between and strength in Chest Press (CP) (R=0.317, P=0.002) and Lateral Pull Down (LPD) (R=0.308, P=0.002). and strength

**CONCLUSION:** The initial findings show that increased predicted and muscular strength as indicators of physical fitness are associated with decreased BP. Further, increased BP is associated with a higher RHR and CRP. However no relationship between cholesterol and BP with levels of physical fitness was found within this cohort.

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**Board #202 June 2 8:00 AM - 9:30 AM**

**Walking Performance Assessed by Incremental Shuttle and Six-minute Walking Tests among Older Tennis Practitioners**

Ricardo L. F. Guerra, Arino Anjos, Victor Zuniga Dourado. UNIFESP, Santos, Brazil. (No relationships reported)

The regular practice of physical exercise reduces the decline of functional fitness and tennis practice is a possibility for this

**PURPOSE:** To assess the relationship between behaviour, as reflected by physical fitness markers: maximal aerobic capacity () and muscular strength, health status and CV risk.

**METHODS:** This is the first phase of a study to examine the effects of fitness centre based exercise on CV health and wellbeing. Participants were then randomly assigned to either a structured gym based exercise or unstructured gym based exercise. A control group receiving physical activity counselling was also included.

**RESULTS:** Initial baseline findings show moderate correlations between and strength in Chest Press (CP) (R=0.317, P=0.002) and Lateral Pull Down (LPD) (R=0.308, P=0.002). and strength

**CONCLUSION:** The initial findings show that increased predicted and muscular strength as indicators of physical fitness are associated with decreased BP. Further, increased BP is associated with a higher RHR and CRP. However no relationship between cholesterol and BP with levels of physical fitness was found within this cohort.

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**Board #204 June 2 8:00 AM - 9:30 AM**

**A Comparison of Two Different Body Positions Used During Rowing**

Daniel G. Syrotuik, Bill Reynolds, Jack Bennett, Pierre Gervais, Gordon J. Bell. University of Alberta, Edmonton, AB, Canada. (No relationships reported)

The amount of power output (PO) generated during a rowing stroke is partly dependent on the length of the stroke and this can be enhanced by using a greater extension at the finish position of the stroke. However, there is little research that has compared the differences of performing the rowing stroke at varying lean-back (LB) positions.

**PURPOSE:** The purpose of this study was to compare two different LB positions during 3 different graded exercise trials on a Concept II rowing machine.

**METHODS:** Nine men and 5 women with a mean age (± SD), height, body mass and peak of 29 (11) yrs, 185.6 (11.4) cm, 84.8 (15.9) kg, 51.2 (6.9) ml×kg

**RESULTS:** The initial baseline findings show moderate correlations between and strength in Chest Press (CP) (R=0.317, P=0.002) and Lateral Pull Down (LPD) (R=0.308, P=0.002). and strength

**CONCLUSION:** The initial findings show that increased predicted and muscular strength as indicators of physical fitness are associated with decreased BP. Further, increased BP is associated with a higher RHR and CRP. However no relationship between cholesterol and BP with levels of physical fitness was found within this cohort.
METHODS: Six trained male endurance runners (aged between 20-23 years old) ran on a NT and MT at the speed of 8, 11 and 14 km/h in a randomized order (3 min for each trial), with 5 min rest between trials. For each trial, VO2 was measured between the 2nd and 3rd minutes, while HR and EMG from the gluteus maximus(GM), biceps femoris(BF), rectus femoris(RF), vastus medialis(VM), and tibialis anterior(TA) were recorded between 2’30” and 2’40”.

RESULTS: Faster speeds produced greater HR(p<0.001), VO2(p<0.001)and iEMG (p<0.01). VO2 and HR were significantly higher for the NT compared to MT (p<0.001). iEMG was also significantly higher for the NT (p<0.05) except VM and TA . Significant condition × speed interactions for VO2 (p<0.001) and iEMG (p<0.05) meant that the condition effects were more pronounced for faster speeds.

CONCLUSIONS: NT running results in higher HR, VO2 and iEMG of lower limbs (except VM and TA) than that in MT running. These discrepancies of physiological responses need to be considered when prescribing exercise programs for NT users.

Nogrant for this study.

<table>
<thead>
<tr>
<th>3485</th>
<th>Board #206</th>
<th>June 2</th>
<th>8:00 AM - 9:30 AM</th>
<th>Relationships Between Free Testosterone, Cortisol, And Anaerobic Performances In Recreationally-trained Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matthew J. Andre, Andrew C. Fry, Jason B. Winchester, Arnold G. Nelson, FACSM, Jatin P. Ambegaonkar, Shane V. Caswell, University of Kansas, Lawrence, Ks. 1Midwestern State University, Wichita Falls, TX. 2Louisiana State University, Baton Rouge, LA. 3George Mason University, Manassas, VA.</td>
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<td>No relationships reported</td>
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Free testosterone (FT) and its ratio to cortisol (FT/C) has been correlated with jumping and sprinting ability in football, soccer, throwing, handball, and volleyball athletes (Cardinale & Stone, 2006; Nelson et al., 2009; Winchester et al., 2008a). One study has also reported significant relationships in a recreationally-trained population (Winchester et al., 2008b).

PURPOSE: To examine relationships among salivary FT or FT/C and anaerobic performances in recreationally-trained individuals.

METHODS: Saliva was collected from 17 recreationally-trained college males, followed by testing for vertical jump (VJ), standing broad jump (SBJ), and 36.6m (40yd) sprint (SPR). Saliva samples were analyzed in duplicate for FT and cortisol (C) via ELISA. Pearson product correlation coefficients (r) examined relationships between salivary FT or FT/C and performance (p<0.05).

RESULTS: Mean VJ (cm), SBJ (cm), and SPR (seconds) were 58.1±2.3, 2.22±0.06, and 5.51±0.10, respectively. Mean FT (nmol/L), C (nmol/L), and FT/C were 1.09±0.2, 5.89±1.4, and 0.29±0.04, respectively.

| Pearson Correlation Coefficients (rcrit=0.48, n=17, α=0.05) |
|----------------|----------------|----------------|----------------|----------------|----------------|
| Vertical Jump  | Standing Broad Jump | Sprint |
| FT              | 0.37            | 0.08           | 0.21           |
| Cortisol       | 0.02            | 0.25           | 0.01           |
| FT/C           | 0.21            | 0.11           | 0.22           |

No correlations were statistically significant.

CONCLUSION: The results of this study suggest that FT, C, and FT/C are not related to vertical jump, standing broad jump, or sprint performance in non-athletic, but physically-active, populations. Further research is needed to determine relationships between endocrine profiles and anaerobic performances for this population.

<table>
<thead>
<tr>
<th>3486</th>
<th>Board #207</th>
<th>June 2</th>
<th>8:00 AM - 9:30 AM</th>
<th>Stability Ball Sitting During Semi-Recumbent Exercise</th>
</tr>
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<tbody>
<tr>
<td>Charles R. Marks, Jenna Leach, Deborah Wagner, Leslie Schachinger, Blake Brennan, Steven Grapsas, Oakland University, Rochester, MI. (Sponsor: Tamara Hew-Butler, FACSM)</td>
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<td>No relationships reported</td>
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PURPOSE: This study predicted that stability ball sitting during semi-recumbent exercise will affect cardiorespiratory, electromyography, and kinematic parameters when compared to chair sitting.

METHODS: Sixteen healthy young adults underwent two semi-recumbent graded exercise tests to volitional fatigue over two consecutive days: one stability ball sitting, the other chair sitting (order randomized). Pedaling while sitting behind a cycle ergometer and holding onto cycle seat was used for the semi-recumbent position. VO2 and heart rate (HR) were continuously measured. During two stages of exercise right side flexor digitorum (FD), erector spinae (ES), external oblique (EO), quadriceps (QC), hamstrings (HM), and gastrocnemius (GN) % MVC EMGs were measured; also, video of the right hip back view was taken for vertical (Hip V) and lateral (Hip L) displacement. Repeated measures ANOVA with paired t test for post hoc analysis (P < 0.05) were done.

RESULTS: All participants achieved the same peak power output for both tests. VO2, HR, ES, and HM had non-significant sitting mode main effects and interactions (P > 0.35) while EO tended towards significant sitting mode main effects (P = 0.113). FD, GN, and QC had significant sitting mode main effects (P < 0.042). Hip V and Hip L also had significant sitting mode main effects (P < 0.004). The table below reports the means ±sd for all but ES and HM.

<table>
<thead>
<tr>
<th>Table</th>
<th>Ball</th>
<th>Chair</th>
<th>Ball</th>
<th>Chair</th>
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<tbody>
<tr>
<td>VO2</td>
<td>1.59±0.31</td>
<td>1.56±0.39</td>
<td>1.40±14</td>
<td>1.42±11</td>
</tr>
<tr>
<td>50% of Peak</td>
<td>FD</td>
<td>2.47±0.60</td>
<td>2.49±0.70</td>
<td>2.74±11</td>
</tr>
<tr>
<td>Peak</td>
<td>2.89±0.71</td>
<td>2.83±0.68</td>
<td>3.85±9</td>
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</tr>
<tr>
<td>GN</td>
<td>45.9±17.7</td>
<td>45.0±7.6</td>
<td>45.9±17.7</td>
<td>45.0±7.6</td>
</tr>
<tr>
<td>EO</td>
<td>40.3±13.2</td>
<td>45.6±15.5</td>
<td>40.1±7.8</td>
<td>44.2±7.8</td>
</tr>
<tr>
<td>EMG %</td>
<td>54.4±6.1</td>
<td>51.6±8.1</td>
<td>52.7±20.7</td>
<td>52.2±17.5</td>
</tr>
<tr>
<td>Stage 1</td>
<td>49.4±7.9</td>
<td>48.8±8.7</td>
<td>48.6±42.2</td>
<td>48.3±16.7</td>
</tr>
<tr>
<td>Hip V</td>
<td>3.2±0.9</td>
<td>2.5±1.8</td>
<td>4.6±1.7</td>
<td>1.1±0.48</td>
</tr>
<tr>
<td>Hip L</td>
<td>4.7±1.8</td>
<td>2.1±0.5</td>
<td>5.5±1.9</td>
<td>2.3±0.7</td>
</tr>
</tbody>
</table>

* Ball versus Chair Paired t P < 0.018
CONCLUSION: It is concluded that the stability ball may alter arm and leg muscle recruitment patterns with an increase in coronal plane hip motion during semi-recumbent exercise but without affecting cardiorespiratory parameters.

Supported in part by an Oakland University Faculty grant.

3487 Board #208 June 2  8:00 AM - 9:30 AM
Gross Mechanical Efficiency And Physical Strain During Submaximal Cyclic Arm-leg Cruiser® Exercise
Lucas H. van der Woude1, Liesbeth Simmelink2, Ilse Borgesius3, Florentina Hettinga2, Rienk Dekker2. 1Center for Human Movement Sciences, University Medical Center Groningen, Groningen, Netherlands. 2Center for Rehabilitation, University Medical Center Groningen, Groningen, Netherlands. (Sponsor: TWJ Janssen, FACSM)

(PURPOSE: The Cruiser® ergometer (Enraf Nonius, The Netherlands) is a testing and training device, which allows combined asynchronous arm-leg exercise in a stable recumbent sitting position. As such it is frequently used in Dutch rehabilitation as a cardiorespiratory fitness intervention for lower limb impaired persons.

METHODS: To compare gross mechanical efficiency (GE) and physical strain during steady state submaximal Cruiser, cycling and upper body handbike exercise.

RESULTS: Twenty Healthy men (n=10; 24±1.8yrs; 79±10.5kg) and women (n=12; 22.1±2.4; 65.8±10.2kg) enrolled in a series of 4 submaximal steady state exercise tests on the Cruiser, a bicycle ergometer, a handbike on a motor driven treadmill and again the Cruiser. In each mode subjects performed a series of six 3min bouts (PO=20-45W) at a constant cadence. Oxygen uptake, energy cost, ventilation, breathing frequency, heart rate and RPE were monitored. GE was derived from PO and energy cost.

RESULTS: Cruiser GEs (45W; men: 13.0±1.3%, women: 15.0±3.1%) were not significantly different from cycling (45W; men: 13.2±1.9%, women: 14.6±1.9%), yet both were significantly higher than in handcycling (45W; men: 11.2±0.8%, women: 12.2±1.2%; P<0.05). A similar pattern was found for each of the physical strain parameters: a comparable strain between Cruiser and bicycle test, yet a significantly higher strain for handcycling (P<0.05). Apart from RPE, the repeated Cruiser tests did not show significant differences.

CONCLUSIONS: Submaximal Cruiser exercise is a cyclic form of large muscle exercise, comparable in efficiency and physical strain to cycling. As such it seems a safe, repeatable and effective exercise mode, involving both asynchronous upper and synchronous lower body work.

G-40 Free Communication/Poster - Fitness and Performance Testing VI

3488 Board #209 June 2  9:30 AM - 11:00 AM
Validation Of The Actiheart For Estimating Physical Activity Related Energy Expenditure In Pregnancy
Katarina Melzer1, Matteo Lazzeri2, Stephane Armand1, Michel Boulvain1, Bengt Kayser1. 1Swiss Federal Institute of Sports, Macolin, Switzerland. 2Institute of Movement Sciences and Sports Medicine, Geneva, Switzerland. 3University Hospitals of Geneva, Geneva, Switzerland.

(PURPOSE: The Actiheart (CamNtech Ltd., Cambridge, UK), a combined heart rate and movement sensor device, was shown to give precise estimates of activity energy expenditure (AEE) among men and non-pregnant women. The objective of this study was to assess the validity of the individually calibrated Actiheart in pregnant women against indirect calorimetry in a laboratory setting.

METHODS: Ten healthy pregnant women (aged 32.9±3.2 yrs, pre-pregnancy BMI=21.0±2.4 kg/m², 36.9±2.4 weeks of gestation) walked at 3, 4, 5, and 6 km/h on a treadmill, cycled at 25W and 50W on an ergometer and stepped on and off a 15 cm high step. During each routine, AEE was measured simultaneously with the Actiheart (AEEa) and indirect calorimetry (AEEcalo). AEE measurements were compared with paired Student’s t-test, and their agreement with Bland and Altman plots.

RESULTS: The mean AEEcalo were not significantly different from AEEs for any activity except for cycling at 50W (-45 J/kg/min, p=0.01). Cumulated AEEa and AEEcalo, combining all activities, were not different (p=0.9). All data points (100%) fell within ±2SD for all activities except for walking at 6km/h (89% of data points). All data points fell within ±2SD for the sum of all speeds of walking (3, 4, 5, and 6 km/h).

CONCLUSIONS: The Actiheart can be used as a valid method for AEE estimation in pregnant women. The data serve as valuable information for improving the assessment of AEE in pregnancy and clarifying the association between activity and particular health outcomes in this population group.

3489 Board #210 June 2  9:30 AM - 11:00 AM
The Energy Cost Of Carrying A Portable Metabolic Analyser
Lars McNaughton, FACSM, Andy Sparks. Edge Hill University, Ormskirk, United Kingdom.

(PURPOSE: Portable gas analysers, such as the Cosmed and Metamax, are commonly used in exercise and sporting activities, and such systems have been shown to be both valid and reliable. Little is known however, of the impact on energy expenditure (EE) on individuals that are required to carry them during exercise bouts.

METHODS: Eight male participants of (Mean ± SD) age 25.0±9.47y, body mass 78.5±8.39kg, and height 183±0.8 cm, completed two random incremental exercise bouts on a motorised treadmill. Following 4 min of standing, the participants walked at 4km.h-1 and then completed a progressive exercise test with 4 min stages and 2km.h-1 increments until volitional exhaustion. The experimental (PT) trial required participants to complete the exercise bout whilst wearing a portable respiratory gas analysis system (Metamax 3B, Cortex, Germany). During the control trial (C) the weight of the gas analyser was supported by a harness adjacent to the treadmill. Throughout each exercise trial, heart rate (HR) and rating of perceived exertion (RPE) were measured and respiratory gases were used to calculate EE via indirect calorimetry. All data were analysed using ANOVA with Repeated Measures; significance was p<0.05.

RESULTS: During the exercise bouts, the rate of EE increased as the intensity of exercise increased (p<0.001). There was a significantly greater rate of EE during PT between the running speeds of 7 - 14 km/h (p=0.05), but no significant differences were observed during standing, walking or at maximal exercise (p>0.05). There were no significant effects of wearing the gas analyser on VO2 max. (4.10±0.53, and 4.28 ±0.75 for the C and PT trials respectively), HR or RPE.

CONCLUSION: Portable gas analysis systems have no effect on the energy expended during standing, walking for short periods, or during maximal exercise, but significantly increase the energy demands of submaximal running when carried on the person.
The studies describing the energy expenditure during offshore sailing regattas are very rare. This is rather disappointing, if we consider that in offshore sailing several environmental and tactical factors may place a considerable physical load and mental stress on our body.

**PURPOSE:** The aim of the study consists in assessing the energy expenditure during long distance offshore sailing and in describing the physical activity intensity involved in this type of competition. METHODS: Six subjects (age: 46.3 ± 3.4 yr; BMI: 26.7 ± 1.7 kg/m², VO²peak: 2.97 ± 0.56 l/min) participated in the study. During the regatta (double-handed, 500 miles in the North Adriatic, lasting 3-5 days) the subjects wore an activity monitor (Actiheart, CamNtech, E) that allows estimate energy expenditure, physical activity level (PAL) and minutes spent at each level of intensity (sedentary, S ≤1.5 MET; light, L 1.5-2.9 MET; moderate, M: 3.0-6.0 MET; vigorous, V >6.0). The time spent at each level of intensity was evaluated using one-way ANOVA; pairwise comparisons were performed using Student-Newman-Keuls test.

**RESULTS:** Daily energy expenditure (TEE) amounted, on the average, to 3408 ± 453 kcal per day; daily activity energy expenditure (AEE) amounted to 1208 ± 339 kcal per day, PAL, calculated as TEE divided by resting energy expenditure (RMR, estimated with Schofield formula), was 1.8 ± 0.2. Subjects spent a significant (p < 0.001) longer period of time in S (643 ± 193 min per day) and L (516 ± 177 min per day) than in M (95 ± 34 min per day) and V (6 ± 4 min per day) activity. On the average, the subjects slept 5 times per day (±1.4) for about 36 minutes (±9) in each sleeping period.

**CONCLUSION:** TEE per day and PAL during double-handed offshore sailing race turned out to be similar to that measured using double-labeled water technique in single-handed offshore sailing (3451 kcal/day and 2 l, respectively). Moreover, this study reports for the first time, not only TEE, but also AEE and the time spent sleeping and that performing activities of different intensity. The high TEE seems to be likely the consequence of the short and rare periods of sleep spent during the competition than of the bouts of moderate to vigorous physical activity.

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**3490 Board #212 June 2 9:30 AM - 11:00 AM**

**Exercise Intensity and Performance Analysis of Taekwondo Combats in Master Athletes**

Francesco Tornello¹, Laura Capranica¹, Carlo Minganti², Salvatore Chiiodo¹, Antonio Tessitore³, ¹University of Rome, Rome, Italy, ²University of Catanzaro, Catanzaro, Italy, ³University of Catanzaro, Rome, Italy. (Sponsor: Carl Foster, FACSM)

Since martial arts are widely practiced at all ages, the main argument is about to evaluate their impact on health. In a review, Bu et al. (2010) reported a general positive influence, however most of the studies were not conducted during official combats and no information is available for master athletes.

