



E-ISSN: 2321-2187
P-ISSN: 2394-0514
www.florajournal.com
IJHM 2021; 9(3): 35-38
Received: 11-02-2021
Accepted: 14-03-2021

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Potentiality of Phytochemical Resource of India: A review

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Abstract

Plant derived substances have recently gained great interest owing to their versatile application in healing and curing of human diseases. These substances also known as phytochemicals exhibit antioxidant properties and are therefore, responsible for plants showing pharmacological activities. Various studies have been conducted regarding the importance, uses and estimation of phytochemicals present in medicinal plants and their application in treating human diseases in India and North east India. This review provides a brief description of selected studies reflecting the importance of medicinal plants in the field of therapeutics.

Keywords: Medicinal plants, Phytochemicals, Antioxidant activity

Introduction

Microorganisms causing harmful infectious diseases all over the world are becoming resistant to the antibiotics produced by the pharmacological industries. Although antibiotics and chemically synthesized medicines are able to cure the microbial infections very fast, they may cause certain side effects and disturb the natural immunity of the body. This calls for an alternate source of medicine that would reduce the hazard created by these microorganisms and also replace the synthetic drugs at the same time. In this regard medicinal plants have emerged as a boon to the society. Plants that retain curative properties or expend beneficial pharmacological effects on an organism are generally known as “medicinal plants”. These plants have been used in elimination of human disease and maintenance of human health from time immemorial. Various medicinal plants have been used for years in daily life to treat disease all over the world. The preparation and use of herbal medicines for treating harmful ailments have been mentioned in ancient texts like the Vedas and the Bible. According to the WHO (World Health Organization), 80% of the population in developing countries still counts upon the drugs obtained from plants to overcome their primary health care requirements [1]. Medicinal plants are considered to be the most advantageous resource of life saving drugs in the world being the most effective and cheaper alternate source [2].

2. Phytochemistry of Medicinal Plants

Phytochemistry is the term that deals with chemicals derived from plants. Plants have been elemental in the traditional medicine system, practiced for thousands of years, by the people of China, India and many other countries [3]. Based on their use in traditional medicinal systems a remarkable number of drugs have been isolated from these plants. The therapeutic properties of medicinal plants are attributed to the presence of some chemical compounds that tend to produce distinct physiological action on the human body. These chemical constituents include the phytochemicals which are biologically active, naturally occurring compounds found in plants and protect the plants from disease and damage from other environmental factors [4]. According to recent studies and researches phytochemicals not only protect plants but also provide health benefits for humans. They possess properties to prevent human from various diseases. Phytochemicals have also proved beneficial in supplementing the needs of the human body by acting as natural antioxidants [5]. Various studies have been conducted to show that plants are rich source of antioxidants [6]. Vitamins A, C, E and phenolic compounds such as flavonoids, lignins, tannins which naturally occur in plants, all act as antioxidants [7]. Antioxidants play a major role in scavenging reactive oxygen species thereby, inhibiting damages caused by oxidation [8]. Evaluation of antioxidant phytochemicals in medicinal plants have gained attention from researchers in the recent years for their major role in prevention of human diseases [9].

2.1 Role of Phytochemicals

Phytochemicals (from the Greek word “Phyto”, meaning “plants”) are biologically

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Active chemical compounds which occur naturally in plants and provide beneficial health effects for the human body^[10]. Because of this property phytochemicals are considered to possess potential role in the prevention and treatment of many human diseases. These natural phytochemicals are responsible for modulation of various molecular signal transduction pathways involved in the process of inflammation, thereby, preventing the onset of chronic diseases such as cancer, articular rheumatism, atherosclerosis, obesity, skin ageing and diabetes^[11]. Medicinal properties of important classes of phytochemicals is shown in table 1. More than 4000 phytochemicals have been reported and about 150 have been studied in details^[12]. Phytochemicals are classified into primary and secondary metabolites depending on their role in plant metabolism and pharmacological importance. The primary being vital for normal development of the plant while the secondary metabolites aid the plants with defense mechanisms to survive against adverse biotic and abiotic

conditions^[13]. Chlorophylls, sugars, amino acids, proteins etc are included in primary constituents while secondary metabolites include terpenoids, alkaloids, flavonoids, steroids, saponins, glycosides and phenolic compounds^[14].

