Ocimum Sanctum (tulsi): Bio-pharmacological Activities

Corresponding Author:
Dr. Vinod Singh,
Associate Professor and Head, Microbiology, Barlatullah University, Barkatullah University, 462026 - India

Submitting Author:
Dr. Vinod N Singh,
Associate Professor and Head, Microbiology, Barlatullah University, Barkatullah University, 462026 - India

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Author(s): Singh V, amdekar s, Verma O

Abstract

Medicinal plants are used by the practitioners and pharmacologists to prevent and cure many diseases for the last several thousand years. Tulsi is known as “Queen of plants” “The mother medicine of nature”. Tulsi i.e. Ocimum sanctum is a plant with enormous properties for curing and preventing diseases. It is regarded as deity in Indian subcontinent. The genus Ocimum sanctum Linn. (Labiateae or Lamiaceae) comprises 30 species which are found in tropical and subtropical regions. Leaves and flowering tops are used for extracting essential oil. Oil of O. sanctum has revealed the presence of five fatty acids (stearic, palmitic, oleic, linoleic and linolenic acids). It is a good source of beta carotene, calcium, vitamin C and it also contains volatile substances (including estragol, linalool, eugenol, methyl chavicol and small quantities of methyl cinnamate, cineole, and other terpenes), tannins, camphor, flavonoids, triterpene: urolic acid. Leaves are diaphoretic, anti-periodic; they are also used in bronchitis, gastric and hepatic disorders. Decoction of leaves is recommended for cough, malaise and in colds. It is a good mosquito repellant as well. Oil extracted from flowers is used in skin diseases and ring worm infection. Various studies have been performed with Ocimum sanctum for its antibacterial, antioxidant, antilulceric, antimalarial, anti-diabetic, anti-inflammatory, antipyretic, anti-asthmatic, hypoglycemic, hypotensive and analgesic activities. Present review incorporates the description of chemical and bio-pharmacological properties of Ocimum species.

Introduction

Plants are the primary source of medicines. Medicinal plants are considered to be very rich sources of secondary metabolites and oils which are of therapeutics importance. The important advantages of medicinal plants in various treatments are: their safety besides being less expensive, efficacy and availability through out the world [1]. Use of plants as a source of medicinal value is a very old concept. Chinese were the first to used plants as therapeutics before 4000-5000 B.C. In India use of plants as a medicine appeared in Rigveda which has been written 3500 - 1600 B.C. Properties of plants as a source of medicine were studied in detailed in Ayurveda which is considered the foundation of all the medical sciences [2]. In India Tulsi is taken as the most sacred plant. The use of Ocimum sanctum (Tulsi) as an aromatic plant has been well documented in Ayurveda. It belongs to the family Labiateae. It is grown in tropical and sub-tropical including India [3]. It is omni present in all Indian fields. It is an erect, sweet scented herb. Name “Tulsi” in Sanskrit means “the incomparable one”. Whole plant is used as a source of remedy [4]. In India two forms of Tulsi are more common - dark or Shyama (Krishna) Tulsi and light or Rama Tulsi. The former possesses greater medicinal value and is commonly used for worship. Various other species are also commonly found in India like O. canum, O. basilicum, O. kilimandscharicum, O. ammericanum, O. camphora and O. micranthum [5], [6]. This plant has been evaluated pharmacologically for antimicrobial, immunomodulatory, anti-stress, anti-inflammatory, antipyretic, anti-asthmatic, hypoglycemic, hypotensive and analgesic activities. Tulsi has been found to be utmost effective in various types of animal models [7]. The leaves contain an essential oil, which contains eugenol, eugenal, carvacrol, methylchavicol, limatrol and caryophylline. The seeds contain oil composed of fatty acids and sitosterol. The roots contain sitosterol and three triterpenes A, B, and C. The leaves also contain usoric acid and n-triacontanol. Eugenol, its methyl ether, nerol, carvophyllen, terpinen 4-decyaldehyde, selinene, pinenes, camphene and a-pinene have been identified in essential oil. Additionally, it also contains rosmarinic acid, thymol, linalool and methyl chavicol and citral etc.[8].
anti-fertility, hepatoprotective, hypotensive, hypolipidemic etc.