**PURPOSE:** Thus, this study aimed to investigate heart rate (HR) responses and performance analysis of Taekwondo (TKD) master athletes combats.

**METHODS:** Twelve official combats of master athletes (age: 39±4 yrs) were observed during the 1st European Masters Games (Venice, Italy, 2011). The HR exercise intensities were determined by the time spent by athletes at three classes of efforts (90% of individual HRpeak). A time motion analysis was applied to measure the duration of actions in relation to three classes of combat phases: Fighting (F), No Fighting (NF) and Stop (ST). The technical and tactical analysis was carried out to analyze: a) the points scored with a kick (1, 2, 3 and 4 points) and punch performed with a clear technique and points scored with a not clear one; b) the strategy adopted for actions (i.e. attack, defence and evasive maneuvers, blocks, etc.). An ANOVA for repeated measure with significance setted at p ≤0.05 was applied for statistical analysis.

**RESULTS:** The HR analysis showed a significant difference for classes of efforts (p<0.01) in the last 90% of individual HRpeak, respectively. The time motion analysis revealed a significant difference between classes of combat phases (p≤0.002) with a mean duration of 1.94±0.48, 6.26±1.83 and 12.97±6.74 seconds and a mean frequency of occurrence of 40.8±5.1%, 48.7±3.7% and 10.5±5.7% for F, NF, ST, respectively. The technical and tactical aspects showed differences for each class and for strategy analyses. Post-hoc revealed that the “1 point scored with a kick” class (59.8±15.8%) and the attack class (50.6±18.9%) were different from all other classes of their respective specific analyses (p<0.001).

**CONCLUSIONS:** This study indicate that the TKD master competition posed a high load on athletes, who, probably due to being former senior athletes, were able to be engaged in a high intensity activity, which requires to be monitored to have a positive impact on health.REFERENCES: Bu et al. (2010). JEBM, 3, 205-219.
METHODS: Ten male participants (age, 21 ± 2 yr; height, 177 ± 9 cm; weight, 76.3 ± 3.0 kg) each completed 5 graded exercise tests: 3 treadmill tests (Bruce, UCLA, Wellness Fitness Initiative (WFI)), a field-based running test (Shuttle) and a cycle test. VO$_2$ and HR were measured during each test.

RESULTS: Data are presented in table. All tests were considered maximal as all participants achieved VO$_{2max}$ according to ACSM criteria. VO$_{2max}$ during the cycle protocol was significantly lower than during Bruce and WFI (P < 0.05). None of the other protocols differed from each other. There was no significant difference in the CI or y-intercept across protocols.

**CONCLUSION:** The findings from this study support previous research showing that VO$_{2max}$ is protocol-dependent. However, the robust linear relationship between HR and VO$_2$ is unaffected by exercise mode or protocol.

Supported by contract from DHS Science and Technology awarded to UCLA.

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**Board #215**

**June 2**

**9:30 AM - 11:00 AM**

**Energy Expenditure During Sessions of static Stretching**

Ricardo A. Simões, Marcio A.G. Sindorf, Pamela R.G. Gonelli, Marcelo C. Cesar. UNIMEP - Methodist University of Piracicaba, Piracicaba, Brazil.

(No relationships reported)

American College of Sports Medicine (ACSM) recommends stretching exercises as part of a program for health to maintain and improve flexibility. Stretching exercise has also an energy expenditure that could contribute to weight maintenance programs, besides providing an efficient method of heating for more intense exercises. However, there is the need for a study to evaluate the energy cost of static stretch exercise in young women.

**PURPOSE:** To evaluate energy expenditure during a static stretch session in young women, as recommended by ACSM.

**METHODS:** Subjects were 12 women (23.3 ± 3.5 years; 58.8 ± 6.1 Kg; 1.72 ± 0.1 m; 21.2 ± 1.3 kg/m2) engaged in physical training for a minimum of 6 months. Energy expenditure was measured in non-consecutive days by metabolic gas analyzer and telemetry system. Resting energy expenditure (REE) was done with subjects on 3 hours fasting and 30 minutes rest in supine position, the measures were taken at rest for 12 minutes. The first 2 minutes were discarded and an average of the 10 remaining minutes was used to determine the REE. The stretch energy expenditure (SEE) was measured during static stretches session for about 5 minutes. Stretch exercises were done in standing position, one repetition per muscle group and each position were held for 20 seconds for major muscle groups following exactly the order - biceps, triceps, shoulders, back posterior chain, latissimus dorsi, chest, posterior lower extremity chain, quadriceps and adductor muscles. Mean and standard deviation (±SD) for all variables were calculated and expressed in kilocalories per minute (kcal/min). Normal distribution of the data was checked by Shapiro-Wilk’s test and Friedman test was used for the comparison among the variables.

**RESULTS:** On days 1, 2 and 3 REE were respectively 1.15±0.4, 1.05±0.3, 0.92±0.2 and SEE were 2.09±0.6, 1.9±0.2 and 1.4±0.3 kcal/min. The results show no significant differences in the measured variables at REE and SEE among days 1, 2 and 3 (p>0.05) but there was a significant increase (p<0.05) in energy expenditure between REE and the SEE on all 3 days of evaluation.

**CONCLUSIONS:** The results show that the energy expenditure of young women is significantly increased while performing static stretches, about twice, in relation to REE.

Supported by FAEPES, CAPES and CNPq.

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**Board #216**

**June 2**

**9:30 AM - 11:00 AM**

**The Relationship Between Muscle Activation And Ratings Of Perceived Exertion Across Four Exercise Modes**

Ryan P. McGrath, Kathy D. Browder. University of Idaho, Moscow, ID.

(No relationships reported)

Previous research reported that dual action (arms & legs) elliptical trainer (ET) exercise elicits lower RPE than other forms of exercise (Hughes et al, 2005). However, why RPE is lower has not been explained.

**PURPOSE:** To determine the relationship between rating of perceived exertion (RPE) and muscle activation in ET, dual action (arms+legs) recumbent bike (DB), a treadmill (TM), and single-action (legs only) recumbent bike (SB).

**METHODS:** Ten males and four females (Age:21±2 yr; Height:177.4±10.0 cm; Weight:77.4±13.7 kg) volunteered as subjects. Each subject warmed up 5 min on a stationary bike, and then completed 6 minutes of exercise on each machine in randomized order with 3 min rest period between bouts. The metabolic workload was standardized across machines at ~31.3 ml kg$^{-1}$ min$^{-1}$. Overall RPE (O-RPE), central RPE (C-RPE), and peripheral RPE (P-RPE) were measured at the end of each exercise bout. EMG activity of the biceps brachii (BB), pectoralis major (PM), triceps brachii (TB), middle deltoïd (MD), gastrocnemius (GA), gluteus maximus (GM), vastus lateralis (VL), and biceps femoris (BF) was sampled continuously at 1000 Hz for 6 consecutive strides at the end of each minute of exercise. A one-way repeated measures ANOVA was calculated to determine differences across machines.

**RESULTS:** No significant differences were found in C-RPE (p=0.002) in ET (10±2); C-RPE(DB)12±2; C-RPE(TM)12±2; C-RPE(SB)14±2) across machines. P-RPE was significantly less (p<0.007) in ET (11±2) and TM (11±3) versus DB (12±2) and SB (13±3). GA activation was less in ET than in SB, DB, or TM (p<0.01; GA<sub>ET</sub><sub>V</sub>; GA<sub>DB</sub><sub>V</sub>; GA<sub>TM</sub><sub>V</sub>; GA<sub>SB</sub><sub>V</sub>; in all cases p<0.01). TB activation was greater in DB and ET (p<0.01; BB<sub>ET</sub><sub>V</sub>; BB<sub>DB</sub><sub>V</sub>; BB<sub>TM</sub><sub>V</sub>; BB<sub>SB</sub><sub>V</sub>; in all cases p<0.002). MD activation was greater in DB and TM, and least in SB (p<0.001; MD<sub>DB</sub><sub>V</sub>; MD<sub>TM</sub><sub>V</sub>; MD<sub>SB</sub><sub>V</sub>; in all cases p<0.001). TB activation was greater in DB and ET (p<0.002; TB<sub>ET</sub><sub>V</sub>; TB<sub>DB</sub><sub>V</sub>; TB<sub>TM</sub><sub>V</sub>; TB<sub>SB</sub><sub>V</sub>; in all cases p<0.002). MD activation was greatest in DB and TM, and least in SB (p<0.001; MD<sub>DB</sub><sub>V</sub>; MD<sub>TM</sub><sub>V</sub>; MD<sub>SB</sub><sub>V</sub>; in all cases p<0.001).

**CONCLUSION:** Lower P-RPE and O-RPE in ET may be related to decreased muscle activation in the lower leg, specifically the GA, and less dependent on upper extremity muscle activation. Supported, in part, by SportsArt, Inc.

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**Board #217**

**June 2**

**9:30 AM - 11:00 AM**

**Relationship Of Metabolic Costs Of Aquatic Treadmill Versus Land Treadmill Running**

Sarah Blackwell, Ryan Porter, Gerald Smith, FACSM, Dale Wagner, Dennis Dolny. Utah State University, Logan, UT.

(No relationships reported)

**PURPOSE:** This study investigated whether running using water jets in an aquatic treadmill (ATM) reflects energy expenditure (EE), oxygen consumption, VO$_2$ while running at faster speeds on a land treadmill (LTM).

**METHODS:** Sixteen participants completed two trials on separate days on a LTM and ATM. For the ATM trial subjects performed eighteen, 3-4 min submaximal runs at three self selected speeds (slow, medium, and fast) with either water jet resistances of 0-100% of maximum jet flow capacity in 20% increments. For LTM subjects ran at the same speeds at 0% incline. Trials were separated by at least 48 hours. Oxygen consumption (VO$_2$), heart rate (HR), and ratings of perceived exertion (RPE) were recorded during each trial. Regression analysis estimated TM VO$_2$ from running speed (VO$_2$, ml.kg.min$^{-1}$) = 6.1034+4.37*TM speed (R$^2$ = 0.95, SEE=0.93+0.87 ml.kg.min$^{-1}$). Regression analysis produced prediction equations to estimate LTM running speeds based on ATM EE with adding jet resistances.

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RESULTS: At the same speed ATM VO2 EE with 0 and 20% jet settings were lower than TM. However by ATM 40% jet resistances VO2 was greater (p<0.02) than LTM. Differences in ATM VO2 associated with each jet setting (0, 20, 40, 60, 80, and 100%) corresponded to a change (M±SD) in comparable LTM speed of -1.00 (.90), -.96 (.82), +.91 (.72), +1.53 (1.14), +3.05 (1.16), and 4.47 (1.32) miles per hour respectively.

CONCLUSIONS: These results demonstrate that the ATM jets have the potential to provide an added metabolic challenge to mimic TM running that is ~.5 mph faster. One potential benefit is to use ATM with jets to allow subjects to experience a training load that may be much greater than their current/chronic orthopedic condition might allow.

3497 Board #218 June 2 9:30 AM - 11:00 AM Effects Of Delayed Onset Muscle Soreness On Maximal Incremental Exercise Test Results Bryna C. Driscoll1, Linsey Taylor2, Jason C. Siegel, FACSM3, Adrian W. Midgley1. 1The University of Hull, Hull, United Kingdom; 2The University of Bedfordshire, Bedford, United Kingdom; 3The University of Western Sydney, Sydney, Australia. (Sponsor: Jason Siegel, FACSM)

PURPOSE: Delayed onset muscle soreness (DOMS), is considered one of the most common forms of sports injury. Training or competing with DOMS may result in a less than optimal training intensity or significant decrements in exercise performance. Despite numerous studies investigating the effects of DOMS on exercise performance, no definitive studies have investigated the effects of DOMS on maximal incremental treadmill test results, which was the objective of the present study.

METHODS: Twenty healthy males, randomly allocated into a control group (n = 10) and experimental group (n = 10), completed three tests on three separate occasions (familiarisation, pre and post intervention tests). The experimental group also completed an intervention test consisting of eccentric knee extension and flexion exactly 48 h prior to the post intervention test.

RESULTS: No significant changes were observed in any of the dependent variables pre-post intervention in the control group. In the experimental group, the median change in perceived muscle soreness was 58, 59 and 44 mm at 24 h, 36 h and 48 h post-intervention compared to pre-test intervention (p = 0.001). Maximum voluntary isokinetic peak torque of the knee extensors decreased by 8% (p = 0.006) and 18% (p = 0.005) in the dominant and non-dominant leg respectively and by 37% (p = 0.012) for knee flexion in the dominant leg. During the post-intervention test, time to exhaustion decreased by 9% (p = 0.001) and maximal blood lactate concentration decreased by 11% (p = 0.005) compared to the pre-test intervention. Furthermore, energy expenditure for the same treadmill velocity increased by 17% (p = 0.04).

CONCLUSIONS: The results from the present study suggest that performing a maximum incremental exercise test with DOMS, results in individuals failing to achieve their maximum treadmill velocity, which could invalidate the results obtained from this test. Additionally, running efficiency is reduced whilst suffering from DOMS.

3498 Board #219 June 2 9:30 AM - 11:00 AM Simultaneous Observation for Oxidative Stress and Muscle Damage with High-Intensity Kendo Training Kazuho Kizaki1, Tomoyoshi Tera1, Hajime Ariyakawa1, Tomio Tajima1, Kazunori Hoso1, Hajime Imai1, Seichi Era1. 1Gifu University Graduate School of Medicine, Gifu, Japan; 2National Defense Academy, Yokosuka, Japan; 3Kaneka Corporation, Osaka, Japan; 4Gifu University Faculty of Education, Gifu, Japan. (No relationships reported)

Kendo is a Japanese martial art based on traditional samurai swordsmanship. Despite kendo having a long history in Japan, few studies have examined the effects of kendo training on the human body. Human serum albumin (HSA) is the most abundant serum protein found in the bloodstream and is composed of both reduced and oxidized forms. We have developed a convenient chromatographic method for the separation of both forms of HSA and have reported dynamic changes in the redox state of HSA in health, disease and aging.

PURPOSE: To examine both oxidative stress and skeletal muscle damage caused by kendo training over a four-day period, we measured the ratio of reduced to oxidized HSA for oxidative stress, and serum concentrations of creatine kinase (CK) and myoglobin (Mb) for skeletal muscle damage.

METHODS: Seventeen male students from the National Defense Academy and Gifu University, all elite kendo athletes (20.0 ± 1.0 yrs) participated in this training camp. Blood samples for the analysis of serum levels of HSA, CK, and Mb were drawn just before and after the training period. Differences between the mean values were tested for significance using paired t-test.

RESULTS: The four-day kendo training significantly lowered the percentage of reduced HSA from 78.9 ± 2.3% (before) to 73.9 ± 2.6% (after the training, p<0.0001). Simultaneously, the median change in reduced HSA concentration was 1.1 ± 1.1% (before) to 1.2 ± 0.9% (after the training, p<0.0001). The experimental group also completed an intervention test consisting of eccentric knee extension and flexion exactly 48 h prior to the post intervention test. The intervention group also completed an intervention test consisting of eccentric knee extension and flexion exactly 48 h prior to the post intervention test. The intervention group also completed an intervention test consisting of eccentric knee extension and flexion exactly 48 h prior to the post intervention test.

CONCLUSION: These findings suggest that the four-day intensive kendo training period gave rise to oxidative stress and skeletal muscle damage for male collegiate kendo athletes.

3499 Board #220 June 2 9:30 AM - 11:00 AM Menstrual Cycle Effect on Metabolic Acidosis During High Intensity Intermittent Exercise Deborah Van Langen, Jessica Brown, Ryanne Cammichael, Nicole Polland, Sarah Schultz, Daniel Sheehan, Tracey Matthews, Vincent Paolone, FACSM. Springfield College, Acton, MA. (No relationships reported)

Physiological Changes Over Four Maximal Incremental Cycling Tests Within One Day

3500 Board #221 June 2 9:30 AM - 11:00 AM

Menstrual Cycle Effect on Metabolic Acidosis During High Intensity Intermittent Exercise

Deborah Van Langen, Jessica Brown, Ryanne Cammichael, Nicole Polland, Sarah Schultz, Daniel Sheehan, Tracey Matthews, Vincent Paolone, FACSM. Springfield College, Acton, MA. (No relationships reported)

Ovarian hormonal fluctuations throughout the menstrual cycle have been associated with a decline in exercise performance. When comparing genders performing the same mode of exercise, women have different fatigue characteristics such as lower lactate and CO2 levels. It has been reported that females use lactate as a substrate more effectively than males during high intensity intermittent exercise. Menstrual cycle phase can have an impact on pH balance therefore influencing metabolic acidosis.

PURPOSE: The study was designed to determine if differences in metabolic acidosis in women between the luteal and follicular phase of the menstrual cycle during high intensity intermittent exercise.

METHODS: The subjects (N = 10) participated in two separate 75 minute cycling sessions determined by menstrual cycle phase. Each 75 minute session was divided into 5 separate 15 minute exercise bouts consisting of 5 minutes of high intensity exercise followed by 10 minutes of active and passive recovery. The intensity of the high intensity bout corresponded to 90% of maximal wattage determined by a VdotO2peak test. The variables evaluated were lactate (mmol/L) and CO2 (ml/kg-1 min-1). Two factorial ANOVAs were computed to determine if significant interactions existed.

RESULTS: A significant interaction was observed between accumulation and clearance over the 75 minute time period for lactate (mmol/L) and CO2 (ml/kg-1 min-1). No significant difference existed between menstrual cycle phases. These data reflect differences in acid base balance between accumulation and clearance of lactate (mmol/L) and CO2 (ml/kg-1 min-1).

CONCLUSIONS: Impaired physical performance during menstrual cycle phases has been associated with symptoms such as fatigue, fluid retention, weight gain, mood changes, and dysmenorrhea. In this study, menstrual cycle phase had no affect on metabolic acidosis during high intensity incremental exercise therefore suggesting no affect on exercise performance. Subjects cleared less lactate (mmol/L) and CO2 (ml/kg-1 min-1) during the active and passive rest periods than expected. As a result, lactate (mmol/L) and CO2 (ml/kg-1 min-1) accumulation created less of a delta showing the inability to clear lactate and CO2 between the exercise sessions.

PURPOSE: To investigate the impact of repeated maximal incremental cycling tests on physiological variables in trained and untrained individuals.
RESULTS: Individualized ramp protocol and was based on predicted VO2max obtained by a questionnaire. Maximum velocity was determined based on ACMS equation. Initial velocity for all subjects was 60% of maximum predicted velocity. Tests were considered maximal when three of the four criteria proposed by Midgley et al. (2009) were attained. For statistical analysis, firstly Passing and Bablok regressions were used to model the relationship between cardiorespiratory variables (VO2, VO2R, HR, HRR) and velocity, and was verified which relationship presented a better fit to the identity line.

