Review on Therapeutic Potential of Phytochemicals from Medicinal Plants

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Nature has provided plants with a vast range of phytochemicals. These phytochemicals are enriched with different pharmacological activities. These pharmacological activities have a potential to be wisely used for therapeutic purpose. It can be utilized in so many ways for the expansion of therapeutic strategies. With the advancement in the field of medicine and due to increasing side effects of synthetic medicines there emerges a need to discover novel therapeutic remedies. Medicinal plants serve as the best source for the manufacture of new remedies for many diseases. Medicinal plants bear a potential towards treating incurable chronic diseases. The aim of this review is to provide a therapeutic potential of individual phytochemical of different medicinal plants so that it can be further studied, researched and used for manufacturing medicines with lesser side effects and better therapeutic potential.

**Keywords:** Medicinal plants, phytochemicals, therapeutic potential, pharmacological synthetic medicines.

**Graphical Abstract**
INTRODUCTION

Medicinal plants are gaining popularity by virtue of their therapeutic potential. Several therapeutic remedies are acquired through plants and the significance of medicinal plants has expanded in recent years (Aye et al., 2019). Since ancient times, remedial plants are used in medicines. Many drugs such as antitumor, antimicrobial and anti-hepatotoxic compounds are made with the aid of therapeutic plants. Lesser complications have been observed from the use of pharmaceutical drugs derived from medicinal plants (Howes et al., 2020). These phytomedicines are cheap, secure, efficient and feasible. Compounds of folk medicines are acquired through therapeutic plants. Folk medicines are used by 80% population of developed countries. The properties and effectiveness of plants should be explored properly for better use of them (Yadav and Agarwala, 2011). Indian system of medicines is also based on therapeutic plants. Modern allopathic drugs are not as safe to use as compared to phytomedicines. Health-related problems of the global populace are cured by phytomedicines as stated by the world health organization (Balyan, et al., 2021). Therapeutic plants are a bucket of natural products which are safe to use.

Importance of Medicinal Plants

Therapeutic plants play an essential part in providing fitness to people mainly rustic people and eighty percent of the world’s borderline population also uses them for health maintenance. The abundance of uses of aromatic plants in households also indicates their significance. Since the beginning of time, many traditional medicines were made through these therapeutic plants. Manhood got new therapies to use these medicinal plants. The intricate chemical compounds are difficult to access for the innovation of new drugs, these therapeutic plants having many varieties provide purified components in addition to natural products for new drug formulation. Due to a lack of trace elements, uneven body growth takes place. Herbs play a major role by providing us with alimentary and trace elements. Chemicals having medicinal value are also gained through therapeutic plants. Each one has an essential role when a deficiency occurs in the body (Evanjelene and Velu 2021). Few of important medicinal with their therapeutic potential are mentioned in Table 4.

The present review will help in enabling us to add new information to existing knowledge about the cost-effective treatment of different ailments with medicinal plants.

Phytochemicals

The biochemicals in the plant are called phytochemicals (Figure 1) which got their name from the Greek word Phyto (Plant). The growth of plants and safety from pathogens and predators is due to the presence of these phytochemicals. Many pharmacological properties are present in phytochemicals but they are not considered important diet components and are not required for survival (Thakur and Sharma, 2018).

Bioactive agents present in the therapeutic plants provide health care defense to the human body and these include carbohydrates, flavonoids, steroids, tannins, alkaloids and terpenoids. These are produced in plants by both primary and secondary metabolic procedures (Jan et al., 2021) (Figure 2). Primary and secondary metabolites are obtained through plants in the form of compounds that have a long-lasting positive effect on one’s health and also assist to cure ailments meritoriously. Especially, the tonic role in human beings is played by secondary compounds as they are produced in abundance by plants (Fardiyah et al., 2020).