**Tulsi as a prophylactic agent**

Decoction of leaves is used against the gastritis and hepatic disorders [9]. The juice of fresh leaves is also given to patients to treat dysentery. In a study, it has been found that methanolic extract of Ocimum suave showed healing effect against chronic gastric ulcers induced in experimental rats. Ocimum sp. along with pepper, turmeric and onion is prophylactic against malaria. Oil is insecticidal and larvicial. It contains: β-bisabolene (13-20%), methyl chavicol (3-19%), 1,8-cineole (9-33%), eugenol (4-9%), (E)-α-bisabolene (4-7%) and α-terpineol (1.7-7%) are the main constituents of tulsi oil [1]. Often, Tulsi is planted in Indian gardens as a mosquito repellent. Essential oils of Tulsi possess 100 % larvicidal property. It has been found that Tulsi has excellent anti-malarial properties as well. Eugenol is the main constituent and it is responsible for its repellent property. Paste prepared from Tulsi leaves is used against the ringworm infection. Tulsi removes worms and parasites. Tulsi extract with honey is recommended so that the parasites may be excited, thus drawing them out of their hiding places. Paste of its leaves is applied on face to clear marks [6]. Urosolic acid present in leaves returns elasticity and removes wrinkles. Tulsi helps skin stay healthy and supple. Use of Tulsi in the treatment of all kinds of cuts, wounds and ulcers is highly beneficial. The leaf juice of tulsi along with triphala is used as an eye tonic and is recommended for glaucoma, cataract, chronic conjunctivitis and other diseases associated with eyes. Chewing 3-4 of leaves before a meal helps stimulating the appetite, and a tea taken after a meal promotes digestion by increasing the flow of gastric juices, while reducing gas and bloating. Ocimum sanctum also reduces the chances of ulcers. It is an active diaphoretic common cold. It removes excess cough from lungs and nasal passages. A decoction of Tulsi leaves is a popular remedy for common cold in India. It is also given for fever along with the clove. It also lowers the uric acid levels and hence is considered as a potential anti-inflammatory agent. The leaves of basil are specific for many fevers. During the rainy season, when malaria and dengue fever are widely prevalent, tender leaves, boiled with tea, act as preventive against these diseases. In case of acute fevers, a decoction of the leaves boiled with powdered cardamom brings down the temperature, thereby it has been considered as a potential antipyretic cocktail as a home remedy. Tulsi is an important constituent of many cough syrups and expectorants. It helps to mobilize mucus in bronchitis and asthma. Chewing tulsi leaves relieves cold and flu. The leaves are nerve tonic and also sharpen memory. They promote the removal of the catarrhal matter and phlegm from the bronchial tube. It is useful in teeth disorders and is also recommended as a remedy against pyorrhea. Also, it is used as a remedy for night blindness and conjunctivitis. Being nerve tonic the leaves are used to sharpen memory. It is a good source of antioxidants and offer substantial protection against free radical induced damage. Oxygen free radicals are natural physiological products, containing one or more unpaired electrons [1]. Reactive oxygen species (ROS) may damage life important membrane lipids, proteins, DNA and carbohydrates [2]. This damage has been implicated in the causation of several diseases such as liver cirrhosis, atherosclerosis, cancer, and diabetes etc. [3], [4], [6], [7]. It has been well accepted that dietary antioxidants have great potential in ameliorating these disease processes [8]. Antioxidants thus play important role in protecting the human body against damage by reacting oxygen species [9]. It also decreases the lipid peroxidation and increases the activity of super-oxide dismutase [10]. Presence of eugenol attributes to its anti-oxidative property and is also thought to be responsible for inhibition of lipid peroxidation [11]. This property helps in maintaining good health and in preventing the chances occurrence of heart diseases as well as most of the other biochemical diseases because oxidative stress is the hallmark of such diseases [12].

**Antibacterial, antiviral and antifungal activities**

Essential oil present in most of the Ocimum species is responsible for its antifungal, antibacterial and antiviral properties. Microorganisms develop resistance against various antibiotics and due to this an immense clinical problem develops in treatment of infectious diseases. Medicinal plants can be used to overcome this problem. Tulsi leaves have been reported to show strong antifungal activities against the Aspergillus species [13]. In vitro antifungal activity was also observed against Candida species also when oil from O. gratissimum L. was used [14]. Ocimum shows strong antibacterial activity against Klebsiella (causes pneumonia and urinary tract infections), E. coli, Proteus & Staphylococcus aureus and Vibrio cholerae. Studies have shown O. basilicum act as a strong antiviral agent against DNA viruses (herpes viruses (HSV), adenoviruses (ADV) and hepatitis B virus) and RNA viruses (coxackievirus B1 (CVB1) and enterovirus71 (EV71)) [7]. O. tenuiflorum also has been reported to be having antiviral activity against Bovine herpes virus -1. Essential oil from Ocimum sp which contain eugenol, carvacrol, methyl eugenol, carvophyllene are considered mainly to be responsible
for various antimicrobial properties.

**Antidiabetic properties**

Leaves of *O. sanctum* have been shown to possess hypoglycaemic effects in experimental animals [15], [16], [17], [18]. Decoction prepared with various parts of plant lowers the blood sugar level [19]. A study conducted [20] on rats has suggested that constituent of *O. sanctum* leaf extracts have stimulatory effects on physiological pathways of insulin secretion. Various studies have been performed on the antiglycemic properties of Ocimum but its mechanism of action has not been elucidated as yet [20], [21]. Study [22] conducted with tulsi plus neem has suggested that this combination is better for the diabetic patients in lowering the sugar level.