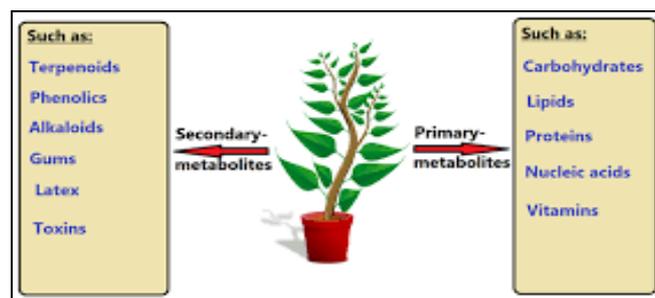


Fig 1: Major classes of phytochemicals

Table 1: Medicinal properties of major classes of phytochemicals

Phytochemicals	Activity
1) Alkaloids	a) Used as potent anti-bacterial and analgesic agents ^[15] b) act as antimicrobial agents by promoting white blood cells to discard harmful microorganisms ^[16] c) Act as antimalarial agents, treating hypertension, rheumatism, motion sickness and increases the life of hormones ^[17]
2) Tannins	a) Induces apoptosis to inhibit the growth of tumor ^[18] b) Suppress the mutagenicity of carcinogens ^[19] c) Inactivates microbial enzymes by causing cell wall/membrane disruption ^[16, 20] d) Tannins exhibit wound healing, anti-inflammatory and analgesic properties and also show antioxidant activities ^[21, 22]
3) Flavonoids	a) Found effective in reducing atherosclerosis, coronary thrombosis, and cholesterol level ^[23] b) Reduces oxidative stress ^[20] c) Eliminates mutagens and carcinogens by activating phase two enzymes ^[24] d) Disruption of microbial membranes ^[25-27]
4) Saponins	a) Increases the blood flow of the coronary arteries, prevent aggregation of platelets and decreases the oxygen consumption by heart muscles ^[28] b) Exhibit anti-inflammatory, antiviral, antifungal and antibacterial activity ^[20] c) Also possess anticarcinogenic, membrane permeabilising and immunostimulant properties ^[29]
5) Phenolic acids	a) Serve as antioxidants and neutralize deleterious free radicals, regulate carbohydrate metabolism ^[30] b) Tends to increase bile secretion, reduces blood cholesterol and lipid levels also possess antimicrobial properties ^[31] c) Act as antiulcer, anti-inflammatory, anti-tumor and anti-depressant agents ^[32]
6) Terpenoids	a) Shows anticarcinogenic, anti-malarial, antiulcer, antimicrobial, hepatocidal activities ^[33] b) Tends to reduce epilepsy, cough and cold, influenza and acute bronchial diseases ^[20]

In recent years, phytochemicals have been widely investigated as a source of medicinal agents which could be used for the treatment of many diseases^[34]. Plant constituents such as phenolquinones, flavones, tannins, terpenoids, alkaloids and essential oils possess antimicrobial properties and have been by several authors^[35]. A study on the phytochemical constituents of two indigenous plant species viz., *Eucalyptus camaldulensis* and *Ocimum basilicum* in Sudan detected the presence of alkaloids, saponins and flavonoids^[36]. The bark and leaf extracts of the plant *Goniothalamus velutinus* Airy Shaw obtained from Brunei Darussalam, Borneo were tested for phytochemical and antioxidant activities which showed the presence of alkaloids, steroids, terpenoids and cardiac glycosides indicating that its medicinal properties might be due to the presence of the phytochemicals^[37]. Evaluation of extracts of 61 medicinal plants from Pakistan detected the presence of glycosides, alkaloids, flavonoids, tannins, phenols, saponins, coumarins and terpenoids^[38]. The extracts also showed varying degrees of antibacterial potential and antioxidant activities.