Secondary compounds are both chemically and taxonomically diverse metabolites. From the beginning, many phytomedicines are produced through plant compounds. Plant
constituents are derived from aerial and floral parts of plants including leaves, roots, barks, fruits, and seeds. For the preparation of intricate chemical compounds, righteous information about chemical agents in plants is required (Yadav and Agarwala, 2011). Safety, therapeutic usage, efficiency, quality control, dosing, clinical trials, toxicity characteristics of plant species, and drug interactions are all essential parts of scientific information (Balyan et al., 2021).

![Pie chart representing phytochemicals](image)

**Figure 1: Pie chart representing phytochemicals (Thakur and Sharma, 2018).**

*Therapeutic Potential of Phytochemicals from Plants*

Both in recent and conventional point of view therapeutic plants play a major role in medicines. The plants are used in medicines due to the presence of alkaloids, phenols, tannins and flavonoids (phytochemical agents). For the treatment of illnesses and care for human health, many chemicals are obtained from plants that are nonnutritive bioactive compounds known as phytochemicals. Phytochemicals are beneficial in the control of ailments and provide a defensive mechanism to herbs along with imparting color and characteristic odor to the plants. A phytochemical analysis is essential for the regular use of therapeutic plants (Deora and Bano, 2019). Several phytochemicals are present in diets help to protect the innate system from oxidative damage and also provide defense against long-lasting diseases (Sharma et al., 2019).

Secondary metabolites are used in many fields such as in medicine, plant pathology, scientific research, and many others. In vitro studies exposed the inhibitory action of a large number of biological agents belonging to many chemical classes on all types of microbes. These secondary elements are very important as more than thirty percent of the whole plant or entire species of them are used for therapeutic drives (Ashu and Naidoo, 2015).

**Flavonoids**

Less systemic toxicity is caused by flavonoids which are a major group of bioactive substances. Many compounds such as flavanones, flavones, and flavonols of class flavonoids belong to common secondary metabolites present in different types of vegetables, fruits, and other therapeutic plants. Anesthetic and strong antioxidant properties are shown by these compounds (Adamczak, et al., 2019). Foods obtained from plant origin have flavonoids (dietary polyphenols) and phenolic acids which are expended in large quantities. These have a major role in the curing of prolonged and degenerative ailments besides many other positive
effects (Mileo, et al., 2019). Many other activities such as anti-diabetic, antitumor, anti-proliferative, and immune stimulatory activities along with anesthetic and antioxidant properties are revealed by these (Kumar et al., 2019). *Waronia saharae* is a plant that is very much rich in containing flavonoids. It is used for its anti-diabetic potential (Ajebli and Eddouks, 2019). A number of other medicinal plants containing flavonoids with their therapeutic role are mentioned in Table 1. Biologically micro and macronutrients are high as likened to dietary polyphenols. 5-10% of dietary polyphenols are immersed in the small intestine. The pathogenic intestinal microflora is controlled by phytochemicals acting as prebiotics revealing antimicrobial properties. It is also stated in recent data that flavonoids have a role in wound healing and also have defensive potential against cutaneous inflaming reactions (Chuang et al., 2017).

<table>
<thead>
<tr>
<th>Flavonoids</th>
<th>Plant source</th>
<th>Medicinal use</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hesperedin</td>
<td>Legume, birch, lip flower</td>
<td>Anticancer activity</td>
<td>Chen et al., 2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Antibacterial, anti-inflammatory</td>
<td>Devi et al., 2015</td>
</tr>
<tr>
<td>Aurone</td>
<td><em>Antirrhinum majus</em></td>
<td>Anticancer agent</td>
<td>Alsayari et al., 2019</td>
</tr>
<tr>
<td>Quercetin</td>
<td>Berries, Green tea, and Grains</td>
<td>Colorectal cancer</td>
<td>Rauf et al., 2018</td>
</tr>
<tr>
<td>Myricetin</td>
<td>Various fruit, vegetables, tea,</td>
<td>Anti inflammatory anticancer</td>
<td>Devi et al., 2015</td>
</tr>
<tr>
<td></td>
<td>berries and red wine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sacriflavone A</td>
<td><em>Artemisia sacrorum</em></td>
<td>Antifungal potency</td>
<td>Peralta et al., 2015</td>
</tr>
<tr>
<td>Sacriflavone B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baicalin</td>
<td><em>Scutellaria baicalensis</em></td>
<td>Antidiabetic efficacy, Antimicrobial</td>
<td>Shi et al., 2016</td>
</tr>
<tr>
<td>Anthocyanins</td>
<td>Berry fruits</td>
<td>Antiviral</td>
<td>Akinmusi et al., 2022</td>
</tr>
</tbody>
</table>

