
Tulsi: The Pharmacological significance

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ABSTRACT

The "Tulsi" plant or Indian basil occupies an important place in the Indian population. The plant grows in the wild in the tropics and other warm regions. The study followed an exhaustive literature survey and further concluded its uses in edibles as well as in therapeutic formulations. Leaves of Tulsi was found to be used in various pathological conditions like cough, respiratory disorders, eye disorders, depression & fever. Traditionally, tulsi is consumed as many practices like in dried powder, herbal tea and fresh leaf and/or mixed with ghee. Essential oil obtained from "Karpooratulasi" is commonly used for medicinal values as well as in herbal cosmetics. The active chemical constituents found in tulsi are eugenol, ursolic acid, oleanolic acid, rosmarinic acid, carvacrol, linalool & β -caryophyllene.

Keywords: Tulsi, Pharmacological properties

Introduction

Ocimum tenuiflorum (synonym *Ocimum sanctum*), also known as holy basil or "Tulsi" is an aromatic plant belonging to family *Lamiaceae*. [1,2] The plant is native to Indian subcontinent and widely distributed and cultivated throughout the South-east Asian's tropics tropical regions. Tulsi is cultivated for its spiritual as well as medicinal determinations and for the essential oils it contains. In the Indian subcontinent it is widely known as herbal tea and frequently consumed in Ayurveda having an important role. The variety of *Ocimum tenuiflorum* used in Thai-cuisine is called Thai-holy basil. [3, 4]

Distribution: DNA barcodes of various biogeographically isolated tulsi within Indian subcontinent are now existing. In a large-scale study of this species accompanied using chloroplast genome sequences, have proved the plant's originating from North Central India. [5] The finding might put forward the progression that the tulsi is associated with the ethnic migratory patterns within the Indian subcontinent. [6]

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Morphology: Holy basil is a straight, with branched sub-shrub 30–60 cm in size tall carrying the hairy stems. Leaves are green and purplish in color, oval shaped with almost 5 cm long blade usually having a considerably ragged margins. [7,8] They are strongly scented having a decussate arrangement of leaves on an axis or stem. The purple color's flowers are arranged in adjacent whorls on elongated racemes. The two main species cultivated in India as well as in Nepal with green leaves is known as Sri or Lakshmi tulsi and those with purple leaves are abbreviated as Krishna tulsi. [9, 10]

Chemical constituents: The active chemical constituents found in tulsi are eugenol, ursolic acid, oleanolic acid, rosmarinic acid, carvacrol, linalool & β -caryophyllene. The essential oil present in Tulsi has been found to contain mostly eugenol almost 71%, β -elemene likely to be 10.0%, β -caryophyllene 7% & germacrene 3% with the presence of various trace compounds amongst which terpenes are mostly abundant. Isolated plant extracts have been reported some antibacterial activity against *P. aeruginosa*, *E. coli* & *S. aureus*. [11, 12]

Pharmacological properties

Effective in dental plaque & gingival inflammation: *Ocimum sanctum* has been found with good effectiveness in dental anti-caries. P. Agarwal et al. studied *Ocimum sanctum* extract (4%

concentration) an antibacterial agent against bacterial flora of the oral cavity and found effective.[13] In another study *Ocimum sanctum* was attaining analogous effect on plaque & gingivitis when compared with Chlorhexidine without any significant side effect. The stem as well as leaves of the plant contained the diversity of constituents responsible for anti-bacterial activity. Saponins, triterpenoids, flavonoids & tannins forming high molecular weight complexes with soluble proteins in the saliva, increase bacterial breakdown upon the tooth surface & saliva as well as also interfered with bacterial adherence mechanisms on tooth surfaces. [14, 15]