METHODS: On the first day resting VO2 and resting HR were measured, and the participants were habituated to the equipment and test protocols. On the second day the incremental exercise testing was performed, using a pre-task warm-up and instructions to maintain intensity and heart rate of their choice. Tests were considered maximal when three of the four criteria proposed by Midgley et al. (2009) were attained. For statistical analysis, firstly Passing and Bablok regressions were used to model the relationship between cardiorespiratory variables (VO2, VO2R, HR, HRR) and velocity, and was verified which relationship presented a better fit to the identity line.

RESULTS: Maximal power output did not change significantly over the four tests in the T group (306 ± 41 vs. 309 ± 40 vs. 307 ± 41 vs. 304 ± 41 W; P = 0.23), but decreased from the third test in the UT group (201 ± 35 vs. 198 ± 36 vs. 192 ± 33 vs. 186 ± 30 W; P < 0.01). VO2max remained unchanged in both groups (P = 0.32 and P = 0.33, respectively). The heart rate curve was elevated from the third test in the T group and from the second test in the UT group (total increase: 6 ± 6 and 9 ± 8 min; P < 0.05). The individual anaerobic threshold (IAT; T: 173 ± 30 W; UT: 125 ± 25 W) increased in the T group from the second, and in the UT group from the fourth test (total increase: 12 ± 8 and 10 ± 10%; P < 0.05). Pre-exercise epinephrine and norepinephrine levels increased from the first to the fourth test in the T group (P < 0.05), but not in the UT group (P = 0.24 and P = 0.11, respectively). Post-exercise catecholamine concentrations did not change in either group (P ≥ 0.14).

CONCLUSIONS: If maximal performance parameters are assessed, it is recommended that trained and untrained individuals perform up to four and two incremental cycling tests on one day, respectively. As submaximal cardiocirculatory and metabolic parameters changed from the second test on, only one test should be performed if these parameters are the prime focus.

CONCLUSIONS: The presented data showed significant differences for almost all Passing and Bablok regressions, except for HRR and velocity in which both, intercept and slope, were inside confidence interval range. These results suggest that HRR, between all tested variables, appears to be the best potential parameter for submaximal exercise prescription.

CONCLUSIONS: We observed that most of the time (51.9% for G1 and 66.8% for G2) of Spinning classes was performed on heavy or very heavy intensity. Older participants completed their Spinning sections accumulating more time on the very heavy intensity compared to the younger group. Regarding exercise safety, this situation should be avoided, considering that age above 45 years for men and 55 years for women is considered a risk factor for cardiovascular disease.

CONCLUSIONS: This project used accelerometry and heart rate monitors to evaluate the quantity and intensity of physical activity in boys playing paintball. This project also evaluated the changes in heart rate due to physical activity and excitement while playing paintball.
METHODS. Eleven boys (12.7 ± 1.0 y, 51.5 ± 11.3 kg, 161.8 ± 10.1 cm) engaged in a graded exercise test in order to develop a heart rate/oxygen consumption correlation. Then, on a separate day, the boys played 7 games of outdoor paintball while wearing a heart rate monitor and accelerometer. The games had a stated 20 minute time limit, but players who were marked were eliminated from game play. The starting and stopping time of each game was recorded, along with the time each boy was eliminated during the game. RESULTS. During the 6 hours of paintball playing, the boys played paintball for a total of 80.6 ± 10.0 minutes with an average length of game play 11.5 ± 6.2 minutes. Average heart rate during the 6 hours of paintball play was 127 ± 6.5 beats/min, representing ~40% of heart rate reserve. During the 6 hours of paintball play the boys accumulated 141.8 ± 24.3 minutes of moderate and 6.1 ± 4.6 minutes of intense physical activity. During game play the boys accumulated 63.2 ± 15.1 minutes of moderate intensity activity and 2.6 ± 2.8 minutes of vigorous activity.

CONCLUSIONS. A day of paintball play provides some intense physical activity and enough moderate physical activity to promote health. However, a considerable amount of the physical activity occurred during the time before and after game play, when the boys were walking from the staging area to the playing field and vice versa.

3504 Board #225 June 2 9:30 AM - 11:00 AM
The Difference in Caloric Expenditure between Walking and Jogging in Adults
Joseph L. Andreucci, FACSM, Curt B. Dixon, FACSM, Kevin Moyer1, Tara Campbell, Dustin Pine, Rachel Hikes1. Bloomsburg University, Bloomsburg, PA.
(No relationships reported)

PURPOSE: To examine the energy expenditure (EE) differences between walking and jogging one-mile on a treadmill.

METHODS: Fifty-seven females and fifty-four males (age 20.7 ± 1.4 years) participated in this study. All subjects performed a 1-mile walk and a 1-mile jog on a motorized treadmill, during the same exercise session. Oxygen consumption (VO2) and EE were measured continuously via a ParvoMedics metabolic measurement system. Heart rate and OMNI-RPE were measured throughout both of the exercise bouts.

RESULTS: When compared to walking, jogging 1-mile resulted in a significantly (P<0.001) higher total EE (women = 105.3 ± 17.7 vs. 82.4 ± 13.9 kcal; men = 147.2 ± 22.5 vs. 114.5 ± 16.9 kcal), VO2 (women = 33.8 ± 3.8 vs. 15.0 ± 2.7 mL/kg/min; men = 37.1 ± 6.1 vs. 16.3 ± 3.8 mL/kg/min), HR (women = 174 ± 15 vs. 120 ± 6 beats/min; men = 169 ± 16 vs. 115 ± 17 beats/min), and OMNI-RPE (women = 4.3 ± 2.1 vs. 1.3 ± 0.6; men = 4.5 ± 1.3 vs. 2.0 ± 1.2) in both genders.

CONCLUSIONS: Although total EE was higher when jogging, the mean difference between exercise modes was relatively small (women = 22.9 kcal; men = 32.7 kcal). From a practical standpoint, health and fitness professionals may want to determine whether the extra energy expenditure is worth the additional physiological and anatomical stress that often accompanies jogging. In unconditioned individuals, compliance with exercise programs may be improved with the less stressful walking mode with only a few less calories expended during the workout.

3505 Board #226 June 2 9:30 AM - 11:00 AM
Effect of Neuromuscular Electrostimulation via the Peroneal Nerve on Muscle Soreness Following Intense Intermittent Exercise
(No relationships reported)

PURPOSE: To investigate the effects of cognitive behavioral therapy (CBT) on physical fitness of patients with AN and to evaluate the feasibility of the Eurofit Physical Fitness Battery test (EPFTB) in this population.

METHODS. Forty-one female participants (45.7 ± 9.3 yrs old) underwent a pre-test and a post-test consisting of a back saver sit-and-reach test, trunk rotation test, plank test, and an abdominal six-rep max test. Each participant was involved in either a Beginners, Essential, Essential Plus, or Intermediate Pilates class. The treatment lasted five weeks and was performed on

3506 Board #227 June 2 9:30 AM - 11:00 AM
Physical Fitness Before and After Weight Restoration in Anorexia Nervosa
Marta Alberti1, Carlo Capelli1, Marwan ElGhoch2, Simona Calugi1, Riccardo Dalle Grave2. 1University of Verona, Verona, Italy, 2Villa Garda Hospital, Garda (VR), Italy.
(No relationships reported)

PURPOSE: To investigate the effects of cognitive behavioral therapy (CBT) on physical fitness of patients with AN and to evaluate the feasibility of the Eurofit Physical Fitness Battery test (EPFTB) in this population.

METHODS. No systematic data have been collected to classify the functional level of cardiovascular, muscular and resistance performances in patients with Anorexia Nervosa (AN) before post weight restoration, even though AN are considered to be more physically active and to engage longer periods of moderate-intense physical exercise than the general population.

PURPOSE: To investigate the effects of cognitive behavioral therapy (CBT) on physical fitness of patients with AN and to evaluate the feasibility of the Eurofit Physical Fitness Battery test (EPFTB) in this population.

RESULTS. EPFTB tests showed good feasibility, but some AN patients refused to sustain some of them at the admission. CBT was associated with a significant improvement in BMI (from 14.3 ± 1.5 to 18.8 ± 1.2, Z = 4.20, p < 0.001) and in 4 out of 6 EB tests (p<0.05) in the AN group. However, both in pre and post conditions, AN patients generally showed lower EPFTB scores than the control group (all p < 0.001), with the exception of sit up score.

CONCLUSIONS. Adapted EPFTB can be recommended for evaluating physical fitness parameters in AN patients. Physical fitness is lower in AN patients than in controls both at baseline and after weight restoration. These data suggest the need to associate to the classical inpatient treatment of AN specific therapeutic strategies to improve physical fitness.
the STOTT Reformer. A MANOVA was used to assess the differences in effects among the four groups within the dependent variables. A univariate ANOVA was conducted for each dependent variable.

RESULTS: The MANOVA was found to be significant (p < .0001). The ANOVA results showed that all four dependent variables in all four of the classes were statistically significant (F values ranged from 8.54 to 88.21, p values ranged from .029 to <.0001). The Beginner’s class improved the most in the trunk rotation test (20.95%) as well as the back-saver sit-and-reach (27.13%), while the Essential Plus class improved the most in the plank test (37.13%) and six-rep max test (28.77%).

CONCLUSIONS: Five weeks of Pilates was long enough to significantly increase core strength and flexibility in four different levels of classes. This was true even for the subjects in the intermediate class who had completed the three previous levels of Pilates classes prior to the study.

### Table

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### Board #231  June 2 8:00 AM - 9:30 AM

**Comparison between Blood Lacatate Concentrations in Different Swimming Incremental Protocols**

Kelly de Jesus1, Ana Sousa1, Carla de Jesus1, Marisa Sousa1, Pedro Figueiredo2, Susana Soares1, Carlo Baldari, FACSM2, Laura Guadetti2, João Paulo Vilas-Boas1, Farah Ramírez-Marrero, FACSM1, Lucía Martínez1, Alexis Ortiz1, 1University of Puerto Rico, San Juan, Puerto Rico. 2University of Puerto Rico-Medical Sciences Campus, San Juan, Puerto Rico.

(No relationships reported)

In intermittent incremental protocols blood lactate concentrations ([La]) are used to assess relevant variables associated with swimmer’s performance, particularly the anaerobic threshold and the energy cost of exercise. However, some literature refers that to accurately determine the [La] corresponding to each step of the incremental protocol, each one should be of 4min duration (or more).

PURPOSE: To compare the [La] kinetics in three variants of a swimming intermittent incremental protocol (with different step lengths).

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METHODOLOGY: Six national level swimmers (21±2.16 yrs, 1.79±0.32 m, 71.75±1.89 kg, and 11.25±3.59 yrs of competitive experience) performed, in a randomized order, 7x200, 7x300 and 7x400 m front crawl intermittent incremental protocols until exhaustion, with increments of 0.05 m/s between steps, 30 s rest intervals, and 24 h resting period in-between (the velocity of each step was common to the three groups). Capillary blood samples were collected from the ear lobe during the intervals, at the end of exercise, and at the 3rd and 5th min of the recovery period (Lactate Pro, Japan). These data allowed assessing the blood lactate profile through the [La] vs. velocity curve modeling method using Matlab software (The Matworks Inc., USA). Friedman’s test statistic was used to compare each step of the intermittent incremental protocols with different step lengths (p<0.05).

RESULTS: [La] values had a similar behavior along the three variants of incremental protocols: (i) 1.2 IQR 0.9-1.6mmol/l to 7.17 IQR 6.2-8.9mmol/l in the 7x200; (ii) 1.1 IQR 0.8-1.4mmol/l to 7.03 IQR 6.3-8.6mmol/l in the 7x300; and 1.1 IQR 0.9-1.4mmol/l to 6.7 IQR 6.4-8.1mmol/l in the 7x400m. No differences were detected between each step of the three protocols (p>0.05).

CONCLUSION: Distances of 200, 300 or 400 m seem not to differ from different [La] kinetics along the studied incremental intermittent protocol. This evidences that, due to pragmatic reasoning, coaches should use the incremental test of 200 m steps, once it’s simpler and faster and swimmers will be easier motivated to perform a maximal effort.

ACKNOWLEDGEMENTS: Supported by grants PTDC/DES/101224/2008 (FCOMP-01-0124-FEDER-099577) and CAPES 5431-10-7/2011.
RESULTS: The CV was obtained at 10.3±0.2 km/h and estimated ARC was 73.0±3.4 m. The RAST promoted the lactate peak at 5.9±0.2 mm and determined the Pmax (3.6±0.2 W/kg), Pmed (2.8±0.1 W/kg), Pmin (2.3±0.1 W/kg) and FI (30.4%). The LM intensity was 8.7% lower than CV (9.47±0.13 km/h) and these parameters were not significantly correlated (r=0.23). The LM (blood lactate) was 3.1±0.3 mM, showing interesting and significant correlation with lactate peak (r=0.78).

CONCLUSION: The specific non-invasive method can be used for determine the aerobic and anaerobic parameters in female basketball players. However, as occurs in others sport modalities, CV upper estimate the LM intensity.

3514 Board #235 June 2 8:00 AM - 9:30 AM

Blood Acid-Base Status Response And Running Performance At Different Constant Loads

Thiago F. Lorenço, UNICAMP, Campinas, Brazil.

(No relationships reported)

The maintenance of blood acid-base status (ABSB) is primarily accomplished by adjusting the partial pressure of CO2 in the lungs. For exercise intensities above the respiratory compensation point (RCP), the buffering limited capacity of blood and the hyperventilation controlled by the central nervous system are insufficient to control ABSB. Despite the importance of RCP in this control, no study has investigated the ABSB response during constant load at or higher than RCP running speed (sRCP).

PURPOSE: Analyze the runners ABSB response after 10-km running performed at three different constant loads.

METHODS: With at least 72 hours rest between the tests, twenty-five amateur runners (34.6±5.7 yrs; 68.7±10.2 kg; 10-km performance 48.9±7.3 min e VO2max de 40.9±6.5 ml·kg·min) performed a maximum effort protocol to determine the running speed related to VT (sVT), RCP (sRCP) and VO2max (sVO2max) and three 10-km races at constant load on the sVT, sRCP and V1 (sRCP + 0.25×[sVO2max - sRCP]).

RESULTS: All runners that ran at sVT and sRCP completed 10-km with no changes in blood pH (7.48±0.05 vs 7.5±0.02, p>0.05), even with increased in blood lactate (2.8±0.8 vs 5.5±4.2 mmol·L-1) and decreased in bicarbonate (25.4±2.8 vs 22.4±4.2 mmol·L-1, p<0.05). At V1 intensity, only three of sixteen runners completed 10-km. The others completed only 5.2±2.2 km with a significant decrease in pH (7.48±0.02 vs 7.33±0.04, p<0.05) and bicarbonate (24.1±0.5 vs 14.6±1.0 mmol·L-1, p<0.05).

CONCLUSIONS: All runners that ran at sVT and sRCP completed 10-km with no changes in blood pH (7.48±0.05 vs 7.5±0.02, p>0.05), even with increased in blood lactate (2.8±0.8 vs 5.5±4.2 mmol·L-1) and decreased in bicarbonate (25.4±2.8 vs 22.4±4.2 mmol·L-1, p<0.05). At V1 intensity, only three of sixteen runners completed 10-km. The others completed only 5.2±2.2 km with a significant decrease in pH (7.48±0.02 vs 7.33±0.04, p<0.05) and bicarbonate (24.1±0.5 vs 14.6±1.0 mmol·L-1, p<0.05).

3515 Board #236 June 2 8:00 AM - 9:30 AM

Applying Lactate Analysis to Establish and Monitor Intensity during Interval Training in Coronary Heart Disease Patients

Jeffrey W. Christie1, Ulrik Wisløff2, Axel Pressler1, Martin Halle1.1Technical University of Munich, Munich, Germany. 2Norwegian university of Science and Technology, Trondheim, Norway.

(No relationships reported)

PURPOSE: Relatively high-intensity interval training (AIIT) has been shown to be effective in coronary artery disease (CAD) therapy. To prescribe and monitor training intensity during interval training, percent heart rate (%HR) and ratings of perceived exertion (RPE) from exercise testing (CPET) are the most commonly used methods, but have limitations. This study examines the potential of arterial lactate kinetics to aid in the prescription and monitoring of exercise intensity during AIIT.

METHODS: Thirty-five clinically stable CAD patients (age 64 ± 7, 66% male) performed stepwise peak exercise testing (CPET) to volitional exhaustion. Heart rates at 50% to 60% and 80% to 90% of peak aerobic capacity (VO2peak) were calculated and used to establish interval training intensities. Patients performed one bout of AIIT (see figure). Heart rate was recorded continuously and RPE and [lactate], data were collected at rest and during the last 10 seconds of each interval. [lactate] data was then graphically analyzed and evaluated using a 4 mmol/L lactate steady state threshold (LSST) to indicate a relevant anaerobic contribution.

RESULTS: Heart rate targets were reached in > 85% of all intervals. Mean [lactate] was substantially over the 4 mmol/L LSST (4.14 mmol/L in moderate-intensity phases and 4.65 mmol/L in high-intensity phases). Data for HR and RPE correlated well to changes in load during exercise training (r2 = 0.81), whereas [lactate], did not correlate to any of the other parameters (see table).

CONCLUSIONS: During aerobic interval training, a constant accumulation of lactate in both the high and low intensity thresholds of training being performed above the lactate steady state threshold.

3516 Board #237 June 2 8:00 AM - 9:30 AM

Kinetics Of Lactate Removal After Brazilian Jiu Jitsu Match

Tactio P. Souza-Júnior1, Daniel Pinheiro2, André Luís Amaral Rodrigues Almeida1, César Cavinato Cal Abad1, Federal University of Paraná, Curitiba, Brazil. 2Uninsantana, São Paulo, Brazil. 1Infortisíc, São Paulo, Brazil. 2Heart Institute (InCor) of University of São Paulo Medical School, São Paulo, Brazil. (Sponsor: Carlo Baldari, FACSM)

(No relationships reported)

The Brazilian Jiu Jitsu is one of the most practiced martial arts in the World but the number of studies about this sport is still poor. Traditionally, analysis of lactate concentrations have been used in different types of martial arts to determine the physiological profile, competitive performance, metabolic demand and the effect of physical training.

PURPOSE: Verify the analysis of blood lactate during two simulated Jiu-Jitsu matches.

METHODS: Twenty-one male athletes (age 28.3 ± 6.45 years, height, 1.75 ± 1.0 cm, body weight, 78.07 ± 9.40 kg, percent fat, 14.29 ± 4.79%, years of practicing , 11.03 ± 2.4) performed two simulated 10-min match with a 48-hour interval. In both matches blood lactate was collected before and after each bout.

RESULTS: Lactate at rest, heating, 1, 5 and 10 min were, respectively (0.94 ± 0.20, 2.19 ± 0.78, 10.51 ± 1.73, 7.77 ± 1.69, 6.28 ± 1.30 in bout 01 and 0.96 ± 0.14, 1.98 ± 0.78, 9.46 ± 0.96, 7.24 ± 1.24 in bout 02). There were significant differences among all the moments of the same match (One-way ANOVA; p<0.05) but no difference for the same times between the bouts was found. The Pearson’s correlation of the lactate of two matches was 0.95 while the correlation between the matches at rest, heating, 1, 5 and 10 minutes were, respectively 0.59, 0.60, 0.47, 0.44, 0.47 (p<0.05).