2.2 Phytochemicals reported in Medicinal plants of India

Chloroform, water and acetone extracts of triphala (herbal formulation consisting of 3 medicinal plants *Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus emblica*) have shown effective anti-mutagenic activity against *Salmonella typhimurium*^[39]. The ethyl acetate and acetone extracts of "triphala" possess potent antioxidant property. The cytotoxic effect of triphala was also checked on monolayer corneal cells which showed negligible cytotoxicity in presence of triphala extract^[40]. The phytochemical constituents and antioxidant potential of the plant species *Anethum graveolens*, Piper betel, *Coriandum sativum*, *Cinnamomum zeylanicum*, Wheat grass and Jackfruit leaf showed convincing antioxidant activity, thereby, indicating their ability to treat certain medical conditions^[41]. Evaluation of qualitative and quantitative phytochemicals invitro antioxidant properties of various methanolic and aqueous extracts of leaf and root parts of *Hypochoeris radicata* L. showed the presence of alkaloids, total phenolics, total flavonoids, tannins, saponins and ascorbic acid. The species also possessed potential antioxidant activity^[42]. The phytoconstituents of four ethnobotanically important

plants viz., *Justicia tranquebariensis*, *Tribulus terrestris*, *Aloe vera* and *Curcuma longa* from Semmalai, Tamil Nadu exhibited the presence of flavonoids, steroids, cardiac glycosides, alkaloids, tannins and terpenoids [43]. Reported the presence of proteins, carbohydrates, phenols, tannins, flavonoids and saponins in seven medicinal plants collected from Sonitpur and Dibrugarh districts of Assam which could be used as an important source for developing new drugs [44]. The therapeutic potential of 25 traditional medicinal plants collected from different zones of Tiruchirappalli district, Tamil Nadu can be correlated with the detection of tannins, flavonoids, phenols, saponins, steroids, cardiac glycosides and alkaloids [45]. The ethyl acetate extract of papaya, pomegranate, banana and guava showed potent antibacterial and antifungal activity against the investigated pathogens along with bioactive compounds saponins, alkaloids, flavonoids, terpenoids, carbohydrates and tannins [46]. Phytochemical analysis of methanolic leaf extracts of *Azadirachta indica* [47] showed the presence of phytochemicals with antimicrobial, anti-inflammatory and antioxidant properties. Qualitative phytochemical analysis of some popularly grown medicinal plants in and around Patna revealed the presence of various compounds like saponins, terpenoids, steroids, anthocyanins, coumarins, fatty acids, tannins, leucoanthocyanins and emodins [48]. The presence of bioactive compounds such as alkaloids, flavonoids, glycosides and phenols in five different solvents extracts of *Talinum portulacifolium* leaf may be responsible for its pharmaceutical activity [49]. The in vitro antibacterial activity of *Phyllanthus emblica* leaf extracts against selected bacterial strains showed significant antibacterial and antioxidant properties and also phytochemicals such as tannins, phenols, sterols, terpenoids, proteins, flavonoids and quinones [50]. The qualitative and quantitative phytochemical components of mahua (*Madhuca longifolia*) and pomegranate (*Punica granatum*) revealed the presence of alkaloids, flavonoids, tannins, carbohydrates and proteins in the leaf extract of mahua while pomegranate showed the presence of flavonoids, tannins, terpenoids, proteins, carbohydrates and phenols. They also showed potent activity against two tested bacterial strains (*S. aureus* and *E. coli*) [51].

3. Conclusion

It has been universally recognized and accepted that the medicinal value of plants lies in the bioactive phytoconstituents produced by them [16]. The advantages of using herbal medicine over synthetic drugs lies in the fact that herbal drugs are inexpensive, safe and possess multi-targeting effect [52]. Thus, medicinal plants are the basic source for discovering and screening of important phytochemical constituents which may lead to the generation of new and novel drugs for the treatment of many diseases. Therefore, it is the need of the hour to examine the chemical potentiality of medicinal plants in an organized manner for future perspective in medical sector. Therefore, this study is expected to provide an insight into the biochemical potentiality of medicinal plants. Also, proper and organized biochemical studies of all these plants might give a new direction to pharmacology and pharma industries of India.

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