Antibacterial properties: Singh et. al. suggested that higher content of linoleic acid in *O. sanctum* L. and showed good antibacterial activity against *Staphylococcus aureus*, *Bacillus pumius* & *Pseudomonas aeruginosa* amongst *S. aureus* was found to be the most sensitive organism. In another study it was observed that the aqueous extract of *O. sanctum* L. (60 mg/kg) showed wider zones of inhibition against *Klebsiella*, *E. coli*, *Proteus*, *S. aureus* & *Candida albicans* using agar diffusion technique.[16] Alcoholic plant extract illustrated the wider zone of inhibition for *Vibrio cholera*. It has also been reported that ether extract of the leaves of *O. sanctum* possessed antibacterial potential against *Escherichia coli*, *Staphylococcus aureus* & *Mycobacterium tuberculosis*. [17]

Ameliorative properties: *O. sanctum* has been reported for its ameliorative potential. In an experimental study. Histological & morphological observations indicated hepatoprotective potential of *Ocimum sanctum* against meloxicam toxicity (low dose level) in rats. Stomach and intestinal sections from rats receiving meloxicam & extract did not show any microscopic lesions whereas gastric hemorrhages & intestinal ulceration due to meloxicam toxicity were significantly developed in rats receiving only meloxicam. [18]

Another study also reported that *Ocimum sanctum* possessed antitumorogenic potential against aspirin induced in rats. Clinical symptoms like diarrhoea appeared during meloxicam administration, did not appear in the rats administered with *Ocimum sanctum* extract along with meloxicam. Meloxicam alone also elevated the serum biochemical levels, whereas those of *Ocimum sanctum* treated rats were found with unchanged biochemical parameters, indicating its protective action.[19, 20]

Antidiabetic properties: *O. sanctum* has also been reported to possess excellent anti-diabetic

potential. Hydroalcoholic extract of the plant was found to be significant (250 and 500 mg/kg) against streptozotocin & nicotimanide induced diabetes in rats when compared with glibenclamide. Hyperglycaemia was reduced in alloxan diabetic rats when administered ethanol extract of *O. sanctum* in both acute & long-term feeding studies. In another study by J M AHannan et. al. noted the prominent insulin-secretory effects in the pancreas of rats with the ethanol and three partition (ethylacetate, butanol and aqueous fractions) extract of *O. sanctum*. Similar effects were also found in an acute insulin release study using isolated rat islets. [21, 22]

Genoprotective properties: Identification and consequent genoprotectant use could prove beneficial in occupational and therapeutic settings where genotoxic chemicals are exposed. An investigation conceded genoprotective effects of *O. sanctum* indicating that the pre-treatment of rats with *O. sanctum* extract (50 mg/kg) every day for 21 consecutive days possessed significant effects in the mitotic index (MI) depression by chlorpyrifos as standard. *O. sanctum* had also been reported to have a genoprotective effect on the chromosomal aberrations. *O. sanctum* extract also caused a significant decrease in chromosomal aberrations (CA%) in in vitro lymphocyte cultures. The genoprotective effect of *O. sanctum* was hypothesized to be associated with the presence of flavonoids i.e. orientin & vicenin, which is responsible for scavenging reactive intermediates, capable of binding to proteins and DNA. [23]

Hepatoprotective properties: In an experimental study, *O. sanctum* extract was found to be greatly effective as hepatoprotective potential. In this study administration of the alcoholic leaves extract of *ocimum sanctum* exhibited significant hepatoprotective potential in terms of improvement in LFT's including histopathological diagnosis.[24] Synergistic effect was observed when *O. sanctum* extract & Silymarin were simultaneously administered. *O. sanctum* extract alone showed better hepatoprotection than simultaneous administration of *O. sanctum* extract with Silymarin. In another investigation it was observed that values of serum enzyme were significantly reduced in animals those administered *O. sanctum* extract & paracetamol than those given paracetamol alone. The study indicated the lesser magnitude of degree of hepatic cell damage in *O. sanctum* extract treated group. [25]

