

Tulsi: The Indian holy power plant

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Abstract

Tulsi (Ocimum sanctum Linn.) herb has been known from as early as the Vedic period. Its extract has numerous pharmacological activities like hypoglycaemic, immunomodulatory, antistress, analgesic, antipyretic, anti-inflammatory, anti-ulcerogenic, antihypertensive, CNS depressant, radioprotective, antitumour and antibacterial. The active constituents of the herb include volatile oil chiefly eugenol and β -caryophyllene, flavonoids and a number of other components present in fixed oil. This article outlines the present knowledge of pharmacological and other studies on this plant.

Keywords: *Ocimum sanctum*, Tulsi, Holy Basil, Medicinal plant, Antimicrobial, Hypoglycaemic, Hypolipidemic, Immunomodulatory, Anti-stress, Antioxidant, Anti-inflammatory, Anti-ulcerogenic, Chemopreventive.

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Introduction

Plants are one of the most important source of medicines. Among them *Ocimum* species belonging to the family Lamiaceae are very important for their therapeutic potentials. *Ocimum sanctum Linn.* (*Tulsi*), *O. gratissimum Linn.* (*Ram Tulsi*), *O. canum Sims* (*Dulal Tulsi*), *O. basilicum Linn.* (*Ban Tulsi*), *O. kilimandscharicum Guerke* (*Camphor Basil*), *O. americanum Linn.* (*Hoary Basil*) and *O. micranthum Willd.* are examples of known important species. Among them Holy Basil, *Ocimum sanctum* has been well documented for its therapeutic potential¹.

Tulsi is a fragrant bushy perennial growing up to 1.5 m in height with profusions of white blooms and slightly purple tinted foliage. This herb has been known from as early as the Vedic period and is held sacred by the Hindus

and is often planted around temples and used in rosaries. It is native to India, reached Western Europe in the 16th century. In several ancient systems of medicine including Ayurveda, Greek, Roman, Siddha and Unani, *O. sanctum* has vast number of therapeutic applications such as in cardiopathy, haemopathy, leucoderma, asthma, bronchitis, catarrhal fever, otalgia, hepatopathy, vomiting, lumbago, hiccups, ophthalmia, gastropathy, genitourinary disorders, ringworm, verminosis and skin diseases, etc. It is commonly used in cough, cold, mild indigestion, diminished appetite and malaise. The only side effect reported is constipation.

Medicinal Properties

Hypoglycaemic and Hypolipidemic activity

O. sanctum has numerous pharmacological activities. Oral



Tulsi plant

administration of alcoholic extract of leaves led to marked lowering of blood sugar level in normal, glucose fed hyperglycaemic and streptozotocin induced diabetic rats². It might potentially regulate corticosteroid-induced diabetes mellitus³. Halder *et al* demonstrated anti-cataract activity *in vitro* which could be related with its aldose reductase inhibitory effect⁴. But Vats *et al* failed to demonstrate any anti-cataract effect in spite of significant antihyperglycaemic activity⁵. Sharma *et al* suggested that it delays the process of cataractogenesis in galactosaemic cataract⁶. The higher doses are more effective and have no promising prophylactic role rather than curative one. In addition to the hypoglycaemic, hypolipidemic effect of *tulsi* in diabetic rats was also indicated⁷. Sarkar *et al* demonstrated that administration of fresh leaves of *tulsi* mixed in diet resulted in significant lowering in serum total cholesterol, triglyceride, phospholipid and LDL-cholesterol levels, and significant increase in the HDL-cholesterol and total faecal sterol contents⁸.

Its fixed oil can inhibit enhancement of the vascular/capillary permeability and leukocyte migration following inflammatory stimulus⁹. Long-term feeding offers significant protection against isoproterenol-induced myocardial necrosis in Wistar rats through enhancement of endogenous antioxidants¹⁰. It may be of therapeutic and prophylactic value in the treatment of myocardial infarction¹¹. Aqueous extract feeding also provided significant liver and aortic tissue protection from hypercholesterolemia-induced peroxidative damage¹².

Immunomodulatory activity

The seed oil can modulate both humoral and cell-mediated immune responsiveness and these immunomodulatory effects¹³ may be mediated by GABAergic pathways¹⁴. Godhwani *et al* indicated an immunostimulant capability, which may be contributory in explaining the adaptogenic action of the plant¹⁵. A methanol extract and an aqueous suspension can inhibit acute as well as chronic inflammation in rats as tested by carragenan-induced pedal edema and croton oil-induced granuloma and exudate, respectively¹⁶. Maity *et al* also observed central nervous system stimulant and/or antistress activity¹⁷. Sharma *et al* found that oral administration provides protection against mercuric chloride (HgCl₂) induced toxicity in Swiss albino mice¹⁸.

Ahmed *et al* suggested anti-androgenic property of its leaves¹⁹. Ethanol and chloroform extractives of stem, leaf and stem calli were found effective in

preventing tonic convulsions induced by transcorneal electroshock²⁰. The analgesic action is exerted both centrally as well as peripherally and involves interplay between various neurotransmitter systems²¹.

