



A Review on Some Indigenous Medicinal Plants and their Key Applications

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i53A33648

Editor(s):

(1) Dr. Win Myint Oo, SEGi University, Malaysia.

Reviewers:

(1) Muhsin Konuk, Üsküdar University, Turkey.

(2) Leide Lene Coelho Ferreira, Vital Brazil Institute, Brazil.

Complete Peer review History, details of the editor(s), Reviewers and additional Reviewers are available here:
<https://www.sdiarticle5.com/review-history/77595>

Review Article

Received 25 September 2021

Accepted 01 December 2021

Published 04 December 2021

ABSTRACT

In India, 7,500 plant species out of 17,000 are officially integrated in ayurvedic pharmacopeia for over a millennium. There are many industrial uses of medicinal plants which include traditional medicines, phytopharmaceuticals, herbal teas, health food etc. Now days, in silico approaches have been developed which is used in virtual screening and analysis of medicinal plants to be used pharmacologically. It is a cost effective and efficient way for the production of new drugs which is done in three basic steps i.e. molecular docking, developing pharmacophores and determining molecular similarity in shape. WHO has also acknowledged the importance of medicinal plants and has created various guidelines and strategies to encourage its use. Agro industrial technologies also encourage the use of medicinal plants. India has wide variety of plant species in its ecosystem. Out of 17,000 species of plants 7,500 species are used as medicinal plants by the tribal groups, villagers and in traditional medicinal systems like Ayurveda. The aim of the review is to summarize the information on the recent development in the field of medicinal plants and their key applications.

Keywords: *Medicinal plants; natural extracts; Ayurveda; cancer; neem.*

1. INTRODUCTION

Medicinal plants are being used since historical period, to treat various kind of illness and even cure different forms of cancer [1]. Study of medicinal plants help us to understand its toxicity, which in turn help to protect humans and animals from the naturally occurring poison [2]. Natural extracts study of medicinal plant has increased in past years due to their bioactive compound found in different parts like polyphenols, vitamins and proteins. Phenolic compounds play an important role in pharmacological studies due to their biological effects. These substances have an aromatic ring with one or more hydroxyl group which effects biological activity. Medicinal plant that were studied were used in the ailment of various skin diseases [3]. There are various indications that are written which are around more than 5000 years old that describes the use of medicinal plants such as Sumerian clay plate of Nipper and Egyptian papyri. Effects of various plants that were used in ancient times were confirmed after 1000 years using scientific methods and some of them are also officially a part of pharmacopoeia [4]. Mankind has discovered the use of herbal medicines in relieving pain and treating various diseases since time of yore. The people from ancient era used herbs or their mixtures known as corpus therapeuticum and used it for treatment of number of diseases. Vedas, Indian holy book, also broach treatments by using plants available throughout the country like nutmeg, clove, etc. [5]. Bioactive compounds, from the plants are thought to be renewable source of agents to cure leukemia because of their availability and assortment [6]. Ayurveda and traditional methods have encouraged and described the use of plants in the drug formulation due to the presence of bioactive compounds and secondary metabolites. Medicinal plants also have number of phytochemicals and metabolites that help to boost immune system of human body and be effective against diseases such as Covid 19 [7]. In South Africa, 3 different areas were documented for their plant species that can be used as an effective treatment for cancer. 20 different plant species were reported which belonged to 17 different families where the largest plant species belonged to Hypoxidaceae family [8]. In Thailand, it was estimated that the sales of herbal medicine was more than 2.5 billion US dollar in the mid 90s. In Japan, herbal medicines are more in demand as compared to synthetic drugs created pharmaceutically [9].

India has wide variety of plant species in its ecosystem. Out of 17,000 species of plants 7,500 species are used as medicinal plants by the tribal groups, villagers and in traditional medicinal systems like Ayurveda. There are many industrial use of medicinal plants which include traditional medicines, phytopharmaceuticals, herbal teas, health food etc. [10]. Medicines derived from plants are used in ayurveda for healing. Ayurveda informs that all plants cannot be used in medicine and needs to be adequately studied before its application as even plant derived medicine can be poisonous if not used appropriately. It is reported in ayurveda that if used appropriately even poisons can act as an effective medicine. In India, 1500 plants out of 10,000 plants are officially integrated in ayurvedic pharmacopeia for over a millennium [10]. WHO has also acknowledged the importance of medicinal plants and has created various guidelines and strategies to encourage its use. Agro industrial technologies also encourages the use of medicinal plants Use of medicinal plants for drug production is promoted due to prevention of diseases, promoting health conditions, limited options of treatment of serious illness, side effects of allopathic medication and many more such conditions. The side effects of medicines range from mild to severe which include conditions like insomnia, fatigue, high level of sugar in blood, seizures, anemia, coma and in some cases even death [11]. Study of medicinal plants has increased gradually around the globe due to presence of natural sources that allow them to be used in the pharmacological approaches. Nowadays, *in silico* approaches have been developed which is used in virtual screening and analysis of medicinal plants to be used pharmacologically. It is a cost effective and efficient way for the production of new drugs which is done in three basic steps i.e. molecular docking, developing pharmacophores and determining molecular similarity in shape [12]. A study was conducted which gave information about number of medicinal plants that have potential to cure various cancer types. Based on various documentation Asteraceae, Fabaceae, Euphorbiaceae and Rubiaceae families have various plants that can be used for treatment of cancer [13]. Cancer is a global threat and second most important cause of death in U.S. In Nigeria, cancer of breast and prostate registered 34.2% and 31.7% of death, collectively in females and males. Cases of cancer related death is increasing continuously especially in underdeveloped parts of world due to the lack of facilities for detection of cancer at early stage