CONCLUSION: Our data suggest that the Brazilian Jiu Jitsu fight is very intense and use glycolysis to produce energy. The blood lactate concentration in two fights at 48 hours of intervals are repeatable and can be used for assessment, prescription and monitoring the specific training when performed with the same opponents.

3517 Board #238 June 2 8:00 AM - 9:30 AM

Identification Of The Maximal Lactate Steady State In Obese Zucker Rats

Jeezer A. Almeida. Catholic University of Brasilia, Brasilia, Brazil.

(No relationships reported)

Exercise has been widely applied in the weight loss control, especially for obesity treatment. However, determination of an appropriate intensity of exercise for obese rats (Zucker fa/fa) it was undefined until now. It is well known that maximal lactate steady state (MLSS) has been considered the gold standard for identification of aerobic capacity. Nevertheless this value was not identified in obese Zucker rats at the moment.

PURPOSE: This study aims to identify the maximum lactate steady state (MLSS) in obese Zucker rats in order to provide a more effective tool for the exercise training prescription of this animal model.
RESULTS: In order to ensure the differences between body weight animals, T test was applied. Significant differences were observed in Zucker (390.0 ± 18.8 g) and Wistar rats (227.3 ± 26.2 g) (P <0.05). The MLSS was defined as the highest blood lactate concentration that increased up to 1 mmol·L⁻¹ during constant exercise. In obese Zucker rats, the MLSS was found in a considerable lower velocity (12.5 m.min⁻¹) in comparison to lean Wistar rats (20 m.min⁻¹).

CONCLUSIONS: In summary, the identification of MLSS in obese Zucker rats provides a better intensity determination for exercise on a treadmill running for this animal model.

### Table 1

<table>
<thead>
<tr>
<th>VM Fatigue Index (%)</th>
<th>Blood Lactate [mmol/L]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st set</td>
<td>2nd set</td>
</tr>
<tr>
<td>TR 109 ± 7</td>
<td>93 ± 7</td>
</tr>
<tr>
<td>RA 121 ± 7</td>
<td>100 ± 7</td>
</tr>
<tr>
<td>SS 130 ± 10*</td>
<td>120 ± 10*</td>
</tr>
</tbody>
</table>

*Greater than RA and TR (p<0.05)
*Greater than RA and TR (p<0.05)

CONCLUSION: These results indicate that when compared to TR and RA antagonist preload protocols, the SS protocol provides greater levels of neuromuscular fatigue and is more metabolic demanding. Thus, trainers and physical therapists should avoid prescription of the SS protocol in special populations such as elderly, children and individuals undergoing cardiac or pulmonary rehabilitation.

### METHODS

**Purpose:** In order to make such determination, obese Zucker and lean Wistar rats were here utilized. After adaptation of animals to treadmill running, the MLSS was determined by using three different velocities (10 m.min⁻¹, 12.5 m.min⁻¹ and 15 m.min⁻¹ for Zucker and 15 m.min⁻¹, 20 m.min⁻¹ and 25 m.min⁻¹ for lean Wistar rats).

**Results:** In order to ensure the differences between body weight animals, T test was applied. Significant differences were observed in Zucker (390.0 ± 18.8 g) and Wistar rats (227.3 ± 26.2 g) (P <0.05). The MLSS was defined as the highest blood lactate concentration that increased up to 1 mmol·L⁻¹ during constant exercise. In obese Zucker rats, the MLSS was found in a considerable lower velocity (12.5 m.min⁻¹) in comparison to lean Wistar rats (20 m.min⁻¹).

**Conclusions:** In summary, the identification of MLSS in obese Zucker rats provides a better intensity determination for exercise on a treadmill running for this animal model.
CONCLUSION: Appropriate timing of BL samples in adolescent female athletes depends upon the type of exercise performed. Collecting BL at 1 minute post-maximal aerobic performance and at 3 min post-maximal anaerobic running in adolescent female athletes provides the most consistent and accurate peak values. The advantage of a single BL measurement following maximal exercise includes fewer risks related to serial collection, reduced potential participant stress and substantially lower testing costs. These findings will help direct timing of blood sample collection to improve the accuracy of this metabolic measurement in paediatric populations.

3521  Board #242 June 2  8:00 AM - 9:30 AM
The Relationship Between Onset Of Blood Lactate Accumulation, Body Weight, And Balance Ability In 20-70 Years-old Subjects
Burkhard Weisser, Julia Last. University of Kiel, Kiel, Germany. (Sponsor: Reinhard Ketelhut, FACSM)

(conferences continued)

PURPOSE: To investigate the correlation of balance ability with aerobic exercise performance (onset of blood lactate accumulation at lactate 4 mM, OBLA) and with body weight. METHODS: OBLA was measured using standard bicycle testing (Watt/kg body weight). Balance ability was determined by a validated one-way frontal moving slab with integrated sensor and associated software. Correlations were calculated for balance ability with OBLA and body weight in 296 subjects (age 20-70 years, 147 female, 149 male). In addition, results were analysed in subgroups; younger versus older (20-44 and 45-77 years of age) and active versus sedentary (less than 2 hours vs. > 2 hours of moderate activity per week).

RESULTS: Body weight (mean value +/- standard deviation) was 74 +/- 15 kg, OBLA was 2.0 +/- 0.6 Watt/ kg body weight and balance ability was 4.8 +/- 1.3 (arbitrary units). There was a positive correlation between OBLA and balance (r=0.38; p<0.05) and a negative correlation between body weight and balance (r=-0.41; p<0.05). Balance ability decreased with age, whereas the correlations remained significant in the group 45-70 years of age both in active and sedentary persons.

CONCLUSION: Balance ability decreases with age. Aerobic capacity is positively associated with balance ability, whereas there was a negative correlation between body weight and balance. Thus, elderly subjects might benefit not only from specific balance training but also from general aerobic activity. Higher body weight is a risk factor for worsening balance ability, although a causal relationship remains to be shown.

3522  Board #243 June 2  8:00 AM - 9:30 AM
Determination of Anaerobic Threshold by the Breakpoint of Locomotor Respiratory Coupling
Masanori Takemura1, Mitsuharu Kaya2, Junzo Tsujita1, Yoshitaka Oku1,1 Hyogo College of Medicine, Nishinomiya, Japan,2 Hyogo University of Health Science, Kobe, Japan.

(conferences continued)

PURPOSE: To evaluate whether BPLRC corresponds to AT such as the respiratory compensation point (RC), VT, and onset of blood lactate accumulation (OBLA).

METHODS: Seventeen healthy subjects (8 females and 9 males; age, 25 ± 7 years) volunteered for this study. Ten subjects (Group 1) underwent the incremental exercise test using a cycle ergometer twice, which included a spontaneous breathing trial and a controlled breathing trial to measure BPLRC. The other 7 subjects (Group 2) underwent the incremental exercise test with controlled breathing to measure BPLRC, and blood lactate concentrations were measured. During a controlled breathing trial, we forced subjects to achieve LRC by adjusting their breathing frequency at 30 breaths per min and their pedaling rate at 60 rpm. Subjects declared the breakpoint when they could not maintain LRC (BPLRCself). Additionally, we calculated the breakpoint from the time course of workload and breathing frequency using the two-line regression method (BPLRCcalc). We evaluated the correlations between BPLRCs and several ATs, including RC, VT, and OBLA. ATs and BPLRCs being expressed as workload (W).

RESULTS: In Group 1 (n=10), the single regression analysis indicated that BPLRCself (162 ± 35W) was most suitable for predicting RC (161 ± 33W) during spontaneous breathing (R = 0.877; regression coefficient, 0.823; p<0.001). Then in all subjects, it indicated that BPLRCself (156 ± 31W) was suitable for predicting RC (154 ± 37W) during controlled breathing (R = 0.742; regression coefficient, 0.898; p<0.01).

CONCLUSION: BPLRC, the self-reported breakpoint during incremental exercise at which a subject cannot maintain LRC with controlled breathing at 30 bpm and a pedaling speed of 60 rpm, is a good predictor of RC. Because determining BPLRC does not require special equipment and the threshold is easily determined by self-reporting, we conclude that BPLRC is a practical AT variable.

3523  Board #244 June 2  8:00 AM - 9:30 AM
Blood Lactate Levels are Lower Following Intense Exercise with the Use of a Mouthpiece
Wesley D. Dudgeon1, Timothy P. Scheett1, Larry A. Buchanan1, Ashley E. Strickland1, Dena P. Garner1.1 The Citadel, Charleston, SC,2 The College of Charleston, Charleston, SC. (Sponsor: Gregory A. Hand, FACSM)

(conferences continued)

PURPOSE: This study examined the effect of a performance mouthpiece (ArmourBite Mouthwear) on blood lactate levels in 12 collegiate males who regularly performed lower body resistance exercises.

METHODS: At least 7 days following determination of a one repetition maximum (1RM), subjects completed 2 trials of 6 sets of 10 repetitions of back squats with 2 minutes rest between sets, and were given 7 days between trials. Resistance was set at 80% of each subject’s 1RM and resistance was adjusted during testing so 10 repetitions were completed during each set. The order of treatment (i.e. use of MP) was randomized and blood was sampled as follows for determination of blood lactate (Lactate Plus, Nova Biomedical, Waltham, MA): pre exercise, after 3 sets (mid), post exercise, 30, 60 and 120 minutes post exercise.

RESULTS: There was no difference in lactate (mM/L) immediately pre exercise (0.88 ± 0.23 (MP) vs. 0.97 ± 0.29; P=0.25) or 120 min post exercise (1.30 ± 0.70 (MP) vs. 1.28 ± 0.33; P=0.45) and there was a trend for a difference at mid-point (9.95 ± 2.03 (MP) vs. 11.95 ± 2.91; P=0.09). The MP group had lower lactate immediately post exercise (11.65 ± 2.31 (MP) vs. 13.85 ± 2.80; P=0.06), 30 minutes post exercise (4.53 ± 2.14 (MP) vs. 6.06 ± 1.57; P=0.03) and 60 minutes post exercise (2.13 ± 1.03 (MP) vs. 2.82 ± 0.88; P=0.03).

CONCLUSIONS: This data shows that the use of a custom fit lower mandible MP can reduce blood lactate levels following intense resistance exercise. When viewed in light of the published effect of MPs on lowering cortisol levels, this suggests that MP use decreases stress during exercise recovery, potentially improving human performance.
Board #245  June 2  9:30 AM - 11:00 AM
Effects of Metatarsal Pad and Foot orthotics on Leg Muscle Activities and Foot Pressure

PURPOSE: to evaluate the effects of metatarsal pad (MP) and foot orthotics on leg muscle activities and foot pressure.

METHODS: 15 healthy young females who had no cavus foot or flat foot were participated in this study. The subjects walked on a treadmill under four different experimental conditions: 1) barefoot, 2) MP only (Pad Only) , 3) a soft insole with MP (Soft+MP), and 4) a rigid insole with MP (Rigid+MP). During walking, foot pressure data such as force, peak pressure, mean pressure, force-time integral and pressure-time integral were collected. Also, EMG activities of lower limb muscles such as tibialis anterior(TA), lateral gastrocnemius(GCM), rectus femoris(RF), and biceps femoris(BF) were gathered.

RESULTS: In the foot pressure analysis, the peak pressures(kPa) of 2.3 metatarsal head area were 303.1 with Barefoot, 293.8 with MP Only, 288.4 with Soft+MP( p<.05), and 301.6 with Rigid+MP. The pressure-time integrals (kPa*sec) were 7439.7, 7071.2, 6330.4( p<.05), and 7084.4 respectively in the same order. The dynamic EMG findings (uV) of TA muscle showed that 8.81, 7.14, and 6.31(p<.05). That of BF showed 8.61, 7.93, 7.51, and 7.73 respectively in the same order.

CONCLUSIONS: In the foot pressure analysis, there was significant reduction in case of soft insole with MP than rigid insole. On the other hand, the EMG study showed significant reduction of leg muscles activity in case of rigid insole with MP than soft insole, especially in TA muscle.

Board #246  June 2  9:30 AM - 11:00 AM
Use of Tekscan Matscan® to Detect Static Rearfoot Position Through the Evaluation of Rearfoot Pressure
David A. Titcomb, Mark Blair, Richard Lane. Liberty University, Lynchburg, VA. (Sponsor: Melvin Williams, FACSM)

With the advancement of technology, many clinicians have been able to complement their foot examinations with the use of computerized foot pressure analysis systems.

PURPOSE: The purpose of this study was to test the hypothesis that a biomechanical pressure mat system would reliably detect static rearfoot position based on static heel pressure analysis compared to clinical examination by a licensed podiatrist.

METHODS: Static plantar pressure profiles of 35 subjects across a wide age range (20-89 years; mean age ± SD. 41.0 ± 22.1 years) were obtained using a biomechanical pressure mat system. Subjects with acute injury or clinical evidence of calcaneal fat pad atrophy were excluded from the study. Each subject underwent static plantar pressure assessment by standing barefoot on the calibrated pressure mat with feet in rectus position. A one frame "snapshot" (digital foot pressure image) of both right and left feet was recorded once the subject was standing in a static state. After plantar pressure data were collected, the distribution of both right and left rearfoot pressures of each foot was analyzed. Clinical software was utilized to create two separate masks over each rearfoot digital image, equally dividing it into medial and lateral regions. In each mask, average medial and lateral rearfoot pressure was determined and compared. Each rearfoot was then placed into one of three categories: inverted (greater lateral pressure), everted (greater medial pressure) or neutral (medial and lateral pressures within .03kg). After the plantar pressure assessment was performed, both of the subject’s feet were examined by a licensed podiatrist to categorize their standing rearfoot position as being either inverted, everted, or neutral (rectus). A chi-square analysis with Kappa concordance test was performed comparing the plantar pressure data to clinical examination findings.

RESULTS: A non-significant chi-square (p=.365 (p>.05). Kappa= .17) indicated no significant relationship between the two measures.

CONCLUSIONS: The biomechanical pressure mat data did not reliably detect static rearfoot position based on rearfoot pressure distribution when compared rearfoot position observed during clinical examination. Grant funding provided by The Center for Research and Scholarship Fund of Liberty University #014_022610.
METHODS: 22 girls (11.2 ± 0.2 years) and 20 boys (13.6 ± 0.1 years) were tested at the start of the study (0 months [mos]) and after 6 mos. These age ranges represent the primary growth years. Subject height and mass were measured. GR was calculated as the change in height between testing sessions. PAL was assessed by Physical Activity Questionnaire (PAQ). Subjects completed 3 target-speed walk (TSW), 3 target-speed run (TSR), 3 self-selected speed walk (SSW) and 3 self-selected run (SSR) trials (1.2 ± 0.1 m/s and 2.6 ± 0.1 m/s TSW and TSR). Kinematics and ground reaction forces were collected using a video system (Motion Analysis, Santa Rosa, CA) and a force plate (Kistler, Amherst, NY) respectively. FAT (N) and nFAT (BW) were determined using inverse dynamics. Repeated measures multiple regressions were used to determine if testing session, PAL, GR, and sex had significant relationships with FAT and nFAT (Bonferroni adjusted p < 0.004).

RESULTS: GR was similar for boys (2.1%) and girls (2.4%). FAT and nFAT during SSW and SSR did not differ at 0 and 6 mos (mean FAT at 0 and 6 mos: SSW 1243 ± 31 N; SSR 2168 ± 112 N; p > 0.06). Sex was not a significant predictor of FAT or nFAT in SSW, SSR, TSR, or TSR (p > 0.008). GR and PAL were not significant predictors of FAT or nFAT during SSW or SSR (p > 0.005). FAT during TSW increased at 6 mos (1163 ± 62 N at 0mos, 1230 ± 57 N at 6mos). FAT during TSR (mean FAT 0 and 6 mos: 2089 ± 46 N) and nFAT during TSW and TSR did not differ at 0 and 6 mos (p > 0.006). Growth and PAQ had a significant negative relationship with nFAT during TSR.

CONCLUSIONS: nFAT during walking and running did not differ at 6 mos compared with 0 mos. AT forces (both FAT and nFAT) during walking and running did not differ between sexes. FAT increased at 6 mos only in TSW. GR and PAQ affected nFAT in TWR only and otherwise did not affect AT forces. Of the factors investigated, no consistent relationship between GR, PAL, and sex with AT forces during locomotion were found.
CONCLUSION: The SPARK device allowed the subjects to maintain normal gait kinematics and kinetics while achieving 2.5-3.5 W continuous power output (single foot) while walking at 4.83 km/h. This prototype demonstrates the feasibility of a soldier-ready biomechanical energy harvesting device for field use.

3531  
**Board #252**  
**June 2**  
**9:30 AM - 11:00 AM**  
**Lateral Foot Loading Pattern Concurrs With Increased Disintegration Of The Postero-medial Achilles Tendon Region**  
**Sint Maartenskliniek, Nijmegen, Nijmegen, Netherlands.**  
1Diabetes Center for Pediatric and Adolescent Diabetes Care and Research, Rotterdam, Netherlands.  

Research suggest that excessive pronation (EP) of the foot contributes to Achilles tendinopathy, however it is still not possible to predict who is at risk. From a biomechanical perspective, EP generates a more rapid and repeated transition of the foot from supination to pronation and backwards. This creates a “bow string” loading of the Achilles tendon (AT). In accordance, ultrasonographic (US) and MR imaging of symptomatic ATs often show irregularities in the medial midportion.

**PURPOSE:** To study foot biomechanics as etiological factor in subclinical AT tendinosis.

**METHODS:** AT structure of 20 healthy, asymptomatic subjects (18-60 yr) was examined through ultrasonographic tissue characterization (UTC).[1] In contiguous US images, 3D-stability of echo-patterns was quantified with dedicated algorithms and 4 echo-types were discriminated: I) intact and aligned tendon bundles; II) discontinuous or waving tendon bundles; III) fibrillar components; IV) mainly cellular components and fluid in amorphous tissue. Tendon disintegration was quantified as the sum of echo-types III + IV. Dynamic plantar pressure measurements from a 2m pressure plate during 5 walking trials were documented and normalized for foot size, foot progression angle and total pressure.

**RESULTS:** The percentage level of tissue type III+IV (%III+IV) postero-medial (PM) in the AT (0.73±0.93%) was significantly higher than lateral (2.19±1.34%, p < 0.05) or central (1.16±0.31% p < 0.05) regions. Foot pressure dynamics from AT with PM %III+IV > 3.50 (n=20 feet) showed a more lateral center of pressure and roll-over pattern (0.50±0.89%) when compared to AT with PM %III+IV < 3.50 (<1.58±0.68%, p>0.05), with a lower roll-over speed (>3.50: 0.49±0.16 nU/s vs <3.50: 0.64±0.19 nU/s, p>0.05). Hallux-to-Meta-I pressure ratio, as indicator for functional hallux stiffening,[3] was higher in AT with PM %III+IV < 3.50.

**CONCLUSION:** AT disintegration in PM region may be related to a more lateral foot loading pattern. Functional hallux stiffening may protect against AT tendinosis.

