

PHARMACOLOGICAL PROPERTIES OF MEDICINAL PLANTS

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Abstract

Plants have been medicine for generations. Indian, Egyptian, Chinese, Greek, and Roman medicine utilized plants. Pharmacognosy the study of plant-derived drugs—may lead to novel drug development. Herbs, spices, microbes, and other natural resources are being discovered, extracted, and screened worldwide. Phytochemicals natural bioactive molecules produced from plant parts control biological activity. This article discusses medicinal plants' pharmacological properties and herbal medicines' pros and cons. Pharmaceutical components have traditionally come from plants. Phytochemicals provide them medicinal properties. Plants will continue to be used as medicine and raw materials for the food, cosmetics, and fragrance sectors.

Keywords: Medicinal plants, Pharmacognosy, Phytochemicals, Biological activities

Introduction

Since ancient times, people everywhere have employed plants for basic preventive and curative healthcare. Sickness-fighting herbs have been sought by humans. Pharmaceutical

components have traditionally come from plants. Ancient texts like the Atharva veda, Charaka, Sushruta, and others provide preventive and curative treatments. The Rigveda praises flora extensively. 4000 B.C. Chinese descriptions of medicinal plants. Ancient Greeks and Egyptians used plants as medicine. In "*Historia deplantarum*," Aristotle and Theophrastus (380 BCE) discussed medicinal plants. One estimate puts the number of medicinal plant species at 13,000 [1]. According to the WHO, 4.3 billion people, or 80% of the world's population, use conventional plant-based medical systems for primary care [2]. Medicine men and tribal shamans utilize medicinal herbs, while homemakers use them. Ayurveda, Chinese, and Kampo use medicinal plants. Novel drugs need medicinal plants. Between 1950 and 1970, nearly 100 plant-based drugs entered the US market. They included deserpidine, reseinnamine, reserpine, vinblastine, and vincristine. Ectoposide, E- and Z-guggulsterone, teniposide, nabilone, plaunotol, lectinan, artemisinin, and ginkgolides were among the novel drugs discovered between 1971 and 1990. Paciltaxel, toptecan, gomishin, irinotecan, and others launched 2% of medications between 1991 and 1995. Plants and their products can cure cancer, modulate the immune system, stimulate the neurological system, act as an antipyretic and analgesic, protect the liver, and fight diabetes. Researchers have begun to link a plant's phytochemical components to its pharmacological action and botanical characteristics to its plant. Future multidimensional research will correlate botanical and phytochemical features to pharmacological activity. Plant compounds with central nervous system, cytoprotective, immunomodulatory, and chemotherapeutic effects have received more attention. Plant research on the autonomic nerve system and reproductive control has also declined.

India uses a natural herbal medicine system

Herbal treatment is gaining popularity and scientific and practical support. Herbal medicines are complex combinations of components from one plant or many plants that can have synergistic effects, boosting their medicinal potential. Quality control requires identifying a drug's biologically active constituent. Accurate identification and quality assessment of herbal medicine are essential to its safety and efficacy. The photochemical components of a herbal preparation determine its therapeutic effect. It is crucial to do photochemical research

on medicinally significant plants because it will improve the effectiveness, standardization, and quality evaluation of herbal medicines. In order to identify, validate, and standardize medicinal plants, pharmacognosy is therefore regarded as a key technique in plant science [3, 4].

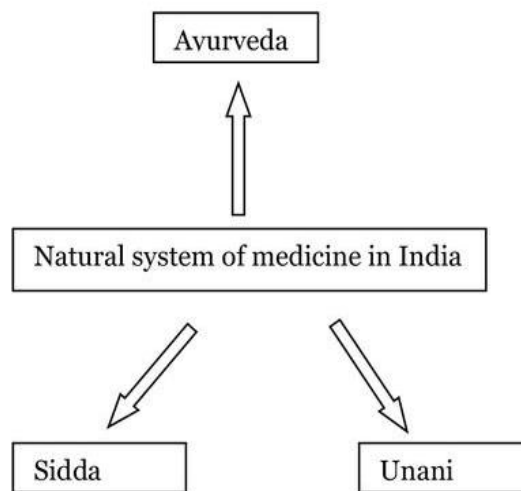


Fig: 1 Natural system of herbal medicine used in India

Plant bio prospecting for drugs

Prospecting for biodiversity or bio prospecting for medicinal plants is a global practice right now. The process of exploring, extracting, and screening biological variety as well as local knowledge in search of genetic and biochemical resources with high economic value is known as biodiversity prospecting. Bio prospecting initially largely concentrated on the plants from the forest habitat. Insects, algae, and bacteria have been researched successfully [5]. Recently, cutting-edge technology has been used to develop new pharmaceuticals, agrochemicals, cosmetics, and other biological variety byproducts [6]. With cutting-edge technology and advanced methods and tools, bio prospecting has become a viable approach for studying metabolic response, genetic change, and new medication development. Pharmacological effects of several bioactive substances have been explored [7].