Antimicrobial activity

The narrowest spectrum of antibacterial activity was observed in *O. sanctum*²². The crude aqueous extract of leaf possesses some antibacterial and immunomodulatory active principles¹⁵. *Neisseria gonorrhoeae* clinical isolates and WHO strains were found to be sensitive to extracts²³. Aqueous extract of the plant showed growth inhibition for *Klebsiella*, *Escherichia coli*, *Proteus* and *Staphylococcus aureus*. Alcoholic extract showed growth inhibition for *Vibrio cholerae*²⁴. The ethanolic extracts from the leaves showed better activity against the β -lactamase producing methicillin-resistant *Staphylococcus aureus* strains²⁵. The essential oil also showed potent anthelmintic activity in the *Caenorhabditis elegans* model²⁶.

Anti-ulcer activity

Holy basil is reported to possess potent anti-ulcerogenic as well as ulcer-healing properties^{27, 28} and it is due to its ability to reduce acid secretion and increase mucous secretion²⁸. The fixed oil of *tulsi* was found to possess significant anti-ulcer activity against Aspirin-, Indomethacin-, alcohol-, histamine-, reserpine-, serotonin- and stress-induced ulceration in experimental animal models. Significant inhibition was also observed

in gastric secretion and Aspirin-induced gastric ulceration in pylorus ligated rats. The lipoxygenase inhibitory, histamine antagonistic and antisecretory effects of the oil could probably have contributed towards anti-ulcer activity²⁹.

Antioxidant activity

It has significant ability to scavenge highly reactive free radicals³⁰. Antioxidant bioassay-directed extraction of the fresh leaves and stems of *tulsi* extract yielded: cirsilin, cirsimaritin, isothymusin, isothymonin, apigenin, rosmarinic acid and appreciable quantities of eugenol. Eugenol is a major component of the volatile oil, and other compounds also demonstrated good antioxidant activity³¹.

Anti-inflammatory activity

Gas liquid chromatographic analysis of fixed oil of *O. sanctum* revealed the presence of five fatty acids (stearic, palmitic, oleic, linoleic and linolenic acids). The triglyceride fraction of the oil showed higher protection compared to fixed oil against carragenan-induced paw edema and acetic acid-induced writhings in rats and mice, respectively³². Linolenic acid present in *O. sanctum* fixed oil has the capacity to block both the cyclo-oxygenase and lipoxygenase pathways of arachidonate metabolism and could be responsible for the anti-inflammatory activity of the oil³³⁻³⁵.

Antistress activity

Treatment of animals with ethanol extract prevents the changes in

plasma level of corticosterone induced by exposure to both acute and chronic noise stress, indicating the anti-stress property against noise³⁶.

Chemopreventive and radioprotective activity

Oral treatment with the leaf extract significantly elevated the activities of cytochrome p-450, cytochrome b5, aryl hydrocarbon hydroxylase and glutathione S-transferase in the liver, all of which are important in the detoxification of carcinogens as well as mutagens³⁷. Karthikeyan *et al* suggested that the orally administered extract of *O. sanctum* may have the ability to prevent the early events of 7,12-dimethylbenz (a) anthracene (DMBA) induced carcinogenesis³⁸. Chemopreventive property of the ethanol extract of the leaves on DMBA-induced skin papillomagenesis in male Swiss albino mice was reported by Prashar *et al*³⁹. A significant reduction in the tumour incidence, average number of tumours per tumour bearing mice and the cumulative number of papillomas was observed in mice treated topically with the leaf extract. Prashar *et al* suggested that its leaf extract blocks or suppresses the events associated with chemical carcinogenesis by inhibiting metabolic activation of the carcinogen⁴⁰. Prakash and Gupta concluded that the potential chemopreventive activity of seed oil is partly attributable to its antioxidant properties⁴¹.

Orientin (Ot) and Vicenin (Vc), two water-soluble flavonoids isolated from the leaves of *O. sanctum* have shown significant protection against radiation lethality and chromosomal aberrations *in*

vivo. Both the compounds showed significant protection to the human lymphocytes against the clastogenic effect of radiation at low, non-toxic concentrations. The radioprotection seems to be associated with their antioxidant activity^{42, 43}.

Other medicinal properties

It possesses cognition-enhancing properties and significantly prevents hypoperfusion-induced functional and structural disturbances³⁰. It is also antithyroidic in nature⁴⁴.

Conclusion

Tulsi has been widely used for curing various ailments due to its great therapeutic potentials. A number of pharmacological effects like hypoglycaemic, immunomodulatory, antistress, anti-inflammatory, anti-ulcerogenic, anti-hypertensive, CNS depressant, radioprotective, antitumour and antimicrobial of *O. sanctum* have been studied by various workers. These studies help in establishing a scientific basis for therapeutic uses of the plant. However, much more studies are still required to explore other potential activities of this plant.

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