Funding: Dutch Diabetes Research Foundation grant#2010.11.1387


3532  
**Board #253**  
**June 2**  
**9:30 AM - 11:00 AM**  
**The Effect Of Foot Orthoses On Peroneal H-reflex In Treadmill Walking. A Pilot Study**  
Antje Reschke, Martin Wolter, Marlene Schoepflin, Niklas Koenig, Frank Mayer, Heiner Baur. University Outpatient Clinic Potsdam, Potsdam, Germany.  

Although the biomechanical effect of foot orthoses is not completely understood, positive effects are attributed to sensorimotor adaptations next to mechanical processes. The analysis of H-reflex response of the ankle stabilizer M. peroneus longus (PL) may further give insight into foot orthoses triggered adaptations.

**PURPOSE:** To investigate the influence of a foot orthosis with medial arch support (O) compared to no orthosis (NO) on PL motor neuron excitability in treadmill walking.

**METHODS:** 35 healthy physically active participants were recruited. From 11 subjects (26.5 ± 2.5 yrs, 1.78 ± 0.08 m, 72 ± 10 kg, 4 ± 1.6 training sessions/wk) H-reflex of PL could be deduced. This cohort performed 2 randomized walking trials on a treadmill at 5 km/h. The stimulating electrode was placed on the nerves tibialis communis in the fossa poplitea and PL-EMG was recorded. Stimuli were paired with a 300 ms delay after initial heel strike in stance. Accordingly, recruitment curves were created (50 measuring points, square impulse: 300 V; 500 µs duration; stimulation- interval: 10 s; increase interval of stimulation intensity: 0.2 mA). Maximum H-reflex amplitude and M-wave were obtained and Hmax/Mmax-ratio was calculated. Descriptive analysis was followed by t-test for dependent samples (p<0.05) (mean and SD of Hmax/Mmax-ratio and 95% CI of the difference).

**RESULTS:** 7 of 11 participants showed an enhanced H-reflex activity of PL among the insode condition compared with no insode. The foot orthoses modification resulted in higher but not statistically significant mean PL Hmax/Mmax-ratio compared to no arch support (NO: 16.6 ± (±0.7)/O: 22.6 ± (±1.7); CI of the difference: -0.18 - 0.06 (p>0.32).

**CONCLUSIONS:** Wearing a medial arch support insode had no significant effect on sensorimotor response of PL muscle during treadmill walking in healthy persons. However, individual responses to a standardized arch height were highly variable. This pilot work suggests the systematic analysis of different arch heights, velocities and stimulation instants during gait.

Moreover a higher number of subjects and patients with chronic ankle instability may help to further validate the approach of sensorimotor effects of foot orthoses.

3533  
**Board #254**  
**June 2**  
**9:30 AM - 11:00 AM**  
**Experimentally Induced Anterior Knee Pain Immediately Reduces Involuntary And Voluntary Quadriceps Activation**  
Jihong Park, David H. Chinn, Adam C. Squires, J. Ty Hopkins, FACSM. Brigham Young University, Provo, UT.  

Although the biomechanical effect of foot orthoses is not completely understood, positive effects are attributed to sensorimotor adaptations next to mechanical processes. The analysis of H-reflex response of the ankle stabilizer M. peroneus longus (PL) may further give insight into foot orthoses triggered adaptations.

**PURPOSE:** To examine the immediate effects of experimentally induced anterior knee pain on involuntary and voluntary quadriceps activation.

**METHODS:** A 3X3 randomised controlled laboratory study with repeated measures was used. Thirteen, neurologically sound volunteers (age: 21.9 ± 3.2 year, height: 1.7 ± 3.1 m, mass: 76.6 ± 10.1 kg) underwent three different conditions (pain, sham, and control). The vastus medialis peak Hoffmann reflex normalized by the peak Motor response (H:M ratio) was used to measure involuntary quadriceps activation. Quadriceps central activation ratio (CAR) using maximal isometric knee extension torque (Nm) was calculated to assess voluntary quadriceps activation. Measurements were recorded at precondition (baseline), condition (immediate post injection), and 20min-postcondition. To induce anterior knee pain and sham condition, 5% sodium chloride (total volume of 1.0 ml for each condition), respectively, were injected into the infrapatellar fat pad on the dominant leg. No injection was performed for the control condition.

**RESULTS:** Our pain model increased perceived pain immediately after the 5% hypertonic saline injection and pain lasted for 12 minutes on average (F<sub>1,12</sub>=16.85, P<0.0001). During the pain condition subjects showed a 12% decrease in H:M ratio (F<sub>1,12</sub>=8.64, P<0.001), a 34% decrease in maximal isometric knee extension torque (F<sub>1,12</sub>=5.89, P=0.005), and a 5% decrease in CAR (F<sub>1,12</sub>=3.83, P=0.05).

**CONCLUSION:** The SPARK device allowed the subjects to maintain normal gait kinematics and kinetics while achieving 2.5-3.5 W continuous power output (single foot) while walking at 4.83 km/h. This prototype demonstrates the feasibility of a soldier-ready biomechanical energy harvesting device for field use.

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CONCLUSIONS: Our data showed that joint pain may be an independent factor to alter function of the muscles surrounding the painful joint. Both involuntary and voluntary inhibitory pathways may play a role in an immediate reduction of muscle activation. Pain control in the acute stage of a joint injury and during chronic joint injury is important not only to decrease perceived pain but also to initiate disinhibition of the surrounding musculature and prevent chronic joint loading.

3534 Board #255 June 2 9:30 AM - 11:00 AM Hip Muscle Recruitment During Weightbearing and Non-Weightbearing Exercises David Wallace, Thomas Durant. Quinnipiac University, Hamden, CT. (No relationships reported)

INTRODUCTION: Studies have suggested that hip strength is a modifiable risk factor for knee osteoarthritis. The purpose of this study was to examine the recruitment of hip musculature during various therapeutic exercises. PARTICIPANTS: Twenty healthy active volunteers between the ages of 18-25 years old participated in the study.

METHODS: Surface EMG recorded the muscle activity of the gluteus maximus (GMax) and gluteus medius (GMed) as subjects performed three sets of five repetitions of the following exercises: (1) Forward Step-up, (2) Side Step-up, (3) 10 repetition maximum (RM) sidelying hip abduction and (4) 10 RM prone hip extension. The normalized peak EMG was determined during each repetition and then averaged across all trials. Using repeated measure ANOVAs, comparisons of the peak EMG activity were made between each exercise. Alpha was set at 0.05.

RESULTS: Performing a 10 RM sidelying exercise recruited GMed significantly greater than remaining exercises (P<0.05). GMed demonstrated greater activity than GMax during each exercise with the exception of the prone hip extension (P=0.05).

DISCUSSION: These results suggest that performing a 10 RM non-weightbearing exercise results in greater muscle activity than a functional weightbearing exercise without load. In addition, forward and side-step steps fail to effectively recruit GMax. GMed was recruited to a higher extent during the stepping tasks; however, further research is needed to examine the impact of external loading on GMed recruitment during stair stepping exercise.

3535 Board #256 June 2 9:30 AM - 11:00 AM Coupled Valgus Collapse Due To Internal Rotation: An Important Factor In the ACL Injury Mechanism Ata M. Kiapour1, Carmen E. Quatman2, Jason W. Levine1, Samuel C. Wordeman3, Timothy E. Hewett, FACSM4, Vijay K. Goel4, Constantine K. Demetrakopoulos5.

1University of Toledo, Toledo, OH; 2The Ohio State University, Columbus, OH. (No relationships reported)

Valgus collapse has been associated with cases of ACL injury. Knee height has focused on the roles of valgus and tibial internal rotation on loading of the anterior cruciate ligament (ACL). The relative importance and nature of this interaction in the ACL injury mechanism are controversial.

PURPOSE: To understand the coupling between internal rotation and valgus orientation, and their effects on ACL strain.

METHODS: 17 cadaveric legs (45±7 yrs) potted at the mid-femur and fixed at 25° of flexion to a 6-DOF force couple testing apparatus. An unconstrained pure moment was applied to the tibia over a continuous range of ±50Nm abduction-adduction under 1200 N quadriceps and 800 N hamstrings loads. Joint kinematics were collected using an Optotak 3020 system. A DVRT transducer was used to calculate ACL strain. Specimens were first tested under isolated abduction-adduction loading. Subsequently, tests were repeated with the addition of 20 Nm internal rotation. Subsequently, specimens were evaluated in a series of impact tests simulating landing under combinations of valgus, internal rotation and anterior shear. Specimens were tested until failure.

RESULTS: 20 Nm pure internal rotation moment produced significant 6.4±3% coupled valgus rotation of the tibia (P<0.0005) with 4.2±3% ACL strain. 50 Nm pure abduction moment produced 6.2±3% valgus rotation with 3.6±3% ACL strain. ACL strain and valgus under either 20 Nm pure internal rotation or 50 Nm pure abduction were not statistically different. No significant coupled internal rotation was observed under 50 Nm pure abduction moment. Axial impact generated a mean 9.1±8 mm anterior tibial translation (ATT) and 15 ACL injuries in 17 limbs. A general regression model showed that internal rotation significantly decreased ATT under axial impact (P=0.03), while valgus did not play a significant role on ATT (p=0.12).

CONCLUSION: Data demonstrated unidirectional coupling between internal rotation and valgus. Our data indicate that while internal rotation may play an important role in ACL injury, it is the coupled valgus motion associated with internal rotation that acts to load the ACL. Supported by NIH Grants ROI AR056259 and ROI AR049375.

3536 Board #257 June 2 9:30 AM - 11:00 AM Previous Hamstring Strain Injury Reduces Knee Flexor Strength And Biceps Femoris Activation David Opar1, Nuala M. Dear1, Ryan G. Timmins1, Morgan D. Williams2, Anthony J. Shield2. 1Queensland University of Technology, Brisbane, Australia. 2University of Glamorgan, Pontypridd, United Kingdom. (No relationships reported)

Hamstring strain injuries (HSI) are the primary injury sustained across a number of sports. A concern is that re-injury rates are also high and previous hamstring injury is the most significant risk factor for future injury. These observations suggest that the maladaptations that occur following HSI require attention, particularly neural maladaptations. Of interest is whether alterations in neural function are responsible for the prolonged eccentric weakness seen following HSI.

PURPOSE: To determine if previous HSI lead to reductions in voluntary activation during concentric and eccentric contraction at fast and slow movement velocities.

METHODS: Thirteen participants had a history of unilateral HSI within the last 18 months but were currently active in their chosen sport. A further 15 participants formed the control group. Thirty participants performed a familiarisation session and one testing session which consisted of maximal isokinetic concentric and eccentric contractions of the knee flexors at ±60°·s⁻¹ and ±180°·s⁻¹ and maximal isokinetic concentric contractions of the knee extensors at ±60°·s⁻¹ and ±180°·s⁻¹. Medial hamstring and biceps femoris activation was assessed using surface electromyography.

RESULTS: Previous HSI resulted in lower knee flexor torque at -180°·s⁻¹ (Mean diff = 21Nm; 95%CI = 10-31Nm; p<0.05), -60°·s⁻¹ (Mean diff = 14Nm; 95%CI = 6-22Nm; p<0.05) and +180°·s⁻¹ (Mean diff = 9Nm; 95%CI = 3-16Nm; p<0.05) in the injured leg compared to the contralateral limb. Lower voluntary biceps femoris activation at long muscles lengths at 180°·s⁻¹ (Mean diff = 0.13; 95%CI = 0.06 - 0.19; p<0.05) and -60°·s⁻¹ (Mean diff = 0.13; 95%CI = 0.05 - 0.22; p<0.05) was also found in the previously injured leg compared to the contralateral limb. No difference was found for voluntary activation of the medial hamstrings at any speed. In the control group there were no differences in torque or voluntary activation between dominant and non-dominant limbs.

CONCLUSION: Strength deficits during both concentric and eccentric contractions are found following HSI. It appears that lower voluntary activation is partially responsible for this strength deficit during eccentric contractions.

3537 Board #258 June 2 9:30 AM - 11:00 AM The Influence of Analysis Epoch on Knee Kinetics Related to Anterior Cruciate Ligament Injury Marc Norcross1, J. Troy Blackburn2. 1Oregon State University, Corvallis, OR. 2University of North Carolina at Chapel Hill, Chapel Hill, NC. (No relationships reported)

Peak internal knee extension moment (KEm) and anterior tibial shear force (ATSF) are commonly identified during landing tasks between the time from initial ground contact (IGC) until peak knee flexion (PKF) to infer anterior cruciate ligament (ACL) loading. However, ACL injury likely occurs within the initial 100 ms following ground contact (IN1), and the magnitude of ACL loading attributable to KEM and ATSF is mitigated as knee flexion angle increases during landing. As such, it is unknown whether identification of these variables during an epoch more closely aligned with the time of injury might be more appropriate for inferring ACL loading.
PURPOSE: To compare the magnitude, time of peak, and knee flexion angle at KEM and ATSF identified during INI and PKF. We hypothesized that when identified during INI, KEM and ATSF would demonstrate similar magnitudes, but occur sooner after IGC and at lesser knee flexion angles compared to KEM and ATSF identified during PKF.

METHODS: Dominant leg lower extremity kinematics and kinetics were measured in 50 healthy subjects (25 F, 25M) during a double leg jump landing from a 30cm box onto a force plate. Paired samples t-tests compared the magnitude, time of peak, and knee flexion angle at peak between KEM and ATSF identified during INI and PKF, respectively.

RESULTS: Peak KEM (0.177 BW*Ht vs. 0.175 BW*Ht, p = 0.047) and ATSF (0.059 BW vs. 0.088 BW, p < 0.001) were greater when identified during PKF than during INI. However, when identified during INI, KEM (62.2 ms ± 51.9 ms, p = 0.024) and ATSF (122.9 ms ± 64.4 ms, p < 0.001) occurred sooner after IGC and with the knee positioned in lesser flexion (KEM: 55.1° ± 53.0°, p = 0.010; ATSF: 71.2° ± 59.1°, p < 0.001) than when identified during PKF.

CONCLUSION: The results indicate that identifying KEM and ATSF during INI may be more appropriate for inferring ACL loading. Although small reductions in the magnitudes of KEM and ATSF were noted when identified during INI, these peak kinematics occurred earlier and with the knee positioned in lesser flexion, likely indicating greater ACL loading. Moreover, the results obtained using each analysis epoch differed, peak KEM and ATSF were identified in some participants more than 100 ms after IGC when using PKF; and after the time when ACL injury likely occurs. Future studies should identify KEM and ATSF during INI.

3538 Board #259 June 2 9:30 AM - 11:00 AM
Changes in Hip Muscle Performance and Lower Extremity Biomechanics Following a Hip-Focused Training Program
Krisen M. Stearns, Christopher M. Powers, FACSM, USC, Los Angeles, CA.

Females have a higher incidence of ACL injury compared to males. Deficits in hip and knee flexion during landing, along with increased knee valgus angles and moments, have been identified as potential risk factors for ACL injury in females. Deficits in hip muscle performance have been proposed as an underlying cause of “at risk” lowering biomechanics.

PURPOSE: To determine if an intervention program aimed at improving hip muscle rate of force development (RFD) can influence lower extremity biomechanics during a drop-jump task in females.

METHODS: Twenty recreationally active females (18-25 years of age) participated in biomechanical and RFD testing before and after a 4 week training program (3 times/week, 30 min/session) consisting of hip-focused plyometric and balance perturbation exercises. Hip abductor (HA), hip extensor (HE), and knee extensor (KE) maximal RFD was assessed during a rapid isometric contraction using a custom testing set-up (ie. load cell aligned perpendicular to the segment being tested). Lower extremity kinematics and kinetics were obtained as subjects performed a double-leg drop-jump from a 36 cm platform. Variables of interest were calculated over the early deceleration phase of landing and included peak hip and knee flexion angle, peak knee abduction angle, and peak knee adductor moment. Differences pre- vs. post-training were evaluated using paired-samples t-tests (p<0.05).

RESULTS: Post-training, there was a significant increase in HA RFD (757.9 ± 164.4 vs. 863.5 ± 220.2 Nm/ms; p=0.002) and HE RFD (1253.3 ± 440.4 vs. 1368.6 ± 437.6 Nm/ms; p<0.0002). Biomechanical testing revealed a significant increase in the peak knee (89.6 ± 7.7 vs. 92.3 ± 8.7; p<0.001) and hip flexion angle (79.3 ± 8.4 vs. 83.9 ± 8.6; p=0.04); and decreases in the peak knee abduction angle (5.3 ± 3.9 vs. 3.9 ± 3.6; p<0.02) and the peak knee adductor moment (0.24 ± 0.1 vs. 0.18 ± 0.1 Nm/kg; p<0.003).

CONCLUSIONS: Changes in lower extremity biomechanics following training were primarily driven by increases in hip muscle RFD as opposed to knee extensor RFD. We propose that injury prevention programs targeting hip muscle RFD may be important in mitigating biomechanical risk factors associated with ACL injury in females.

3539 Board #260 June 2 9:30 AM - 11:00 AM
Knee Rotational Kinematics After Anterior Cruciate Ligament Reconstruction Using Computer Navigation
Jothi Murali1, Robert Shalvoy2, Nicholas Beretta3, Elizabeth I. Drewniak-Watts2, Susan E. D’Andrea4, 1Brown University Warren Alpert School of Medicine, Providence, RI, 2Gait and Motion Analysis Laboratory, Providence VA Medical Center, Providence, RI.

To determine if an intervention program aimed at improving hip muscle rate of force development (RFD) can influence lower extremity biomechanics during a drop-jump task in females.

METHODS: Twenty recreationally active females (18-25 years of age) participated in biomechanical and RFD testing before and after a 4 week training program (3 times/week, 30 min/session) consisting of hip-focused plyometric and balance perturbation exercises. Hip abductor (HA), hip extensor (HE), and knee extensor (KE) maximal RFD was assessed during a rapid isometric contraction using a custom testing set-up (ie. load cell aligned perpendicular to the segment being tested). Lower extremity kinematics and kinetics were obtained as subjects performed a double-leg drop-jump from a 36 cm platform. Variables of interest were calculated over the early deceleration phase of landing and included peak hip and knee flexion angle, peak knee abduction angle, and peak knee adductor moment. Differences pre- vs. post-training were evaluated using paired-samples t-tests (p<0.05).

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CONCLUSIONS: Changes in lower extremity biomechanics following training were primarily driven by increases in hip muscle RFD as opposed to knee extensor RFD. We propose that injury prevention programs targeting hip muscle RFD may be important in mitigating biomechanical risk factors associated with ACL injury in females.

3540 Board #261 June 2 9:30 AM - 11:00 AM
Hip Function in Femoroacetabular Impingement
Alexander B. Dillon, Deepak Kumar, Anthony Lake, FACSM, Thomas M. Link, Sharmila Majumdar, Richard B. Souza, University of CA San Francisco, San Francisco, CA.

PURPOSE: Cam-type femoroacetabular impingement (FAI), with an anatomic deformity at the femoral head-neck junction, is a known risk factor for hip osteoarthritis. Repetitive contact of the deformity with the labrum and cartilage during daily activities can lead to degenerative degeneration. The purpose of this study is to evaluate the hip kinematics and kinetics during a variety of common daily tasks in subjects with FAI and healthy matched controls.