**Terpenoids**

Perennial plants produce a major group of chemicals known as terpenoids. Thousands of terpenoids have been isolated so far (Pichersky and Raguso, 2018). Terpenoids are classified into monoterpenoids, hemiterpenoids and sesquiterpenoids and many others based on a number of their isoprene units. Terpenoids down regulate cytokine expression, reduce tissue loss and act as antioxidants. Infection is repressed by terpenoids by some mechanism (Hossen et al., 2022). Few terpenoids with therapeutic role are mentioned in Table 2.

**Quinones**

As a result of secondary metabolism in plants, quinones are produced. Based on several benzene rings, quinones are divided into 4 types namely benzoquinone, naphthoquinone, anthraquinone and phenanththrenequinone. The initiation of inflammatory mediators is obstructed by quinones. Cytokine expression is slowed down, oxidation is suppressed and inflammation is reduced by quinones (Hossen et al., 2022).

<table>
<thead>
<tr>
<th>Terpenes</th>
<th>Plant Source</th>
<th>Action</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artemisinin</td>
<td><em>Artemisia annua</em></td>
<td>malaria</td>
<td>Bertea et al., 2005</td>
</tr>
<tr>
<td>Thapsigargin</td>
<td><em>Thapsia garganica</em></td>
<td>Rheumatism, sterility, and cold</td>
<td>Andersen et al., 2015</td>
</tr>
<tr>
<td>Paclitaxel</td>
<td><em>Taxus brevifolia</em></td>
<td>Antineoplastic</td>
<td>Zhu and Chen, 2019</td>
</tr>
<tr>
<td>Mipsagargin</td>
<td><em>Thapsia garganica</em></td>
<td>Anticancer</td>
<td>Mahalingam et al., 2019</td>
</tr>
</tbody>
</table>
Thymoquinone, a 1,4-benzoquinone isolated from *Nigella sativa* have shown to exhibit antiproliferative, anti-inflammatory and antimalarial activities (Patel et al., 2021). Dunione 44 is a 1,2-napthoquinone-based natural product isolated from the leaves of *Streptocarpus dunnii* (Gesneriaceae) and used as a substrate for quinone-reductases that may be associated with its antimalarial properties (Bian et al., 2015). Bioactive quinones are tried to develop through different strategies with a potential to treat leishmaniasis, Chagas disease and cancer (da Silva Júnior et al., 2019). Quinones are very important phytochemicals for metabolic processes. Metabolic processes include the transfer of electrons in the Mitochondria through the respiratory chain in the process of respiration and photosynthesis (Radhia et al., 2018).

**Alkaloids**

Alkaloids are the very important constituent of plants with many therapeutic roles. The first alkaloid that was isolated was Morphine. It was isolated from poppy plant. It is used for the treatment of sleeping disorders and pain relieve.