Pharmacy of therapeutic plants

Schmidt coined "pharmacognosy" in 1811. Crude drugs are dry, unprocessed plant, animal, or mineral substances used as medicines. Pharmacognosy comes from the Greek words pharmakon, meaning drug, and gnosis, meaning knowledge. Pharmacognosy, the study of plant-derived medications, may lead to new drug development. Plants produce bioactive phytochemicals. Sugar, proteins, amino acids, chlorophyll, alkaloids, flavonoids, steroids, tannins, etc. Phytochemicals, which are therapeutic, are considered medications. 150 of the 4000 phytochemicals catalogued and categorized by physical, chemical, and defense properties have been studied [8]. Recent study shows that most phytochemicals are anti-microbial, anti-malarial, anti-diabetic, anti-arthritic, etc. Phytoconstituents' medicinal, biological, and pharmacological properties enable plant resource utilization. Combining plant chemical understanding with medicinal properties and other biological processes can help create viable herbal drugs [9].

Physical-chemical analysis is essential to pharmacognostic investigations of crude medicines. Before further study, macroscopic and microscopic examinations must identify adulterants, pollutants, and quality. Extractive and solubility values assist determine a chemical ingredient's dry yield in different solvents. Ash value study may evaluate sand and soil on a plant's surface [10]. Moisture content affects crude medication stability. Fluorescence analysis standardizes crude medicines. The plant extract's chemical components fluoresced when lit. Reagents are used to fluorescent non-fluorescent chemicals [11].

Phyto medicines

Traditional medicine is the foundation of phylomedicine today (which exists in every continent and in every cultural area of the world). East Asian Chinese and Indian Ayurvedic treatment are comparable [12]. Herbal renaissance is happening everywhere. Herbal goods are safer than synthetics, which harm persons and the environment. Herbs' medicinal, delicious, and fragrant virtues have been revered for millennia, but synthetic products briefly dominated them. However, synthetics are no longer needed, and people are returning to

natural goods for safety and security. 75% of the world utilizes plants and plant extracts for wellness [13].

The capabilities of therapeutic plants range widely

Anti-microbiological action

Medicinal plants alleviate human problems because they contain therapeutic ingredients. Antimicrobial usage is uncertain when germ resistance increases. With increased study into natural remedies, plants have long been a significant source of natural substances for human health. While *A. Paniculata* decreased *Escherichia coli* related diarrhoea [14,15]. The methanol extracts of *Acacia nilotica*, *Sida cordifolia*, *Tinospora cordifolia*, *Withania somnifer*, and *Ziziphus mauritiana* showed greater antibacterial activity than root/bark extracts against *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas fluorescens*, *Staphylococcus aureus*, and *Xanthomonas axon A. S. nilotica* and *B. cordifolia* leaf extract was most antimicrobial. *subtilis. S. elegans* root and leaf extract All test microorganisms were particularly aggressive against *cordifolia. A. Nilotica* bark and leaf extract has strong A-antifungal activity. *Z. T. Cordifolia* was D-antifungal. turcica. The S. sp. Methanol extract *cordifolia* inhibited *F. Verticillium* [16].

Anticancer property

One of the top killers globally and a significant public health issue in both developed and developing nations is cancer. WHO estimates that 12.5% of deaths in 2004 were related to cancer. It is characterized by uncontrolled and aberrant cell proliferation inside the human body, resulting in tumours made up of cancerous cells that have the ability to spread to other parts of the body [17, 18]. Physical inactivity, hereditary factors, an inadequate diet, and different environmental conditions may all be major contributors to cancer [19]. Many chemical compounds are used to cure cancer, but because of their toxicity, they cannot be utilized [20]. Chemotherapy, radiation, immunotherapy, and surgery now have a number of harmful consequences on unintended cells and tissues. This highlights the need for alternate cancer medicines and treatments [21]. Numerous cancer research investigations have used