and cost of treatment therefore, people rely on affordable herbal medicine. In a study, 48 medicinal plants, used by traditional practitioners, found in Kebbi state were revealed for the treatment of cancer. These medicinal plants were confirmed for the same in the literature review of many pharmacological studies [14]. Abnormal division of white blood cell cause Leukemia (acute or chronic), which is considered to be most common type of cancer. Acute lymphoblastic leukemia is most common in youngsters between 2-5 years of age [15]. To treat leukemia, chemotherapeutic drugs, hematopoietic stem cell transplantation and radiation therapy is used. Chemotherapeutic drugs are used in combinations and often do not improve patient's rate of survival. Side effects of these drugs also lead to the patients suffering, sometimes even leading to death from various complications of heart and nerves. The over use of these drugs has led to drug resistance in leukemia cells [15]. Therefore, production of novel drugs which have higher potency and lower toxicity are required to decrease the side effects and mortality rate. According to current situation, the enormous amount of threat to humanity is being caused by Covid 19 caused by SARS-CoV-2 Virus or coronavirus. Coronavirus strains resides in bats and wild birds through which they can spread to other beings. They are single stranded RNA viruses which are known to be highly diverse. It was first reported in 1960 [16] The symptoms that are reported include fever, cough, cold and difficulty in breathing. According to WHO, 80% of people depend on the plants because of their medicinal importance, for their health. The epoch of drug development against virus began in 1963 after approval of idoxuridine, an anti-herpes antiviral drug which work by inhibiting synthesis of viral DNA [17] Many medicinal plants like *Dioscorea batatas*, *Mollugo cerviana*, *Polygonum multiflorum* Thunb and many more were shown active against SARS-CoV-2 virus. Extracts of medicinal plants like *Tinospora cordifolia* have been encouraged, for the patients suffering from SARS-CoV-2 virus [16] For the treatment of patients suffering from Covid 19, synthetic drugs are not showing efficacy therefore, herbal medicinal products have become favorable option. Few patients have already under gone clinical setting in which extracts of chinese plants were examined which showed effective result for palliation symptoms [18]. Plant based medicines against virus have shown effective inhibitory effects on properties that range from anti-viral to anti-dengue [16] Various medical combinations using medicinal

plants have been used by people in Iran as tonic for liver [19]. Medicinal plant sources are also used in preparation and development of skin products as an alternative to synthetic products [20]. Some important indigenous medicinal plants and their key applications are described below.

2. *Azadirachta indica*

The term "Neem" is derived over time from a Sanskrit word Nimba. Neem also known as *Azadirachta indica*, is a tree that is grown in the southern region of Asia and Africa and has been used medically for many years. It is believed that various part of *Azadirachta indica* tree are used for different medical illnesses like cancer, diabetes, hypertension, etc. [21]. Neem leaves mainly have proteins, carbohydrates, vitamin C, carotene etc. Various parts *Azadirachta indica* tree have different bioactive compounds like its leaves have nimbosterol and quercetin, its bark consist of nimbidin as a major constituent, flowers are known to have kaempferol [22]. The extracts of neem are known to cure various skin problems like dermatophytosis, atopic dermatitis and scabies. Neem has been traditionally used in Ayurveda to cure several conditions. It is used for the preparation of blood purification mixture and also in management of diabetes. Various bioactive compounds in neem have an antiviral property, and this also prevents them from causing infection. This is done as neem compounds interact with the cell surface and prevents the cell from being infected by the virus [23].

3. *Ocimum tenuiflorum*

Ocimum tenuiflorum commonly known as Tulsi (derived from Sanskrit word) belongs to Lamiaceae family. Two main types grown in India are green leaved Lakshmi Tulsi and purple leaved Krishna Tulsi. Seeds of *O. tenuiflorum* are used for their oil content which possesses medicinal importance [24] Various part of these plants like leaves, seeds and root are used in local ayurvedic medicine. It is reported by many that different parts of *O. tenuiflorum* plant is used for various activities like anti-inflammatory, antifertility, anti-bacterial, etc. [26] Some of the bioactive compounds include methyl eugenol, β -caryophyllene, methyl eugenol, (E)-caryophyllene, eugenol and, β -elemene, methyl chavicol, and linalool [27]. Tulsi is used in treating diseases that affects heart and blood vessels. It is done by lowering the content of lipids in blood which decreases ischemia,

reduces hypertension and also limits cardiac strokes. Tulsi compounds act as a prophylactic agent that helps with insect bites and stings. Tulsi oil has been found to be effective against arthritis. The ethanolic extract of Tulsi are most likely to fight against calcium stone inhibition activity as compared to various other marketed products [28].