<table>
<thead>
<tr>
<th>Alkaloid</th>
<th>Year of discovery</th>
<th>Plant of origin</th>
<th>Common name</th>
<th>Medicinal use</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>1803</td>
<td><em>Papaver somniferum</em></td>
<td>Poppy plant</td>
<td>Analgesic</td>
<td>Reiss et al., 2022</td>
</tr>
<tr>
<td>Emetine</td>
<td>1817</td>
<td><em>Carapichea ipecacuanha</em></td>
<td>Ipecac</td>
<td>Amebiasis</td>
<td>Sohrab et al., 2021</td>
</tr>
<tr>
<td>Nicotine</td>
<td>1828</td>
<td><em>Nicotiana tabacum</em></td>
<td>Tobacco</td>
<td>Antioxidant, Anxiolytic</td>
<td>Boiangiu et al., 2021</td>
</tr>
<tr>
<td>Colchicine</td>
<td>1820</td>
<td><em>Colchicum autumnale</em></td>
<td>Meadow saffron</td>
<td>Gout</td>
<td>Pascart and Richette, 2018</td>
</tr>
<tr>
<td>Quinine</td>
<td>1820</td>
<td><em>Cinchona officinalis</em></td>
<td>Peruvian bark</td>
<td>Malaria</td>
<td>Cumming and Goldring, 2019</td>
</tr>
<tr>
<td>Caffeine</td>
<td>1819</td>
<td><em>Coffee arabica</em> and <em>Coffee canephora</em></td>
<td>Coffee</td>
<td>Parkinson's disease, gallstones, diabetes etc</td>
<td>Mudgil, Barak, and Khatkar</td>
</tr>
<tr>
<td>Brucine</td>
<td>1819</td>
<td><em>Strychnos nux-vomica</em></td>
<td>Kucha, poison nut</td>
<td>anti-inflammatory and analgesic</td>
<td>Abdallah et al., 2021</td>
</tr>
<tr>
<td>Piperine</td>
<td>1819</td>
<td><em>Piper nigrum</em></td>
<td>Black pepper</td>
<td>Cancer, GIT disorders and neurological diseases</td>
<td>Tripathi, et al., 2022</td>
</tr>
</tbody>
</table>

After that several other alkaloids were also identified, isolated and used. These include vincristine, vinblastine, atropine, brucine, colchicine etc. alkaloids are of great therapeutic importance, mentioned in Table 3 and they have proved their action in many researches. The high content of ammonia is present in the alkaloids which are the largest group of secondary chemical constituents. Amino acid building blocks synthesized the contents of nitrogen bases present in alkaloids. In a peptide ring, one or more hydrogen atoms are replaced with various radicals. Most of the peptide ring is occupied by an Oxygen atom. Nitrogenous compounds play role in guarding plants against herbivores and pathogens. They are widely used as poisons, pharmaceuticals, narcotics and stimulants due to their strong biological activities. From a pharmacological view, alkaloids are used in the preparation of Central nervous system stimulants and anesthetics. For medicinal purposes, alkaloids are exploited very low although they are more than 12,000 residing in 20 % of plant species (Mousavi et al., 2018).
**Carbohydrates**

In the normal diet of humans, carbohydrates are the major constituents. 70-80% of energy in one’s body is supplied by starch and sucrose which are major forms of carbohydrates. In the mouth, these are digested first and then lead to the small intestine where carbohydrates are converted into (Glucose 6 carbon compound). Through intestinal walls, glucose is absorbed into the blood. Transporting glucose as a source of energy to different body parts occurs through the liver. Fructose and galactose are digested less in amount than glucose. Disaccharides and oligosaccharides are cleaved into glucose by the aid of alpha-glucosidase membrane-bound enzyme present in the epithelium of the small intestine. For the treatment of diabetes, it is necessary to inhibit the working of alpha-glucosidase so that the absorption rate of glucose is decreased. Phytoconstituents help to suppress the working of alpha-glucosidase. When working is suppressed then glucose absorption in the kidney and small intestine automatically, stops. In this way, after intake of a meal glucose concentration remains constant in the blood and diabetes is treated (Bharti et al., 2018).