traditional medicinal herbs to uncover novel therapeutic molecules without hazardous side effects [22]. Herbal cancer treatments have been well-accepted internationally for decades due to their low adverse effects [23]. Medicinal plants still play a major role in global healthcare. Scientists are only studying a tiny number of medicinal plants, including those in India, for cancer prevention and therapy. Phenol and flavonoids in medicinal plants safeguard biological systems. Plant secondary metabolites have created worldwide anticancer compounds including vincristine, vinblastine, camptothecin, podophyllotoxin, flavofiridol, silvestrol, and others. Antitumor, proapoptotic, and antiangiogenic activities have been examined. Medicinal herbs' antioxidants and immunomodulators fight cancer. Antioxidant phytochemicals protect cells [24].

Anti-oxidant function

Oxygen is a highly reactive atom that is capable of forming part of potentially destructive compounds often termed free radicals such as Reactive oxygen species (ROS) (ROS). ROS considerably outpace the capability of the natural cellular antioxidant defense system when they are present at certain levels, resulting in oxidative stress. Cells and organs may be damaged as a consequence, which might trigger or hasten disease processes. Cancer, ageing, atherosclerosis, ischemia damage, inflammation, and neurological disorders have all been linked to oxidative stress [25, 26]. Free radicals may harm healthy cells, destroying their structure and function. Antioxidants may stop free radicals from damaging cells. Antioxidants maintain cellular and systemic health [27].

Liver-protective behavior

The detoxification of xenobiotics, environmental pollutants, and chemotherapeutic agents is a constant task assigned to the liver, the primary organ of metabolism and excretion. As a result, the disorders connected to this organ are numerous and diverse. The current use of corticosteroids and immunosuppressive drugs only led to symptomatic relief, despite the fact that a curative agent has not yet been discovered in modern medicine [28]. Additionally, using them carries a risk of relapse and a danger of adverse effects. On the other hand, a long history of using plant-based medications to treat liver disorders can be found in Ayurveda, an

indigenous medical system in India [29]. Hepatitis and cirrhosis may develop as a consequence of increased lipid peroxidation brought on by the liver's microsomal ethanol metabolism [30]. There are many medicinal plants that have demonstrated strong hepatoprotective activity and great promise as a natural treatment for acute liver diseases and injuries.

Inflammatory-reduction capacity

A tissue's response to injury, frequently brought on by invading parasites, is inflammation. Increased blood flow to the affected tissue results in an increase in temperature, redness, swelling, and pain. Asthma, heart attacks, cancer, Alzheimer's, and other illnesses have all been linked to inflammation, which is considered a silent killer. It has been scientifically proven that a number of plants have the ability to inhibit inflammation. Andrographolide's anti-inflammatory impact may be due to its capacity to block neutrophil adherence by suppressing macrophage adhesion molecule-1 (Mac-1) up regulation, which may be achieved by down regulating ROS generation through a protein kinase C (PKC)-dependent mechanism [31,32]. An-drographolide also reduced pro-inflammatory protein expression by blocking nuclear factor (NF)- κ B from binding to DNA [33]. *Vitex leucoxylo*n leaves 66 ethanolic extract decreased carrageenan-induced oedema and granulation tissue in rats. *Calotropis procera* dried latex diluted in water was anti-inflammatory in carrageenan and formalin-induced rat paw oedema models [34]. Rabbit eyes tested *Butea frondosa* roots and leaves for anti-inflammatory activities. B gel: results proved. frondosa leaves synthesised with pluronic F-127 commercially decreased intraocular pressure, leucocytosis, and was equal to flubiprofen gel [35]. The *Ocimum sanctum* oil triglyceride fraction protected rats and mice against carrageenan and acetic acid induced paw oedema and writhing better than fixed oil. An alcohol extract of *Ochna obtusata* stem bark reduced inflammation in rat paw oedema and cotton pellet granuloma models. All *Pongamia pinnata* root extracts decreased carrageenan and PGE1-induced oedema inflammation better than phenylbutazone [36,37].