4. *Mentha*

Mentha or mint is a perpetual plant that grows in humid environment and has creeping rhizomes. They have simple, yet distinctive leaves which have beautiful fragrance. There are number of *Mentha species* such as *Mentha spicata* and their major bioactive compounds include menthol, menthone, isomenthone, menthyl acetate, menthofuran, limonene, etc. which are responsible for various activities like antiparasitic, antimicrobial, antispasmodic, antitumor, antiviral etc. [29] Compounds extracted from mint are used in the treatment of indigestion, scalp issues, ear pain, poisonous bites, headache, and flatulence. Mint extracts are known to cure oral issues which include bad breath and soreness of the gums and palate. Mint is used as a diuretic and also as digestive aid which helps to relax stomach muscles, allowing food and flatulence to pass comfortably. Mint is also known to be used to treat dry and itchy skin, and bite of insects and animals. It also has antimicrobial and antifungal properties due to which it is used by people for over 1000 years to treat infections caused by fungus or microbes [30].

5. *Tinospora cordifolia*

Giloy or *Tinospora cordifolia* is one of the most important medicinal plants that is studied in the traditional Indian medicine and is also known as the "Heart-leaved Moonseed" and "Guduchi". Giloy is a shrubby creeper that belongs to Menispermaceae family. It has various biological and therapeutic uses that cure various conditions like that of skin, anemia, inflammation, etc. Bioactive compounds of giloy help immune system to fight infections and uphold the functioning of leucocyte [31]. In a study, cordifolioside A, magnoflorine, β -ecdysone and palmatine were found to be the main phyto-compounds in Giloy [32]. Giloy is known for its property that improves immunity. It is known to have many antioxidants that fight free-radicals keeping cells healthy and eliminate diseases from the body. Giloy helps by removing toxins, purifying blood, and fighting against bacteria.

Giloy are useful to treat respiratory problems like asthma, cough, cold and also tonsils. Recently, Giloy has demonstrated decreased resistance of HIV virus leading to an improvement in the therapeutics and showing its application as an effective medicine [33].

6. *Trigonella foenumgraecum*

Fenugreek also known as *Trigonella foenumgraecum* is a leguminous crop that is cultivated worldwide in different countries and mainly in India. Fenugreek is rich in dietary fiber which ranged from 45–52% and this increase in the intake of dietary fiber may reduce the risk of various forms of cancers [33]. 6-O-Galloylhomoarbutin, Meliadoside B, Protocatechuic aldehyde, Cistanoside C were identified as bio active compounds in fenugreek that are responsible for various actions like antioxidant, anti-inflammatory, antidiabetic, and anticancer [34]. Extracts of fenugreek have shown cytotoxic effect against cancer cell lines that induced T cell lymphoma. In a research conducted it was seen that fenugreek extracts showed inhibitory effect on cancer cell lines of breast, prostate and pancreas. Fenugreek has shown antibacterial activity and has been broadly considered in many studies. The fenugreek seeds contain polyphenolic compounds which are known to impact the health positively. These polyphenolic compounds are also known to have antioxidant effect, cancer preventive activity, and anti-diabetic effects [35].

7. CONCLUSION

Mankind has discovered the use of herbal medicines in relieving pain and treating various diseases since time of yore. The people from ancient era used herbs or their mixtures known as corpus therapeuticum and used it for treatment of number of diseases. Vedas, Indian holy book, also broach treatments by using plants available throughout the country like nutmeg, clove, etc. Use of medicinal plants for drug production is promoted due to prevention of diseases, promoting health conditions, limited options of treatment of serious illness, side effects of allopathic medication and many more such conditions. In a research conducted it was seen that fenugreek extracts showed inhibitory effect on cancer cell lines of breast, prostate and pancreas. Extracts of fenugreek have shown cytotoxic effect against cancer cell lines that induced T cell lymphoma. Giloy helps by removing toxins, purifying blood, and fighting

against bacteria. Giloy are useful to treat respiratory problems like asthma, cough, cold and also tonsils. Compounds extracted from mint are used in the treatment of indigestion, scalp issues, ear pain, poisonous bites, headache, and flatulence. Mint extracts are known to cure oral issues which include bad breath and soreness of the gums and palate. Tulsi is used in treating diseases that affects heart and blood vessels. Tulsi compounds act as a prophylactic agent that helps with insect bites and stings. Various bioactive compounds in neem have an antiviral property, and this also prevents them from causing infection. The extracts of neem are known to cure various skin problems like dermatophytosis, atopic dermatitis and scabies. *In silico* approaches are being also applied to screen out new pharmacological compounds and evaluate their activity of medicinal plants. Molecular docking, mounting pharmacophores and determining molecular similarity may hint the mechanism of action of these medicinally important plants thus lowering the cost and enhancing the competence of overall process. There are several case studies available where compounds isolated from medicinal plants clinically trialed and showed positive results reported in many research papers. Therefore, it has been concluded that the medicinal plants have very promising future in upcoming scenario as they have several compounds proven to be very effective against several diseases and needs more and more attention for advanced research and clinical trials.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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