**Non-Digestible Carbohydrates**

From plants complicated, heterogenous dietary substances are derived which are known as nondigestible carbohydrates. Non-starch polysaccharides, non-digestible oligosaccharides and resistant starch are the 3 types of Non-digestible carbohydrates. Improper intake of nondigestible carbohydrates most often causes stomach disorders and colorectal cancer. These are considered essential constituents of food (Mousavi et al., 2018).

**Therapeutic Activities of Medicinal Plants**

Chronic diseases of people living in emerging countries are treated with aid of drugs having plant origins. It is documented that bacteria have developed resistance against many antibiotics such as Erythromycin, penicillin and cephalosporin, tetracycline, metronidazole and their derivatives which are used to treat oral contagions. Many side effects like tooth diseases, nausea, and gastrointestinal infection take place due to changes in oral microbiota as a result of the usage of medicines (Palombo, 2011).
Table 4: Medicinal plants with therapeutic potential

<table>
<thead>
<tr>
<th>Sr no.</th>
<th>Botanical name</th>
<th>Common name</th>
<th>Part used</th>
<th>Curing diseases</th>
<th>Antimicrobial activities</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Psidium guajava</em></td>
<td>Guava</td>
<td>Leaves</td>
<td>Toothache, coughs, sore throat and inflamed gums</td>
<td>Antibacterial and antifungal</td>
<td>Adamu, 2021</td>
</tr>
<tr>
<td>2.</td>
<td><em>Syzygium cumini</em></td>
<td>Jambolana</td>
<td>Leaves</td>
<td>used for treating diabetes mellitus complication</td>
<td>Antibacterial and antifungal</td>
<td>Kauthkar, et al., 2020</td>
</tr>
<tr>
<td>3.</td>
<td><em>Moringa oleifera</em></td>
<td>Horseradish tree</td>
<td>Leaves</td>
<td>Diarrhea, stomach disorder, acne and jaundice</td>
<td>Antibacterial and antifungal</td>
<td>Sen &amp; Behera, 2019</td>
</tr>
<tr>
<td>4.</td>
<td><em>Azadirachta indica</em></td>
<td>Neem</td>
<td>Leaves</td>
<td>Treat inflammations, infections, fever, skin diseases, and dental problems</td>
<td>Anti-bacterial and anti-fungal</td>
<td>Altayb, et al., 2022</td>
</tr>
<tr>
<td>5.</td>
<td><em>Aloe barbadensis</em></td>
<td>Aloe vera</td>
<td>Gel</td>
<td>Stimulation of synthesis and/or release of insulin from pancreatic beta cells in diabetes mellitus</td>
<td>Anti-bacterial, antifungal and antiviral</td>
<td>Kumar et al., 2020</td>
</tr>
</tbody>
</table>

**Anti-Cancer activity**

Cancer is a condition of uncontrolled growth of cells. Due to uncontrolled growth these cells become abnormal and don’t perform their proper activity and lead towards different derangements in the body. Although there are several treatment modalities that are available now a days for cancer but there is a need for the novel treatment strategy. It can be obtained from the phytochemicals derived from medicinal plants. Several plants have proved their anticancer and antitumor properties (Iqbal et al., 2017). These plants include *Catharanthus roseus*, *Taxus brevifolia* have proved anticancer properties. Vincristine, Catharanthus and Tricyclic diterpenoids from *Taxus brevifolia* are the active phytochemicals that have been studied and used for the treatment of various cancers with successful results. Similarly several other plants also possess anti-cancerous properties like Casticin from *Vitex trifolia*, Isoliquiritigenin from *Spatholobus suberectus*, Psoralidin from *Psoralea corylifolia* all have potential antitumor activities (Majolo et al., 2019).