METHODS: 7 patients with cam-type FAI (5 M, 2 F; mean age = 36.6 ± 9.7 years, mean BMI = 26.2 ± 6.9) and 14 normal volunteers (10 M, 4 F; mean age= 30.4 ± 10.6 years, mean BMI = 23.3 ± 2.8) had 3T hip MRI scans to evaluate anatomical deformity. 3D motion analysis was performed for four tasks: 1) gait, 2) deep-squat, 3) drop jump, 4) single leg hop. Timed Up and Go (TUG) was used for functional performance. Student’s tests were used for between group comparisons and paired t-test for involved and contralateral side (α = 0.05)

RESULTS: During walking, FAI group had less flexion-extension motion compared to contralateral side and a similar trend was seen when compared to controls (p = 0.068). During the drop jump, FAI group had more external rotation at the hip compared to controls with similar trend seen when compared to contralateral side (p = 0.073). FAI group absorbed less power while flexing during drop jump. During drop jump (p = 0.067) and deep-squat (p = 0.058), FAI group showed a trend for lower external rotation moment when compared to controls. Finally, patients were significantly slower (9.7 ± 1.3 sec) than controls (8.4 ± 0.9 sec) at completing the TUG task.

CONCLUSIONS: Reduced sagittal motion was consistent with the literature. During drop-jump, lower hip power while flexing could be due to poor eccentric control resulting from hip and leg muscle weakness. External rotation moment during drop-jump and deep-squat indicate forced motion due to the cam deformity and avoidance of internal rotation during deep hip flexion. Future analysis will correlate functional biomechanics and the cartilage T1rho and T2 relaxation times.
**Board #262**  
**June 2  9:30 AM - 11:00 AM**  
**Influence of Hip Flexibility on Dynamic Alignment During the Overhead Squat Test in Adolescent Athletes**  
Anh-Dung Nguyen¹, Michelle C. Boling², Ashley N. Varone³, Kristin L. Kreene¹, Lindsay J. DiStefano¹.  
¹College of Charleston, Charleston, SC. ²University of North Florida, Jacksonville, FL. ³University of Connecticut, Storrs, CT. (Sponsor: William R. Barfield, FACSM)  
(No relationships reported)

The overhead squat test is a clinical screening tool that may be used to assess dynamic malalignments of the lower extremities that potentially increase the risk of knee injuries. While rotational flexibility of the hip has been suggested to contribute differences in lower extremity motion during the overhead squat, this relationship remains unclear.

**PURPOSE:** To determine the influence of hip range of motion on hip and knee kinematics during the overhead squat test.  

**METHODS:** Clinical measures of hip internal (HIR) and external (HER) rotation range of motions were measured on the dominant limb of 76 adolescent athletes (48 M, 28 F: 15.7±1.2 yrs, 173.9±11.0 cm, 67.9±12.9 kg) as part of a larger, multi-center risk factor screening project. Three-dimensional kinematics of the hip and knee during the descent phase (start to maximum knee flexion) were also assessed during five consecutive overhead squats. The average of three trials for HIR and HER were predicted hip and knee kinematics during the overhead squat in males and females.  

**RESULTS:** In males, HER was a positive predictor of hip flexion (R²=0.210, P=0.002) and hip adduction (R²=0.110, P=0.032) motion during the overhead squat. HIR was a significant positive predictor of knee external rotation motion, explaining 20.4% of the variance (P=0.003). In females, HER was a significant negative predictor of knee valgus motion, explaining 15.5% of the variance (P=0.046) while HIR was a significant negative predictor of knee flexion motion, explaining 19.0% of the variance (P=0.026).

**CONCLUSIONS:** Based on these results, flexibility of the hip internal and external rotators influence joint motions during the overhead squat test. This may in part be due to the changes in the length-tension relationship of the surrounding muscles, which can lead to dynamic malalignments known to be predictive of knee injuries. Ongoing research is examining whether these range of motion differences increase the risk of knee injuries in adolescent athletes.

Supported by University of North Florida Faculty Development Research Grant.
RESULTS: Peak VCC in stance (Day 1 mean = 0.55 ± 0.26, Day 2 = 0.57 ± 0.26, ICC = 0.79, SEM = 0.10, p = 0.001) and swing phases (Day 1 mean = 0.73±0.15, Day 2 mean = 0.64 ± 0.20, ICC = 0.76, SEM = 0.08, p = 0.001) were found to be highly reliable. The peak for stance consistently occurred in mid-stance (40-48% of GC) and in the terminal swing phase (98-0% of GC).

CONCLUSION: Individuals with CAI exhibited very stable ankle-joint coupling variability patterns during walking across 2 different days. The timing and magnitude of peak joint coupling variability were consistent across the 2 days of testing. The peaks in coupling variability were associated with the transitions between absorption and propulsion (mid-stance) and swing to stance phases (terminal swing). Ankle-knee joint coupling variability appears to be reliable over time in those with CAI and offers insight into the stability of the relationship around gait transitions.

3545 Board #266 June 2 9:30 AM - 11:00 AM
Perceptions of Function Differ from Quantitative and Qualitative Tests of Physical Performance After ACL Reconstruction
Caitlin Gollehon, Maggie Dewitz, Jenna Kokes, Ryan L. Mizner. University of Montana, Missoula, MT.

There are a wide variety of assessments available to quantify outcomes prior to anterior cruciate ligament reconstruction (ACL). Most studies use questionnaires to measure patients’ perception of their functional ability. Others employ assessments like the Y balance test and hop test to quantify physical performance. Relatively few studies go so far as to include 3D motion analysis of patients completing sports related tasks. The relative interplay between these levels of outcome assessments as they relate to evaluation of outcomes after ACLR remains understudied.

PURPOSE: To assess the relationships present between a wide variety of means to quantify clinical outcomes in patients with unilateral ACL reconstruction.

METHODS: Participants included 17 (7 males) physically active (≥ 4 Tegner Scale) subjects, ages 16-31 with unilateral ACLR. A one-time session was completed where participants were assessed with an 8 camera Vi-sion system with force plates for peak knee flexion moment during a single leg land (SLL) and vertical ground reaction forces (VGRF) during a drop vertical jump (DVJ). Patients completed the International Knee Documentation Committee (IKDC) questionnaire. Performance was quantified by the difference between limbs for both the anterior reach of the Y Balance Test and the single leg hop for distance.

RESULTS: Our results show that the IKDC was only significantly correlated to the Hop test for distance (r=0.62, p=.008). The Hop test was significantly correlated to peak knee moment during the SLL (r=0.59, p=0.013), but was not correlated to asymmetries in VGRF during the DVJ land (r=0.16, p= 0.53). The Y balance is not correlated with asymmetry in VGRF during the DVJ (r=-0.16, p= 0.54) or the peak knee moment during the SLL (r = -0.35, p= 0.17).

CONCLUSION: No one measure seems to give a complete picture of an athlete’s outcome following ACLR. None of the correlations between measures were strongly correlated to each other. While the commonly used questionnaires are inexpensive they fail to relate qualitative assessment of the motion analysis. The performance assessments were a closer approximation of the motion analysis, but the motion analysis seems to provide additional information to quantify performance. A broad assessment is needed to fully appreciate patient outcomes after ACLR.

3546 Board #267 June 2 9:30 AM - 11:00 AM
Functional Weight Bearing Exercises Normalized to Leg Length Among Males and Females
Lucinda E. Bouillon, Jacqueline Whelrn, Patricia Eisel, Jessica Wisner, Megan Rachow, Lindsay Hatteberg. University of Findlay, Findlay, OH.

Researchers have used various step heights and lunge distances when assessing functional exercises. These height and distance variations make comparisons difficult between gender and tasks. Leg length differences may also affect the ability to perform the task.

PURPOSE: Determine if muscle activity of the rectus femoris (RF), rectus abdominis (RA), external oblique (EO), erector spinae (ES), gluteus medius (GMed), gluteus maximus (GMax), tensor fascia latae (TFL), and biceps femoris (BF) differs between gender among three single-limb weight bearing exercises using normalized leg length distances.

METHODS: Twenty men (23.2±2 yrs, 1.84±0.09m; 85±20 kg) and 20 women (23.2±2 yrs, 1.64±0.07m; 84±7 kg) who were healthy and recreationally active participated in the study. Surface electromyography (SEMG) and 2-D video were used to collect SEMG data for the RF, RA, EO, ES, GMed, GMax, TFL, and BF muscles of the dominant lower extremity. Maximal voluntary isometric contractions (MVIC) were used to normalize SEMG root mean square values for each muscle, which were expressed as %MVIC. Participants completed unilateral functional exercises (step down, forward lunge, and side-step lunge) in a randomized exercise order. The subjects performed 2 x 10 repetitions at a pace of 80 bpm. Distances for each exercises were normalized to the participant’s lower limb length (25% step down, 65% forward lunge, 10% side-step). Descriptive statistics, ANOVAs, and ICCs with 95% confidence intervals were calculated. Normalized SEMG values were analyzed using 8 X 3 X 2 ANOVA with follow up using Bonferroni post-hoc testing.

RESULTS: Descriptive statistics found males were taller and heavier compared to the women. No differences were found between gender by task for the eight muscles. Regardless of gender, the step down task resulted in higher GMax %MVIC compared to lunge, (p=0.002). Step down exercise was also higher for GMed %MVIC than lunge (p=0.002) and side step (p=0.013). ICCs ranged from moderate to high (0.74 to 0.97) for the three tasks.

CONCLUSIONS: Muscle activity was similar for males and females during the step down, side-step and lunge with distance normalized to the participant’s leg length. The step down task recruited higher GMax %MVIC activity when compared to the lunge; and greater GMed %MVIC activity than lunge and side step tasks.

3547 Board #268 June 2 9:30 AM - 11:00 AM
Efficacy Of Goniometry-based Q-angle For Measuring Change
Lawrence W. Weiss, FACSM, Kelley G. Hammond, Brian K. Schilling, Lucas C. Ferreira. The Univ. of Memphis, Memphis, TN.

Quadriceps angle (Q-angle) has been used to reflect the extent of genu valgum and may have implications for activity selection, training considerations, and/or potential medical interventions. Q-angle evaluation must be stable and sufficiently precise in adults if it is to have clinical and/or research utility.

PURPOSE: To establish the stability reliability, precision, and minimum difference needed to represent a change in Q-angles obtained using surface goniometry.

METHODS: Q-angle was assessed for 25 men and 27 women with surface goniometry on two separate occasions separated by 48 hours. Well-rested subjects assumed a supine position with: 1) extended hips and knees, 2) a neutral hip rotational position, 3) a neutral foot position, and 4) a contracted quadriceps femoris muscle. The axis of a manual goniometer was placed over the center of the right patella with the fixed arm situated over the anterior-superior iliac spine and the mobile arm over the center of the tibial tuberosity. Stability reliability was calculated using intraclass correlation (ICC, 2-way random) and precision by standard error of measurement (SEM). 95% limits of agreement (LOA) was also calculated to estimate the magnitude of difference needed to represent actual change. Acceptable ICC’s were set at ≥0.70 for reliability.

RESULTS: The following ICC (SEM) were found: all subjects = 0.88 (1.0 deg), men = 0.77 (1.0 deg), women = 0.85 (1.0 deg) (See Table 1).

CONCLUSION: The surface goniometry protocol described herein was reliable for all subjects, men only, and women only. Although precision also appeared to be reasonable, a minimum difference of three degrees would be needed to represent a change or difference in Q-angles.

Table 1. Q-angle based on surface goniometry.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Mean1 (SD1) (deg)</th>
<th>Mean2 (SD2) (deg)</th>
<th>ICC</th>
<th>ICC Conf Limits</th>
<th>SEM (deg)</th>
<th>SEM Conf Limits</th>
<th>95% LOA (deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>13 (3.2)</td>
<td>13 (3.1)</td>
<td>0.88</td>
<td>0.81 - 0.92</td>
<td>1.0</td>
<td>0.9 - 1.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Men</td>
<td>13 (1.9)</td>
<td>13 (2.1)</td>
<td>0.77</td>
<td>0.58 - 0.88</td>
<td>1.0</td>
<td>0.8 - 1.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Women</td>
<td>13 (2.6)</td>
<td>13 (2.9)</td>
<td>0.85</td>
<td>0.73 - 0.92</td>
<td>1.0</td>
<td>0.8 - 1.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>
**METHODS:** Screen® (FMS) assesses core, balance, and movement patterns. The aim of this study was to examine if a relationship exists among the FMS, core stability, and dynamic balance tests. Composite reach distance (sum of 3 directions and divided by 3 times LL and multiplied by 100). This score was recorded as % of LL. The FMS included seven tests that were summed together: extensor endurance: repetitions (EE); Star Excursion Balance Test (SEBT); and FMS. The athletes performed 3 excursions of the SEBT (anterior, postmedial, and postlateral) bilaterally. A correlation assessed the relationship among core stability, SEBT, and FMS scores. Inter- and intraclass coefficients (ICC) were used to examine rater and ratings across trials for each limb (R total score, L total score) and was scored by two raters for all tasks. All tests were performed three trials and best score was recorded. Repeated-measures ANOVAs were performed to examine core balance symmetry among the athletes. Clinicians and coaches should be aware that scores on the core stability and dynamic balance tests do not relate to FMS scores.

**RESULTS:** There were no significant (p<0.05) differences observed in the peak torque production between the three stretching protocols when comparing athletes and non-athletes, indicating that either static or dynamic stretching is acceptable prior to exercise, regardless of activity level. Research was funded by a Math and Science Summer Research Fund.

**INTRODUCTION:** Although warm-up and stretching exercises are routinely used as pre-exercise static and dynamic stretching on peak torque of the knee flexors in trained and untrained females.

**METHODS:** Fifteen healthy, college aged, female NCA Division III athletes (mean age: 20.2 years, height: 171.7 cm weight: 71.9 kg) and fifteen healthy, female non-athletes (mean age: 20.93, height: 167.82 cm, weight: 68.79 kg) were tested on a Cybex NORM isokinetic dynamometer. Subjects completed two familiarization sessions and three experimental testing sessions. In all sessions, subjects warmed up on a stationary bike for five minutes and performed one of three randomly assigned stretching protocols (no stretching, static or dynamic stretching). Subjects then performed eight maximal knee extensions through a 90 degree range of motion at each of three descending, velocities (180, 120 and 60 deg/s). Flexion was held constant at 300 deg/sec for all velocities and there was a 60 second rest period following each velocity set. A repeated measures ANOVA was used to analyze data with α<0.05.

**RESULTS:** No relationships were found among outcome measurement scores. A time effect was found for the SEBT scores pre-to post season with improvement for the right composite score from 83% to 89% of LL (p<0.001) and the left increased from 81% to 88% of LL (p=0.001). The ICCs were very reliable for the two raters (.99 to 1.0) and between trials (.81 to .98).

**CONCLUSIONS:** Core stability, SEBT, and FMS tools were reliable between two raters and across trials among the collegiate athletes, however no relationships were found among these outcome measures. The only change that was found was an increase in excursion distance on right (6% of LL) and left (7% of LL). Right and left limb distance were <4cm suggesting bilateral dynamic balance symmetry among the athletes. Clinicians and coaches should be aware that scores on the core stability and dynamic balance tests do not relate to FMS scores.
CONCLUSION:
RESULTS:
post-intervention and analyzed with a two-way, repeated measures ANOVA; alpha was set at 0.05
extensions on the Cybex; subjects used their dominant arm for the first treatment and non-dominant arm for the second. Data were collected before intervention, and at 24, 48, 72, and 96 hr respectively, whereas arm circumference (p<0.01), RANG (p<0.05), and VAS (p<0.01) increased by 3, 19, and 39%, respectively.

Betaine supplementation fosters an anabolic endocrine profile: increased GH and IGF-1 and decreased cortisol. This hormonal profile suggests signaling that promotes increased protein synthesis. We conclude that betaine supplementation may provide ergogenic benefit via a heightened anabolic endocrine profile that supports increases in protein synthesis.

CONCLUSION: The exercise intervention induced DOMS, but betaine supplementation did not ameliorate its effects compared to placebo.

Purposes:

Methods:

Results:

Conclusions:

Purpose:

Methods:

Results:

Conclusion:

Purpose:

Methods:

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Conclusion:

Purpose:

Methods:

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Conclusion:

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Conclusion:

Purpose:

Methods:

Results:

Conclusion:
PURPOSE: The purpose of this study was to evaluate the Mg status, using four different methods, in individuals with the MetSyn or T2DM. This study is part of a larger clinical trial that is on-going.

METHODS: Participants arrived at the Clinical and Translational Research Center at the University of Pennsylvania, after an overnight fast, to be evaluated for Mg status. Serum Mg, ionized Mg, RBC Mg, and urinary Mg via the MLT were all assessed.

RESULTS: Our 23 participants (10 men, 13 women) were 55.6±177.9 years of age and had a body mass index (BMI) of 35.1±177.3 kg/m². Serum Mg levels were 1.98±177.0 mg/dL (normal values ≥8805.1 mg/dL). Ionized Mg concentrations were 0.48±177.05 mmol/L (normal values ≥8805.05 mmol/L). RBC Mg concentrations were 1.94±177.03 mmol/L (normal values ≥8805.75%).

CONCLUSIONS: Evaluation of four methods of assessing Mg status in this small sample size of participants with MetSyn and T2DM showed that serum and RBC Mg levels were overestimated, and ionized Mg and MLT may have underestimated Mg status. However, because MLT is considered a gold standard of assessing Mg status, we conclude that ionized Mg may be the best method for analyzing Mg status, if MLT cannot be used.

Funding Support: This work supported by NIH-NIDDK 5 R21 DK 78368 02

3555 Board #276 June 2 8:00 AM - 9:30 AM
High Isoflavones and Magnesium as Anti-Inflammatory Agents to Enhance Performance of Aerobic and Resistance Exercise
Brooke E. Starkoff, Robert A. DiSilvestro, Brian C. Focht, FACSM, Steven T. Devor, FACSM. The Ohio State University, Columbus, OH. (No relationships reported)

METHODS: Subjects were a subsample of young adults (18-30 years) participating in a similar study. Following an initial fitness evaluation to determine 1-repetition maximum (1RM), subjects returned to perform an exercise assessment including a 70% 1RM for chest press, biceps curl, and leg extension to exhaustion followed by 2 sets of upright rows; one set of 50 and another to fatigue. Subjects then ran 3 miles, cycled for 25 minutes, and lastly completed a 90 second step-test. Time, distance, and steps were recorded, respectively. Each subject was assigned to 1 of 3 supplement combinations containing low or high isoflavone soy protein, pumpkin seed oil, and/or magnesium glycinate to consume for 4-weeks. Subjects then returned to repeat the same pre-intervention exercise assessment.

RESULTS: Univariate ANOVA analysis revealed that all treatments resulted in significant, comparable pre- to post-intervention improvements in chest press, biceps curl, leg extension, cycling, and step test performance (p ≤0.05). Additionally, the treatment main effect for cycling performance approached significance (p =0.06). Post hoc analysis of change in performance revealed that the HIGH treatment resulted in superior improvement in cycling performance when compared to the CON treatment (d = 0.937).

CONCLUSIONS: Nutritional supplementation with high isoflavone soy protein may provide an attenuation of muscle fatigue during aerobic exercise.