**As an anticancer agent**

Cancer has been a leading cause of death in the developing countries. With changing standard of living and food habits and also due to availability of curative treatment for many infectious diseases, cancer is surpassing other ailments as a principle cause of morbidity and mortality even in developing countries. Surgery, radiotherapy and chemotherapy- the established treatment modalities for various cancers are costly, mutilating, having serious side effects and associated with residual morbidity as well as frequent relapses. In ayurveda, various plants are used as a potential source of anticancer and antitumor properties. It has been found that ethanolic extract of *O. sanctum* mediated a significant reduction in tumor cell size and an increase in lifespan of mice having Sarcoma-180 solid tumors [23]. Similar results were also obtained by others where anticancer activity of *O. sanctum* in Lewis lung carcinoma animal model has been reported [24]. Ursolic acid and oleanic acid possess anticancer property. Ocimum has the ability to protect the DNA of the body from dangerous radiations [25].

**Antilipidemic efficacy**

Hyperlipidaemia, atherosclerosis and related diseases are becoming a major health problem now days. Aqueous extract of *O. basilicum* reduces the level of total cholesterol, triglycerides and LDL-cholesterol levels in acute hyperlipidaemia induced by triton WR-1339 in rats [26]. In a study conducted on rabbits a diet supplemented with 1-2 % fresh leaves of Tulsi for 28 days lowered the total lipid [27].

**As an antifertility agent**

One of the major constituents of the Tulsi leaves is ursolic acid and it has been reported that it possess anti-fertility effect. This effect has been attributed to its anti-estrogenic activity which may be responsible for arrest of spermatogenesis in males and due to inhibitory effect on implantation of ovum in females. This constituent may prove to be a promising anti-fertility agent devoid of side effects. In males, Tulsi leaves reduce spermatogenesis by retarding sertoli cells activity [28]. The leaves of *O. canum* have been shown to possess anti-implantation activity in experimental albino rats. Ursolic acid is responsible for its anti-sterility property [1]. Tulsi leaves have antifertility action [29] as well. Benzene extract of *O. sanctum* in albino rats decreases the total sperm count and sperm motility [29].

**Stress relieving agents**

Stress is a common phenomenon that is experienced by every individual. Stress is defined as "non specific result of any demand upon the body". Stress can be either physical or psychological. When stress becomes extreme, it is harmful for the body and, hence, needs to be treated. Stress is involved in the pathogenesis of a variety of diseases that includes psychiatric disorders such as depression and anxiety, immunosuppression, endocrine disorders including diabetes mellitus, male impotence, cognitive dysfunction, peptic ulcer, hypertension and ulcerative colitis. Tulsi is an excellent rejuvenator, which has been known to help reduce stress, relax the mind and assist the body in improving memory. Tulsi has antihypoxic effect and it increases the survival time during anoxic stress [30]. A study conducted with rabbits has suggested that Tulsi decreased oxidative stress [31]. Tulsi leaves are regarded as an 'adaptogen' or anti-stress agent. Recent studies have shown that the leaves afford significant protection against stress [32]. If taken twice a day, Tulsi is a powerful calming herb. It also counteracts many troublesome effects of chronic stress, including nervousness, sleeplessness, and digestive disorders. Animal research has verified that extracts of Tulsi leaves prevented changes in plasma levels of the stress hormone corticosterone induced by both acute and chronic noise stress.

**As an immunomodulatory agent**

Tulsi strengthens the immune response by enhancing both cellular and humoral immunity. It shows anti-inflammatory action akin to aspirin but doesn’t show any side effects. It reduces the pain and dangerous inflammation that leads to arthritis. Studies conducted on Freund’s adjuvant induced arthritis, formaldehyde-induced arthritis and also turpentine oil-induced joint edema in rats have shown that oil of Tulsi decreased significantly the symptoms of arthritis and edema [33]. Fixed oil of Ocimum sanctum (Labiatae) was found to possess significant anti-inflammatory activity against carrageenan- and different other mediator-induced paw edema in rats. Ocimum sanctum may be a useful anti-inflammatory agent which blocks both
the pathways, i.e. cyclooxygenase and lipoxygenase of arachidonic acid metabolism.

Conclusion

Conclusions

There are many herbal plants in the world but the Ocimum sanctum (Tulsi) is considered to be the queen of herbs due to its greater medicinal values. It is well documented in the Hindu mythology about the Tulsi. Considering the health beneficial effects of Tulsi our ancestors in India insisted to plant a Tulsi sapling in everyone’s house. Keeping the various medical benefits in view, investigations are called for to be attempted towards purifications of Tulsi components and their characterization in terms of chemical natures and bio-pharmacological activities. Probably, such natural components might prove to be potentially beneficial but comparatively less toxic. Eventually, plants belonging to Ocimum genus could contribute a lot towards economy and healthy problem.

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Authors

Sarika amdekar
P.h.D. Scholar, Barkatullah University Bhopal(M.P) India
462026.
Omparakash Verma
National JALMA Institute for Leprosy and other Mycobacterial Diseases Tajganj Agra(U.P.) India
2610002.
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