**Anti-Hypertensive activity**

Hypertension is becoming a global problem. About one third of the whole world population is facing this problem. There are several causes of this problem. The risk factors may be changed in different countries. The overall causes include high intake of cholesterol, decreased physical activity, sedentary life style, poor eating habits and the genetic factors. There are many medicines that are used by the people for its treatment (Valenzuela et al., 2021). These medicines are also associated with some side effects. There is a need for an alternative way of treatment of hypertension, to control this continuously expanding disease. Medicinal plants serve as the best choice for treating these types of chronic ailments. *Allium sativum*, *Cannabis sativa*, *Ajuga integrifolia*, *Tribulus terrestris* are very famous for their antihypertensive potential. *Citrus aurantifolia*, *Ficus palmata*, *Senna tora*, *Teucrium roglanom*, *Valeriana officinalis*, *Ziziphus mauritiana* have also reported antihypertensive activities (Malik et al., 2018).
**Antibacterial Activity**

Artificial products are considered unsafe for the health of human beings as well as for the surroundings as compared to therapeutic products. Antimicrobial resistance can easily develop against antimicrobial commonly used medicines (Bibi et al., 2023). Therefore it is best to deal patients suffering from teething troubles are by traditional naturopaths and dwellers suffering from a toothache are also cured by traditional shamans in the region of Tanga in Tanzania. Dental problems are treated with aid of home-grown plants (Agbor and Azodo, 2011). Therapeutic herbs are very important mainly in healthcare because they are having antibiotic properties as well as anti-inflammatory properties and are used to treat varieties of oral ailments. Many curative properties are present in secondary compounds of herbs and due to these curative properties, therapeutic herbs are used for eras for the treatment of many diseases (Ashu Agbor and Naidoo, 2015).

Control of dental problems such as toothache is treated by many therapeutic plants. Traditional well-being practices are used to cure ten different oral infections such as tooth staining, abscess of the mouth, tooth degeneration, enlarged tonsil, gingivitis, oral thrush, angular stomatitis, black tongue and ulcerative gingivitis. The medicinal plant *Psidium guajava* is used in the preparation of several medicines. *P. guajava* greeneries and bay has extensive antiquity to be used for remedial purposes, leaves and barks are still used for medicinal uses. When the plant is used ethnomedicinal the leaves are first creased and then the extract of leaves is applied to bruises, sores, epidermal layer, and fleshy tissue present on the site of infection. The leaves of *P. guajava* are photochemically used to treat diarrhea and breathing disturbances and are also used as medicine to treat inflammation. Leaves of *P. guajava* are used in the United States of America as an antibiotic in the shape of plaster or decoction for bruises, boils and tooth pains. The extract of the leaf has anticestodal, anti-inflammation, antimicrobial, anesthetics, hepatoprotective and free oxygen scavenging properties. *P. guajava* has flavonoids that expressed great antiseptic commotion as it is one of the phytoconstituents present in the aqueous extract of its leaves. Tooth aching is cured through *P. guajava* as this therapeutic plant is having palliatives, anti-inflammatory, and antimicrobial possessions (Kafle et al., 2018).

**Anti Cholesterolemnic Activity**

Interaction between numerous genetic factors, dietary factors, surroundings, and ways of living causes a complex disorder known as obesity. Obesity or heaviness has become a major problem all over the world. Locomotory ailment, diabetes and heart disease are linked with obesity. Obesity has a major impact on the social, financial and psychological status of individual these all causes depression. Anti-obesity effects can be decreased by the use of a combination of polyherbal that acts on multiple target sites. Therapeutic herbs are not only used for treating obesity but have other benefits too (Saad et al., 2022). More than 50% of patients are obese in the United States of America, China and India 3 countries of the world. Many diseases are linked with obesity. Obesity in combination with atherosclerosis causes severe pathological conditions for example cancer in the bowel, stone in the gall bladder, infection in the liver, gut ailments, and many others. For the prevention and counteraction of these diseases management of obesity prove to be beneficial. Respective hormones of adipose tissue, stomach and pancreas are secreted in the presence of dopamine. Abnormality in hormones leads to obesity while normal working of hormones maintains the hunger, satiety and fat of the body (Yeung and Tadi, 2020).