3556 Board #277 June 2 8:00 AM - 9:30 AM
25(OH)D Status is Not Related to Bone Mineral Density or Inflammatory Cytokines in Collegiate Athletes
Regina M. Lewis, Maja Redzic, Peter B. Shores, David T. Thomas. University of Kentucky, Lexington, KY. (Sponsor: Jody L Clasey, FACSM) (No relationships reported)

METHODS: Prior to the start of the athletic season in late August, blood was drawn to measure 25(OH)D and cytokine levels. Measures of lumbar spine (LS), proximal dual-femur, and total body BMD were obtained by DXA. Questionnaires collected dietary and lifestyle data.

RESULTS: Mean 25(OH)D levels were 55.6 ± 2.3 ng/mL with a range of 33 ng/mL to 95 ng/mL. Seventeen percent of the sample had 25(OH)D levels less than 40 ng/mL. Mean BMD for the proximal femur, LS, and total body were 1.27 ± 0.02 g/cm², 1.11 ± 0.01 g/cm², and 1.20 ± 0.1 g/cm² respectively. Correlations were examined between 25(OH)D status proximal femur BMD (r = -0.08; p = 0.90), LS BMD (r = 0.09; p = 0.53), and total body BMD (r = 0.11; p = 0.47). Mean concentration of TNF-alpha was 10.98 ± 1.38 pg/ml and IL-6 was 4.0 ± 1.38 pg/ml. Correlations were examined between 25(OH)D status and TNF-alpha (r = -0.05; p = 0.76), and IL-6 (r = -0.11; p = 0.48).

CONCLUSION: While these findings are preliminary in nature, they demonstrate no significant relationship between 25(OH)D and bone or cytokine measures in athletes who primarily train and compete indoors. Perhaps pre-season resistance and dry-land training have a stronger association with these measures in this population. Additional studies are needed to determine if season-long Vitamin D supplementation can improve body composition, decrease inflammation, and improve overall health in Vitamin D insufficient indoor athletes.

Supported by Grant UL1RR033173

3557 Board #278 June 2 8:00 AM - 9:30 AM
The Effects of 4 Weeks Vitamin D3 Supplementation on Athletic Performance
Adrian B. Hodgson1, Andrew J. Ingham2, Jonathon Martin1, Timothy Roberts1, Asker E. Jeukendrup1. 1University of Birmingham, Birmingham, United Kingdom. 2Aston University, Birmingham, United Kingdom. (No relationships reported)

BACKGROUND: Vitamin D deficiency is a growing problem worldwide. Growing evidence in the elderly has shown that individuals with a higher vitamin D status (>75nmol/L) exhibit improved musculoskeletal performance. However it is unknown whether improving vitamin D status in athletes leads to improved athletic performance.

PURPOSE: To investigate the effects of 4 weeks vitamin D3 supplementation on a number of indicators of aerobic and anaerobic performance as well as muscle strength.

METHODS: 36 endurance trained male cyclists/triathletes (Age 39±8, Height 1.80±0.06m, Weight 76.3±6.2kg, VO2 max 60.3±8.3 ml/kg/min) were recruited and randomly assigned into one of four supplementation groups: Placebo (PLA), 1500IU D3/3d, 3000IU D3/3d and 6000IU D3/3d, lasting for 4 weeks, as part of a double blind study design. Athletes reported to the lab for 2 days of performance testing pre and post supplementation, including VO2 max test, 1 repetition max single leg strength test (1RM), maximal voluntary contruction hand grip test, 1 hour time trial and repeated Wingate tests. All data collection was performed at latitude of 52°29’N, between December and March.

RESULTS: Pre supplementation, 53% and 33% of athletes were vitamin D deficient (>50 nmol/L) and insufficient (50-75 nmol/L) respectively. Vitamin D supplementation caused 25(OH)D to increase to a sufficient status (>75 nmol/L), while those receiving PLA saw small non significant changes to 25(OH)D. Small significant improvements in 1 RM leg extension for those athletes receiving 6000IU were observed on both the dominant (5.3±1.4kg (6000IU) and 2.0±1.9kg (PLA) p<0.05) and non dominant leg (5.8±1.0kg (6000IU) and 1.5±1.8kg (PLA) p<0.05). Furthermore there was a tendency for peak power output to improve during the wingate test for 3000IU/d and 6000IU/d, however this difference did not reach significance. For the remaining performance tests no difference was observed.

CONCLUSIONS: The study shows that 4 weeks vitamin D supplementation, above the currently debated IOM RDI 600IU/d, can improve vitamin D status in athletes. Small significant improvements in 1RM leg extension performance were observed at the highest dose. Based on these results it could be argued that the potential benefits of vitamin D to athletic performance may be specific to resistance based exercise.

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Studies suggest that increased serum concentrations of 25-hydroxyvitamin D (25-OH)D are associated with slowing the development of many age-related chronic diseases. Recent data supports a positive relationship between 25-OH and muscle synthesis, strength, power and decreased body fat in elderly individuals. However, these findings have not been consistently replicated in younger, healthy populations.

**PURPOSE:** To investigate the relationship between 25-OH and muscle synthesis, strength, power and decreased body fat in elderly individuals.

**METHODS:** Twenty-six subjects (9 male, 17 female; 23.4 ± 3.9 years old) reported to the lab six times for testing. Blood was drawn to determine 25-OH concentrations using an ELISA. Primary outcomes included: Body composition (DXA); resting metabolic rate, VO2max, power output (Wingate); and strength (8RM of bench press, upright row, leg extension and leg flexion). While our primary analysis included all participants, we also performed a sub-group analysis on those individuals considered to be sub-optimal or lower (<30 ng/mL); low (n=11, 22.15 ± 0.85 ng/mL) and high (n=15, 40.59 ± 2.51 ng/mL).

**RESULTS:** Overall, we observed no significant correlations between 25-OH and any major outcome variables. While the HIGH 25-OH group showed a positive correlation between RMR and 25-OH status (r = 0.622; p<0.05), neither group showed a significant correlation between 25-OH levels and our other designated outcomes.

**CONCLUSIONS:** RMR was significantly correlated with 25-OH status in individuals with normal 25-OH levels, indicating there may be an underlying mechanism relating 25-OH to body composition and increased energy expenditure.

There is increasing evidence that many athletes are vitamin D deficient. Athletes at risk are those participating in indoor sports, those living at higher latitudes and those with dark-pigmented skin. The high latitude of Norway indicates that vitamin D status is a concern among Norwegian athletes. Vitamin D deficiency may have severe health consequences including risk of bone injuries. Additionally it is discussed whether vitamin D deficiency affects performance and the athlete’s ability to train effectively through its impact on muscle function and the immune system.

**PURPOSE:** 1) To determine the vitamin D status of Norwegian national team athletes living at latitude 60°N; and 2) to evaluate training (outdoor vs indoor) and dietary factors affecting their vitamin D status.

**METHODS:** Athletes representing national teams were invited to participate in the study. Blood tests were analysed for serum 25-hydroxyvitamin D (25(OH)D). Serum 25(OH)D levels were defined as deficient (<50 nmol/L); insufficient (<80 nmol/L); and sufficient (>80 nmol/L). Vitamin D intake were calculated from 7-day weighed food records using a computerized nutrient database.

**RESULTS:** Fifty-five women (mean±SD: 24±4 yrs) and 78 men (24±3 yrs) participated. Mean 25(OH)D-level was 82±30 nmol/L. Seventeen (13%) athletes had levels consistent with vitamin D deficiency (range: 15-49 nmol/L). 47 (25%) had levels defined as insufficient and 69 (32%) had levels defined as sufficient (80-162 nmol/L). Athletes training outdoors (n=108) had higher 25(OH)D-levels than athletes training indoors (n=25, 85±25 vs 69±34 nmol/L; p=0.02). Mean vitamin D intake was 5.3±3.4 µg (0.6-8.0 µg), and 85% (n=113) did not meet the RDA of 7.5 µg vitamin D in Norway.

**CONCLUSIONS:** The mean 25(OH)D-level of athletes living at altitude 60°N were within sufficient levels, still half of the athletes had levels regarded as deficient or insufficient. Due to these results, we recommend screening of vitamin D deficiency in Norwegian athletes. Athletes training outdoors had significant higher 25(OH)D-level than those training indoors, suggesting further research on the sun exposure effect on vitamin D status in athletes living at high altitudes. In general Norwegian athletes should be recommended to increase their vitamin D intake to meet the RDA.

A balanced diet is important to maintain growth, health and athletic performance. Adequate micronutrient intake in athletes is required to prevent nutrient deficiencies and concomitant diseases. However, little is known about habitual micronutrient intake of young German athletes.

**PURPOSE:** To analyze micronutrient intake of young German athletes and to identify micronutrients where supply is crucial.

**METHODS:** 252 young German athletes were included in the study (55 % male; 12 ± 1 yrs; 158 ± 9 cm; 46 ± 9 kg; 20 ± 4 % body fat). Dietary intake was recorded for three days using a validated dietary protocol. Intake of 25 micro nutrients was analyzed based on the German Food Database. Micronutrient intake was compared with German recommended daily intake (RDI) for children. Data are given in mean ± SD. Student’s t-test was used to test for differences between genders (α=0.05).

**RESULTS:** Intake of folic acid, vitamin E and iron was significantly higher in males than in females (p<0.05; table 1). No male and only 2 females reached RDI for folic acid. RDI for vitamin D was not achieved by 96 % of males and 95 % of females. Fluoride intake was below RDI in 98 % of all athletes. Two thirds of females did not reach RDI for iron. Overall, males did not reach RDI of 7 ± 3 micronutrients, and females failed to meet RDI of 8 ± 4 of the 25 micronutrients analyzed (p=0.016).

**CONCLUSION:** Crucial amounts of intake were identified for folic acid, vitamin D, vitamin E, iodine and fluoride. Therefore, intake of those micronutrients must be increased. In addition should be discussed if implementation of nutritional education programs can lead to a higher micronutrient supply.

| Table 1: Extract of critical micro nutrient intake of male and female young German athletes |
|---|---|---|---|
| Micro nutrient | Males | Females | p-values |
| Mean Intake | % of RDI | Mean Intake | % of RDI |
| Folic acid [µg/d] | 232 ± 62 | 38 ± 16 | 211 ± 61 | 33 ± 15 | 0.010 |
| Vitamin D [µg/d] | 2.2 ± 1.4 | 44 ± 28 | 2.2 ± 1.5 | 44 ± 30 | 0.928 |
| Vitamin E [mg/d] | 12.2 ± 4.3 | 84 ± 33 | 10.7 ± 3.7 | 97 ± 34 | 0.004 |
| Fluoride [µg/d] | 934 ± 342 | 47 ± 17 | 873 ± 347 | 44 ± 17 | 0.164 |
| Iodine [µg/d] | 109 ± 39 | 61 ± 22 | 105 ± 43 | 58 ± 24 | 0.356 |
| Iron [µg/d] | 55.1 ± 4.0 | 126 ± 33 | 14.0 ± 3.6 | 93 ± 24 | 0.014 |
Board #284       June 2       9:30 AM - 11:00 AM
Ambulatory Status in Multiple Sclerosis is Linked to Disease Progression and Brain Atrophy
Annette S. Fjeldstad¹, Hanieh Seraj², Monica Rojas¹, Dee Huseby¹, Noel G. Carlson², John W. Rose¹. ¹University of Utah, Salt Lake City, UT. ²VA Medical Center, Salt Lake City, UT. (No relationships reported)

Progressive disability is prevalent in patients with multiple sclerosis (MS) and frequently impacts ambulatory status. Improving knowledge of the disease progression in MS may advance treatment strategies and facilitate clinical assessment of the degree of central nervous system (CNS) degeneration.

PURPOSE: The objective of these studies is to examine the relationship between brain atrophy, disease progression, and ambulatory status in MS patients.

METHODS: A total of 398 MS patients participating in the Intermountain MS Project were classified by disease course (310 Relapsing Remitting (RR-MS); 88 Primary Progressive (PP-MS) & Secondary Progressive (SP-MS)) and ambulatory status (unassisted, assisted or wheel chair). Brain MRI scans were reviewed for all patients to determine which individuals demonstrated a high degree of atrophy of either or both of the cerebral hemispheres and corpus callosum. Correlations between brain atrophy with disease course and ambulatory status were evaluated.

RESULTS: Two significant associations were observed among these patients. First, patients with progressive forms of the disease (PP-MS, SP-MS) had a higher incidence of brain atrophy (43%) than RR-MS patients (17%) (p < 0.0001 (Fisher’s Exact Test)). Second, patients that required ambulatory assistance (or wheelchair) had a significantly higher incidence of brain atrophy (42%) than unassisted patients (15%) (p < 0.0001).

CONCLUSIONS: There was a significant relationship between brain atrophy, disease progression and ambulatory status. These results suggest that incidence of brain atrophy is associated with disease progression (PP-MS, SP-MS) and an enhanced need for ambulatory assistive devices. Neurodegenerative processes are implicated as a contributor to disability in this patient population and may be associated with other biomarkers of disease progression.
The Intensity And Amount Of Daily Physical Activity Necessary For Maintaining The Neurocognitive Function

Ken Kimura1, Akitomo Yasunaga2, Kohel Sato3, Ai Hirasa4, Yukihiko Ito1, 1Tokyo Denki University, Tokyo, Japan. 2Bunka Gakuin University, Tokyo, Japan. 3Japan Women’s College of Physical Education, Tokyo, Japan. 4FANCL Research Institute, Yokohama, Japan.

(Purpose: Recently, there has been emerging evidence that a regular physical exercise program can reduce neurocognitive attenuation caused by aging in elderly people. Likewise, it has been reported that daily physical activity also has an important role in regards to maintaining cognitive health in the elderly. However, it is still not clear exactly what intensity and amount of daily physical activity are most effective in guarding against neurocognitive decline. The present study conducted a cross-sectional assessment to define the intensity and amount of daily physical activity which would have a favorable influence on neurocognitive function.

Methods: More than 100 people aged over 60 years old participated in this study. They wore an electronic accelerometer throughout their waking hours for a month or more to assess the amount and intensity of their individual daily physical activity. This recorded the number of steps per day and the duration per day as one of ten intensity levels (0.5, 1, to 9). Effective cognitive function was evaluated with a task-switching reaction time (RT) test measuring percent RT increase in the switching task, correct response rate, and intra-individual coefficient of variation (ICV).

Results: Within this study, stepwise multiple regression analysis revealed that the amount of 4 Mets intensity of daily physical activity could have a positive influence on the executive performance (i.e., explained 29.3% of the variance in ICV (p<0.01)).

Conclusions: The present study’s data suggests that moderate physical activity in daily life maintains proper neurocognitive function. In this study, we will confirm the validity of the results by using further analysis taking into account latent confounders such as physical fitness level, QOL, social and cognitive activity, and nutrition.

Effects of Acute Exercise on Visuospatial Attention in Undergraduates with Different Levels of Cardiopulmonary Fitness

Chia-Liang Tsai1, Tzu-Chi Chen1, Feng-Ying Choo1, Yu-Ting Tseng1, Meng-Chih Hsieh1, 1National Cheng Kung University, Tainan, Taiwan.

(Purpose: To date, no study has examined the effects of acute exercise on covert orienting of a visuospatial attention task in undergraduate students with different levels of cardiopulmonary fitness. The purpose of this study was to test whether cognitive executive function and level of physical activity are related in healthy older adults. We predicted that the self-reported level of physical activity would be positively correlated with the intensity of brain activation recorded during the execution of a task requiring executive function.

Methods: Twenty-eight undergraduate students aged 18-24 years were assessed by a continuous graded maximal exercise test to identify their cardiorespiratory fitness and divided into high-cardiopulmonary (n=14) and low-cardiopulmonary (n=14) groups. All undergraduate students performed the endogenous Posner paradigm task with ERP recording before and after a 30-min bout of acute exercise. The behavioral and ERP performances in the pre-exercise session were taken as the baseline and compared with those in the post-exercise session in both groups. The behavioral and ERP results were subjected separately to repeated measures ANOVA. A level of p<.05 was accepted as statistically significant.

Results: In the pre-exercise session, the low-cardiopulmonary group had significantly longer RT (270.9±48.03 vs. 236.4±27.93ms, p<0.05) and smaller P3 amplitude (8.09±1.88 vs. 11.59±3.47µV, p<.05) than the high-cardiopulmonary group. After acute exercise, the high-cardiopulmonary group showed faster RT (236.4±27.93 vs. 216.3±23.10ms, p<0.05) and greater P3 amplitude (11.59±3.47 vs. 14.26±4.26µV, p<.05) as compared to the pre-exercise session. However, the low-cardiopulmonary group only exhibited the effect of acute exercise on the RT (270.9±48.03 vs. 257.1±33.50ms, p<.05).

Conclusions: These findings showed that behavioral performance could be improved in the Posner paradigm task in undergraduate students with low- and high-cardiopulmonary fitness. However, the electrophysiological signal was only significantly affected in the undergraduate students with high-cardiopulmonary fitness.

Measurement of Attention from a Cognitive Neuroscience Perspective: An Essential Element of Human Performance

Bartlett A.H. Russell, Fallon Goodman, Brad D. Hatfield, FACSM. University of Maryland, College Park, College Park, MD. (Sponsor: Bradley D. Hatfield, FACSM)

(Purpose: Cognitive reserve, or the amount of residual neural processing capacity available to attend to unexpected stimuli and contexts, is a critical component of adaptive human performance and may be inversely related to primary task load. The purpose of this study was to find an objective measure of cognitive reserve, which would provide a way to study how factors such as expertise, stress, and personality types affect performance in contexts.

Methods: To objectively index cognitive reserve, Electroencephalography (EEG) was used to record brain responses to task-irrelevant sounds in 21 healthy adults while they completed “Easy” and “Difficult” serial subtraction tasks. Auditory probes were standard (180ms complex tone + 520ms of silence) and deviant (100ms complex tone + 600ms of silence) sounds played in a pseudorandom, 80/20 “Oddball” ratio. EEG was time-locked to tone onset and averaged to examine differences in the Event Related Potential (ERP) waveforms in each condition. It was predicted that as task difficulty increased, the amplitude of the attention-sensitive P2 component would decrease, reflecting a decrease in cognitive reserve.

Results: As expected, primary task difficulty increased, percent accuracy (F(2,17) = 32.55, p <0.001) and number of subtractions attempted (F(2,17) = 172.63, p <0.001) decreased. Though plots show decreased P2 amplitude in the Difficult compared to the Easy task condition, contrary to prediction, the difference was not significant (F(1,16) = 1.108, p = 0.308). Additionally, plots show a depression in later potentials in the Difficult compared to the Easy condition, that was closer to, but also failed to reach significance (F(1,16)= 2.781, p = 0.115).

Conclusions: This study failed to distinguish between conditions and was thus unable to index cognitive reserve. This may be partly because the self-paced tasks allowed participants to adjust speed as difficulty changed, thus limiting differences between conditions. Future studies should control pacing to determine whether this method may still provide a useful metric for gauging cognitive reserve in various human performance contexts.

An fMRI Investigation of the Relationship Between Physical Activity and Executive Function in Older Adults

Katie Becofsky1, Gerhild Ullmann1, Roger Newman-Norlund1, Harriet G. Williams2, 1University of South Carolina, Columbia, SC. 2Clemson University, Clemson, SC. (Sponsor: Sara Wilcox, FACSM)

(Purpose: The purpose of this study was to test whether cognitive executive function and level of physical activity are related in healthy older adults. We predicted that the self-reported level of physical activity would be positively correlated with the intensity of brain activation recorded during the execution of a task requiring executive function.