Antiallergic

An allergic reaction is when our immune system overreacts to coming into touch with a specific foreign chemical. It is accentuated because the body often views these foreign chemicals as innocuous and non-allergic individuals don't react to them. Due to their lesser adverse effects, herbal medications are also in demand as anti-allergens alongside synthetic treatments. It was discovered that compound 40/80 did not effectively prevent immunologically induced mast cell degranulation as well as ethanolic extract of *Vitex negundo*. Additionally, it prevented oedema in mice with active paw anaphylaxis. Additionally, the extract prevented tracheal contractions in both their early and later sustained stages. The extract predominantly prevented the release of histamine during the first phase, whereas arachidonic acid derived lipid mediators were released during the later phase [38]. Alcoholic extracts of *Nyctanthus arbortristis* and *Andrographis paniculata* seeds, hexane-soluble extracts of *Cedrus deodara* wood, and *Albizia lebbek* bark showed considerable anti-allergic action in rats with anaphylaxis and mast cell degranulation [39,40].

Diabetic prevention

Diabetes is caused by insulin deficiency or misuse. Insulin turns food into energy. Behaviors and genetics cause diabetes. When the pancreas doesn't produce enough insulin, diabetes develops. This is Diabetes Mellitus. *Water. Paniculata* significantly decreased rabbit oral glucose-induced hyperglycemia [41]. The whole plant of *Phyllanthus amarus* has hypoglycemic properties [42]. Epicatechin, a component of *Pterocarpus marsupium*, protects erythrocytes against osmotic fragility in vitro. In streptozotocin-induced diabetic rats, marsupin and pterostilbene from *Pterocarpus marsupium's* heartwood drastically lowered blood glucose levels [43].

Immune-modulating behavior

Immunomodulators are chemicals, either natural or synthetic, that aid in regulating or normalizing the immune system. They strengthen weakened immune systems and calm hyperactive immune systems. The body can defend itself with the aid of cytokines and other natural and adaptive defensive mechanisms that the immunomodulators promote. Immune stimulation derived from plants is also used in the treatment of autoimmune illnesses. A.

ethanol extract. Andrographolide and paniculata both shown positive immunostimulant effects [44]. By inducing macrophages, natural killer cells, and cytokines, andrographolide also modulates immunological activity that is both antigen-specific and nonspecific [45].

Advantages of herbal medications

Long-term health issues that don't improve with conventional therapy often react better to herbal remedies. The usage of herbs may be safer in the long run since they often have fewer adverse effects. Herbs and alternative treatments for arthritis are a good illustration of this. Due to an elevated risk of cardiovascular problems, the popular prescription medication Vioxx, used to treat arthritis, was recalled. Alternative therapies for arthritis, however, have little negative effects [46, 47].

Herbs' disadvantages

A traditional doctor employing current diagnostic testing, surgery, and medications may cure catastrophic injuries like a broken limb, appendicitis, and heart attacks better than an herbalist. Modern medicine treats accidents and unexpected illness better than herbal or supplementary therapies. Herbal medication may cause self-harm. Many herbs do not come with instructions or box inserts, unlike medicines. Overdose is dangerous. Some people collect wild plants despite the risks. Since herbs are unregulated, customers risk buying low-quality herbs. Herbal products vary by batch, brand, or manufacturer. This makes herb dose prescription difficult [48, 49].

Conclusion

Plants have always been the main source of therapeutic drugs. Medicinal plants heal and drive global trade. Herbal medicines are cheap and have minimal negative effects, thus their commerce has grown rapidly. Plants are therapeutic due to complex chemical elements with different compositions and biological functions. 25% of modern drugs come from traditional botanicals, according to the WHO. Some are synthetic counterparts of plant-derived prototype molecules. 70% of Indian medications are natural. Future generations will use plants for medicine and as raw materials for the food, cosmetics, and fragrance industries.

Medicinal plants' money-making and healing abilities help development. Meeting consumer demand for botanicals and herbal remedies is a booming industry, even though quality consciousness regarding evaluation-related evidences is necessary for herbal remedies' efficacy. Even wealthy nations now use herbal medicine. Plant-based products are definitely more popular. Herbal supplement and remedy sales are expected to rise, increasing demand. Cellular biology has led to a shift from studying plant drug effects to studying changes in cytosolic enzyme activities, DNA patterns, and genetic control. In addition to using technology, this research needs to rationally interpret traditional medicine's codified language. Herbal medicine is widely used and inexpensive. Plant-based medicines for human diseases have garnered attention recently. Thus, global pharmaceutical demand has soared. Due to pharmaceutical demand for plant raw materials, plant biodiversity is threatened. Improved screening approaches from plants and other natural sources must be used to develop and characterize natural medicines. Medicinal herbs are often tested for safety and efficacy as natural remedies [50, 51].

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