For the management of obesity and other abnormalities associated with it, herbs and their products prove to be an effective strategy. Of the 7.5 billion populace of the world, obese people were about 0.774 billion, out of which 1.9 million were overweight. In 2016, in

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less than 5 years 41 million kids and more than 5 years 340 million kids were obese or overweight (Emmanuel and Didier, 2012). All these factors and their working play an important role in the production of new anti-obesity agents. Leaves of remedial plants have much remedial potential to treat obesity, while fruits, roots, and seeds have a less therapeutic role (Saad et al., 2022).

**Anti-diabetic Activity**

Any abnormality in the production of secretion of insulin enzyme by pancreatic islets is the primary reason for diabetes mellitus which is the collective name of metabolic defects. Diabetes mellitus is caused due to increase in the sugar level of a blood condition known as hyperglycemia. A group of abnormalities occurs when insulin action/function decreased on target tissues. Many metabolic anomalies are established due to diabetes mellitus. Oxidative pressure is a staple abnormality among other metabolic anomalies. Due to oxidative pressure, in the cells and tissues of diabetic patients reactive oxygen species proliferate in amount this is revealed by many biochemical studies (Rehman et al., 2018). According to an inhibition, a study link has proven the relieving effect of *P. guajava* leaf extract on the postprandial hyperglycemia and glycosidases of the intestine (Kafle et al., 2018b). *Aloe barbadensis* is a common potted plant having an extensive history as it is having multiuse traditional remedies. Gel and sap are the two elementary parts of *Aloe barbadensis*. Production and discharge of insulin from pancreatic beta cells is the nasty principle of *Aloe barbadensis* (N. Deora et al., 2021).

**Antioxidant Activity**

Oxidative stress in plants is caused due to extreme weather conditions like temperature, shortage of water, deficiency in nutrients, high salt concentration and increase in reactive oxygen species. Cells have enzymatic and co-enzymatic elements present in a complex antioxidant system which help to avoid oxidative stress. Different mechanisms are performed by molecules of a non-enzymatic system. These mechanisms involved enzyme inhibition, free radicals production by chelation of trace elements, and uptake and activation of reactive oxygen species occur through antioxidant defenses present in the cell. For the quantification of antioxidant activity, methods are classified based on the mechanism of action by which applied compounds stop chain-breaking reactions (Chaves et al., 2020).

![Figure 3: Antioxidation process](image_url)
When the content of antioxidants is less than the content of reactive nitrogen species and reactive oxygen species then oxidative stress takes place. For reducing oxidative stress antioxidant intake is considered very important. Various mechanisms: protection of DNA damage, the activity of enzymes, and scavenging of free radicals are important to identify for the measuring of activity antioxidants (Kim et al., 2020). An increase in reactive oxygen species causes oxidative stress which is the primary reason for diabetes. For reducing intestinal absorption of glucose and maintenance of glucose levels by an increase in the working of the pancreatic cell for the secretion of insulin enzyme, plants proved to be beneficial as plants are natural antioxidants. Phyto compounds such as flavonoids, alkaloids, tannins and phenolics are antidiabetic constituents present in the plants. About 25% of drugs are made through plants naturally or synthetically (Shoaib et al., 2021).

CONCLUSION

Medicinal plants are rich in phytochemicals. These phytochemicals possess a broad range of medicinal properties that can be utilized for therapeutic purposes. Several research studies have confirmed their role in the treatment of number of diseases. A lot more research is still required in this field to elaborate and rule out novel phytochemicals and their therapeutic uses. It will help further to better utilize the medicinal plants in the field of medicine with lesser side effect and greater potential.

CONFLICT OF INTEREST STATEMENT

The authors declare there is no conflict of interest.

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AUTHORS’ CONTRIBUTIONS

Iqra Afzal prepared draft of manuscript; Ume Habiba, prepared and reviewed draft of manuscript; Humaira Yasmeen conceptualized, supervised and reviewed the final draft.

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