Methods: A sample of older adults (n=12, 75% female, mean age=70 +/- 5.7) underwent an initial session in which they completed the Physical Activity Scale for the Elderly based on their physical activity behavior during the previous week. Each subject completed computer-based versions of two executive function tasks, Trail Making A & B, while undergoing functional magnetic resonance imaging (fMRI).
RESULTS: First, we examined the contrast (Trails B - Trails A) in order to identify cortical sites specifically involved in cognitive flexibility and inhibition, two important components of executive function. A large cluster of voxels (306) in the left inferior frontal gyrus (brommann’s area 47; coordinates -50, 38, 10) was significantly more active during execution of the Trails B as compared to the Trails A task (t=6.6, p < .001). A smaller cluster (19 voxels) in the left premotor cortex (brommann’s area 6; coordinates -60, 6, 12; 19 voxels) was also more active during execution of the Trails B task (t=5.25, p < .001). Subsequent correlational analyses examining the relationship between the strength of these activations and self-reported physical activity were not significant (r = .36 and r = .28 for brommann’s area 6 and 47, respectively).

CONCLUSIONS: In healthy older adults, cognitive flexibility and inhibition were associated with increased activity in the left inferior frontal gyrus and left premotor cortex. Brain activity recorded during execution of an executive functioning task was not significantly correlated with self-reported physical activity. Future studies might use a larger sample size and/or adopt objective measures of physical activity to examine the association between physical activity and executive function in healthy older adults.

CONCLUSIONS:
Few studies have assessed the relationship between cardiorespiratory fitness and event-related potential with regard to executive functioning, and thus the current findings are somewhat inconclusive.

PURPOSE: The aim of this study was to examine cardiorespiratory fitness and the effects of acute moderate aerobic exercise on executive function by comparing behavioral and electrophysiological performance in young adults.

METHODS: After using a graded maximal exercise test to measure cardiorespiratory fitness by assessing maximal oxygen uptake, twenty-eight young male adults were classified into high fitness (n=14, VO_{2max}=57.69±4.84 mL·kg^{-1}·min^{-1}) and low fitness (n=14, VO_{2max}=37.24±3.53 mL·kg^{-1}·min^{-1}) groups. Each participant performed a task switching paradigm, which included a pure task condition with a repeated single task (e.g., AAAAAA...) and a mixed-task condition with different tasks using an alternating-paradigm (e.g., AABBAAB...), before and after a 30-min session of acute exercise on a treadmill with a carefully controlled workload intensity (60% VO_{2max}) while the behavioral and electrophysiological indices were collected. A mixed-model analysis of variance (ANOVA) was used to analyze reaction time (RT), P3 latency, and P3 amplitude.

RESULTS: A smaller switching cost on RT was only shown for the high fitness group relative to the low fitness group in the post-exercise session (18.85±45.68 vs. 64.45±67.68 ms, p<.05). The P3 amplitude in the high fitness group was significantly larger in the post-exercise session compared to the pre-exercise one (8.30±5.73 vs. 6.51±5.33 μV, p<.05) in the mixed-task condition. In addition, in the post-exercise session, the P3 amplitude was significantly larger for high fitness group relative to the low fitness one (8.30±5.73 vs. 4.90±4.43 μV, p<.05).

CONCLUSION: Based on the behavioral performance results, high fitness adults demonstrated a more efficient executive function than the low fitness ones in the post-exercise session. In addition, the acute exercise used in this work improved the electrophysiological performance of the higher fitness adults when performing the task switching paradigm.

Keywords: cardiorespiratory fitness, acute exercise, executive function, task switching, event-related potential

G-45  Free Communication/Poster - Sports Equipment
JUNE 2, 2012 7:30 AM - 11:00 AM
ROOM: Exhibit Hall

3569  Board #290 June 2 8:00 AM - 9:30 AM
Practice With A Prophylactic Brace Alters Knee Flexion During a Run Stop Jump Task
Jeff Nessler, Natalie Terwilliger, Andres Lopez, Trevor Long-Anastasia, Jacob Studer. California State University, San Marcos, San Marcos, CA.

Anterior cruciate ligament (ACL) injuries are among the most prevalent in sports. Previous study has related decreased knee flexion at specific points during athletic maneuvers with increased likelihood of ACL injury, and a knee brace that promotes increased knee flexion might therefore contribute to reduced risk. Unfortunately, athletes may be hesitant to wear a prophylactic knee brace during competition. These individuals may therefore benefit from a brace that can promote motor learning such that athletes demonstrate increased knee flexion even when the brace is not worn.

PURPOSE: To determine whether one week of practice with a knee extension constraint brace can promote increased knee flexion while un-braced at the instant of greatest ground reaction force (GRF) during a run-stop-jump (RSJ) task.

METHODS: Seventeen recreationally active athletes performed 3 RSJ tasks both with and without the knee brace (6 trials total). Ten subjects then took their brace home and were instructed to use it for at least 3 hours over 3 exercise sessions throughout the following week. The remaining 7 subjects did not use the brace during the week. All subjects returned one week later and repeated the 6 RSJ tests. Data were acquired via eight camera Vicon motion capture system and two Bertec force platforms, and were analyzed using custom routines written in MATLAB.

RESULTS: When the RSJ was compared to the first for subjects who wore the brace throughout the week, knee flexion angle was increased at the instant of greatest GRF during the RSJ trials in which the brace was not worn, though this increase was not significant (34.49±13.48° vs 51.99±15.86°, p=0.109). No change in knee angle at the instant of greatest GRF was noted for the control group. Both groups demonstrated significant increases in knee flexion at the instant of touch down during the push off phase of the jump (14.5±11.62 vs. 23.46±17.01, p=0.046 for both groups combined).

CONCLUSIONS: These data suggest that a knee extension constraint brace has potential for use as a training tool in teaching athletes to avoid movements that might place them at higher risk for ACL injury. While initial results are promising, future study with additional subjects and more specific training regimens will be useful for understanding these effects in greater detail.

3570  Board #291 June 2 8:00 AM - 9:30 AM
The Effects of Ankle Support on Kinematics and Kinetics of Maximal Vertical Jumping Performance
Justus D. Ortega, James H.N. Keallilio. Humboldt State University, Arcata, CA.

Evidence suggests that ankle support such as adhesive tape and ankle braces restrict range of motion at the ankle joint. However, it is unclear how ankle support may affect functional performance.

PURPOSE: To investigate the effects of prophylactic ankle support on the kinematics and kinetics of the lower limbs during vertical jumping performance.

METHODS: Kinematic and kinetic data were collected for 12 healthy young NCAAA Division II collegiate female athletes (age 22.3±3.6 yrs, mass 65.8±9.4 kg) jumping without ankle support and with two different types prophylactic ankle supports (ankle stabilizing orthosis brace and closed Gibney basket weave ankle tape). For each of the three conditions, subjects performed three maximal height jumps with five minutes rest between each jump. For each jump, maximum center of mass (CoM) jump height was measured using a force platform. In addition, we used digital motion capture and force platform data to quantify ankle, knee, and hip joint angle, torque, and power output. We used a MANOVA to determine statistical differences due to ankle support.

(No relationships reported)
CONCLUSION: The results of this study suggest that the use of prophylactic ankle support effectively reduces excessive ankle motion without compromising jump performance.

Lower limb kinematics and kinetics during maximum height jumping

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<th>No Brace</th>
<th>ASO Brace</th>
<th>Tape</th>
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<tr>
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<td>Mean</td>
<td>SD</td>
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<tr>
<td>Peak Hip Plantarflexion (°)</td>
<td>12</td>
<td>4</td>
<td>24</td>
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<tr>
<td>Peak Knee Extension (°)</td>
<td>7</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Peak Hip Extension (°)</td>
<td>10</td>
<td>2</td>
<td>11</td>
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<tr>
<td>Peak Ankle Moment (N.m/kg)</td>
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<td>0.7</td>
<td>6.2</td>
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<tr>
<td>Peak Knee Moment (N.m/kg)</td>
<td>1.7</td>
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RESULTS: Center of mass jump height were similar between the two ankle support conditions (tape = 53.5 ± 7.1 cm and brace = 52.0 ± 7.3 cm) and the “no support” condition (51.2 ± 7.0 cm, p=0.506). However, maximal plantar flexion motion during the force phase of the jump was reduced by approximately 23% in both ankle support conditions (24° ± 6) compared to the “no-support” condition (31° ± 7; p=0.016) without affecting maximum joint torque and power generation at the ankle, knee or hip joints (Table 1).

CONCLUSION: The relationship of athletes and footwear is important to sports performance. The bones and soft-tissues of the hind foot act as a shock attenuator at foot strike and the relative bony motions within the hind foot are the subject of intense research interest for their roles in lower extremity pathology. However, there is little quantity data of the effect of footwear on the hind foot kinematics.
PURPOSE: The purpose of this study was to demonstrate the footwear effects on the hind foot kinematics during landing.

RESULTS: Abating sport-related concussion necessitates evaluation of protective headgear product claims. Research associated with the initial development of a novel inner liner technology was published in peer reviewed scientific literature. Furthermore, multiple patents have been awarded to the American football helmet manufacturer for the novel liner technology.

CONCLUSION: We obtain results for each sample of each color (15 samples for each color) for loads at 50%, 100%, 150% and 200% stretching.

CONCLUSIONS: This study suggested that footwear effect a change in the kinematics of the hind foot during landing.

3574  Board #295  June 2  8:00 AM - 9:30 AM

Wagner Martins, Rafael Souza, Juscelino Blasczyk, Michel Santos Silva, Ariel Vieira, Hugo Paulista, Ricardo Oliveira. Universidade de Brasília, Brasília, Brazil. 

METHODS: Our sample was composed by 105 ED (elastic tubes with average 7cm) of 7 different diameters (identified by different colors) with hooks at their extremities. For the test we utilized a traction machine (MTS® System Corporation, model MTS 810). To measure the elastic force, a load cell with capacity of 100kgf and sensitive of 2mN/V was connected to one extremity of the ED and the upper arm of a traction machine, and the other extremity was connected to the inferior arm of machine. To measure force and dislocation data, we used the Station Manager Software MTS 810. The dislocation speed for each ED was 5 mm/min. The room temperature was constant at 23º Celsius and 50% air relative humidity. The tests were realized at the Mechanical Engineer’s Lab (University of Brasilia). Statistical analysis was realized using average and standard deviation for each color at each stretching position.

RESULTS: We obtain results for each sample of each color (15 samples for each color) for loads at 50%, 100%, 150% and 200% stretching.

CONCLUSIONS: The traction test allowed the determination of values for LS of ED used in this study, offering a possibility of quantitative control of intensity, an important variable to manipulate the resistance training

3575  Board #296  June 2  8:00 AM - 9:30 AM
Linear Impact Energy Attenuation Of A Novel American Football Helmet Liner


METHODS: Absorbers (N=15) from three adult football helmets were impacted at predefined velocities of V1=1.3 m/s, V2=2.3 m/s, V3=3.0 m/s, V4=4.0 m/s, and V5=4.7 m/s using an instrumented drop tower. Force data were acquired via an 88 KN load cell and compression behavior was captured via high speed video at 2100 fps.

RESULTS: Mean peak compression forces, mean maximum compression height, and percent compression were: V1 (734.67 N ±30.98; 21.78 mm ±.33; 42.6%), V2 (955 N ±13.11; 13.04 mm ±.21; 67.7%), V3 (1607 N ±49.2; 10.04 mm ±.16; 76.8%), V4 (9254.67 N ±297.61; 5.01 mm ±.36; 86.8%), and V5 (15849 N ±401.43; 4.04 mm ±.05; 89.4%). A bell-shaped curve was observed at V1, while V2 and V3 exhibited trapezoidal behavior. V4 and V5 curves exhibited an initial trapezoidal region followed by a leptokurtic region.

CONCLUSIONS: Impulsive forces appear to be ideally managed up to a V3 threshold, whereas reported velocities associated with on-field outer shell impacts exceed 7.0 m/sec. Thus, focal outer shell impacts should be investigated to examine the degree to which velocity is diminished prior to line load transfer and the extent adjacent absorbers participate. Additionally, the leptokurtic region of the V4 and V5 curves indicates a third phase that may be defined as densification as demonstrated by the compression approaching 90%. Further investigation into physical, mechanical, and thermal characteristics of shock absorber constituent materials is warranted to potentially provide higher levels of prevention of sport-related concussion.

3576  Board #297  June 2  8:00 AM - 9:30 AM
Evaluation Of Novel Football Helmet Liner Claims

Andrew P. Janisse, Nadine M. Lippa, James T. Goetz, David E. Krzeminski, Trenton E. Gould, James W. Rawlins, Scott G. Pliland. University of Southern Mississippi, Hattiesburg, MS. (Sponsor: Michael J. Webster, FACSM) 

METHODS: Absorbers (N=18) were randomly assigned into two groups: foam pad intact (n=9) and removed (n=9). Absorber attenuation and durability were assessed across three impact velocities (V1=1.3 m/s, V2=3.0 m/s, V3=4.0 m/s) via 15 impacts at one minute intervals. Force data were obtained using an instrumented drop tower. For each impact velocity, a 2 (Condition: pad, no pad) X 15 (Trials: impacts 1-15) mixed model repeated measures ANOVA was conducted.

RESULTS: No interaction or main effects were observed for peak compression force at V1. However, between, within and interaction effects were found at V2 (F(1,4)=70.51, p=.001, f=4.36; F(1,56)=32.13, p=.001, f=2.84; and F(14,56)=17.75, p=.001, f=2.06, respectively). V3 elicited both a between (F(1,4)=213.43, p=.001, f=7.00) and within (F(14,56)=18.01, p=.001, f=2.13) effect, but no interaction effect.

CONCLUSIONS: No improvement in damping or durability was provided with foam pad at V1. Absorber force attenuation degraded over multiple impacts at V2 and V3. The foam pad improved force attenuation and absorber durability at V2, but this protective effect diminished at V3. Findings provide velocity-specific support for the novel helmet liner claims.

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A Comparison of Three Brands of Knee Wrap on Peak Knee Torque
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PURPOSE: The purpose of this study was to determine if there were statistically significant differences in the effects of three commonly used brands of knee wrap (EFS, Inzer Gripper, and Titan RPM) on peak knee torque among highly strength trained collegiate athletes.

METHODS: Eight healthy male, highly strength trained competitive collegiate athletes, ranging in age from 19-22, were utilized in this study. A CSMI Humac Norm isokinetic extremity testing system was used to evaluate peak torque during continuous passive movement isokinetic leg extension with knees (a) unwrapped and (b) wrapped (utilizing each of the three brands of knee wrap). The “crossed” taping method was utilized in this study. Paired samples t-tests were used to determine if there were statistically significant differences between the “wrapped” and “unwrapped” conditions. One-way analysis of variance was then used to determine if there were statistically significant differences in peak torque among the three knee wrap brands during the testing conditions. Alpha levels were set a priori at 0.05 to determine statistical significance.

RESULTS: There were no significant differences among EFS, Inzer Gripper, and Titan RPM knee wrap brands with respect to peak isokinetic knee torque.

CONCLUSIONS: The data from this study indicate that the use of knee wraps, regardless of brand, significantly improve peak knee torque among highly strength trained male collegiate athletes. The data also indicate that there are no significant differences among EFS, Inzer Gripper, and Titan RPM knee wrap brands with respect to peak isokinetic knee torque.

Effects of Chainring Design on 1km Time Trial Performance Over Six Weeks in Competitive Cyclists and Triathletes
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PURPOSE: The purpose of this study was to examine the effects of chainring type (circular vs. the non-circular Rotor Q-Ring) on performance during a 1km time trial and physiological responses over a six week period.

METHODS: Eight competitive male cyclists and triathletes were pre-tested using the original circular chainring. Graded submaximal exercise tests were followed by the 1km time trial with subjects using their own racing bicycle. The circular chainrings were then removed and replaced with Rotor Q-Rings during the intervention period. Subjects trained and raced with this alteration to their bicycles and repeated the submaximal and 1km performance tests for the next four weeks. Post-testing occurred with the original circular chainrings for the final week of testing. Oxygen consumption, carbon dioxide output, heart rate, ventilation, respiratory exchange ratio, and perceived exertion were continuously measured during the submaximal tests. Blood lactate concentration was measured during the last 30 s of each three minute stage.

RESULTS: The main findings were: Significant increases in performance in the 1km time trial with Rotor Q-Rings compared to circular chainrings. Subjects completed the time trial on average 1.6 seconds faster (p < 0.05), increased average speed approximately 0.7 kph (p < 0.05), and increased average power approximately 26 watts (p < 0.05). Furthermore, these performance measures were consistent during the four weeks employing the Rotor Q-Rings. Post-test performance levels returned to initial values during week 1 pre-testing with the circular chainrings.

CONCLUSION: It appears from this study that cycling with the Rotor Q-Ring offers an ergogenic effect that is apparent after only one week of exposure and that long term physiological adaptations are not required. It appears that the co-ordinate structure employed during cycling is well adapted to this alteration in the bicycle drivetrain.
CONCLUSIONS: Results from this study showed that instrumented MGs can accurately measure head impacts. Utilization of this device will provide further characterization of linear and rotational biomechanics of head impacts in helmeted and non-helmeted sports, with future studies allowing for stronger understanding of possible thresholds and mechanisms of traumatic brain injury.

3581  Board #302  June 2  8:00 AM - 9:30 AM
Effects Of A Soccer Specific Warm-up And A Competitive Match On Knee Proprioception
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(No relationships reported)
Changes in skeletal muscle function induced by pre-participation warm-up and prolonged fatiguing exercise might lead to alterations of proprioception, namely knee joint position sense.

PURPOSE: To assess the effect of pre-participation warm-up and fatigue induced by an official soccer match on knee joint position sense of soccer players.

METHODS: Fourteen healthy adult male soccer players (age: 25.9 ± 4.6 years old) were assessed for rate of perceived exertion and knee joint position sense at rest, immediately after a standard warm-up (duration 25 min), and immediately after a competitive soccer match (90 minutes duration). The evaluation of rate of perceived exertion was performed using Borg's rating of perceived exertion scale (scale of 6 to 20 points). Subjects were considered to be fatigued if they reported an RPE of 15 or above. Knee joint position sense of the dominant limb was evaluated by ipsilateral active limb matching responses of a passively determined position, without visual input, in open kinetic chain.

RESULTS: Perceived exertion increased significantly from rest to the other assessments (rest: 8.6 ± 2.0; after warm-up: 12.1 ± 2.1; after soccer match: 18.5±1.3; p<0.001). Compared to rest, after the warm-up, absolute angular error decreased significantly (4.1 ± 2.0° vs 2.0 ± 1.0°; p<0.05). After the match, absolute angular error (8.7 ± 3.8°) increased significantly comparatively to both rest and the end of warm-up (p<0.05). The relative error showed directional bias with underestimation of the test position.

CONCLUSIONS: Joint position sense acuity was increased by pre-participation warm-up exercise and decreased by soccer match induced fatigue.