Memory booster properties: *Ocimum sanctum* possessed nootropic & anticonvulsant potential. Harshad O. et.al. reported the memory boosting effect of *O. sanctum* along with *Phyllanthusemblica* & *Tinosporacordifolia*. It was further considered that plant drugs had potential to reverse cyclosporine induced memory deficit. This effect of the plant drugs was also found to be comparable to the drugs in trend. In case of cyclosporine induced amnesia, the effect was found to be better than piracetam. In another study *Ocimum sanctum* extract exhibited potent memory improving activity on Zonisamide-induced cognitive impairment when studied in mice with co-administering of extract & Piracetam. The adverse effect produced by Zonisamide could be minimized to a superior extent without compromising to its antiepileptic potency. [26, 27]

Alzheimer's disease: M. Raghavendra et. al. noted "beneficial effects of the standardized extract of *O. sanctum* in ibotenic acid and colchicine induced Alzheimer's Disease in rats. Cognitive deficit induced by these neurotoxins was significantly reduced by *O. sanctum* in rats. Rats pre-treated with *O. sanctum* extract showed improved spatial memory performance and also better consolidation of memory. It was also noted that in addition to improving the cognition, *O. sanctum* also facilitated acquisition of new information. *O. sanctum* treatment significantly attenuated the effects of ibotenic acid & colchicine on lipid peroxidation. *O. sanctum* pre-treatment from day 7 to day 28 significantly protected neurotoxin-induced oxidative stress which plays a key role in AD-associated cell death. [28]

Antipyretic activity: Fixed oil of *O. sanctum* was evaluated for antipyretic activity by testing it against typhoid-paratyphoid A/B vaccine-induced pyrexia in rats. The oil on intraperitoneal administration considerably reduced the febrile response indicating its antipyretic activity. The antipyretic activity of the oil at a dose of 3 ml/kg, was comparable to aspirin. Further, the fixed oil possessed prostaglandin inhibitory activity and the same could explain its antipyretic activity. [29]

Anti-coagulant property: The intraperitoneal administration of *O. sanctum* fixed oil at a dose of 3 ml/kg prolonged blood clotting time. This effect was comparable to that obtained with 100 mg/kg aspirin. Anti-aggregator action of oil on platelets can be responsible for this effect. [30]

Radioprotective activity: Subramanian M. et. al. reported a new polysaccharide (OSP) from *O.*

sanctum as an efficient water soluble antioxidants that could prevent oxidative damages to lipids, DNA & splenocytes caused by various oxidation inducers. The activity was specific for OSP and could be attributed to its ability to scavenge various reactive oxygen species. They also noted that addition of OSP in increasing concentrations to the DNA, prior to irradiation, progressively reduced the intensity damage to DNA. It was also observed that addition of OSP prior to irradiation could provide good protection to the mouse cells against radiation induced lethality. Orientin & vicenin, two water-soluble flavonoids isolated from the leaves of *O. sanctum*, have shown significant protection against radiation-induced lethality and chromosomal aberrations in vivo. [31]

5 Effect on testicular function: Jyoti et. al. noted a significant decrease in sperm count in the rabbits on oral supplementation with 2 g fresh leaves of *O. sanctum* daily for 30 days. A marked increase in serum testosterone level was observed in *O. sanctum* treated rabbits [49]. Another study reported significant decrease in sperm count and motility on long term feeding of *O. sanctum* leaves. It was also noted that there was decrease in the weight of testes, epididymis, seminal vesicle, and ventral prostate after long-term feeding of *O. sanctum* leaves. Reghunandan et. al. reported a significant decrease in sperm count after 48 hours of intraperitoneal administration of *O. sanctum* extract at a dose of 300 mg/Kg body weight. [32]

Anticancer properties: Bhartiya et al indicated that the pre-treatment with *O. sanctum* extract at a dose of 40 mg/kg, for 15 days in radioiodine-exposed mice showed significant reduction in lipid peroxidation in both kidney and salivary glands and in liver. Reduction in glutathione (GSH) levels, which was significant reduction after radiation exposure, was also reduced on pre-treatment with *O. sanctum*. It was also reported that ethanolic extracts of *Ocimum sanctum* is cytotoxic to mouse Lewis lung carcinoma (LLC) cells and it also reduced the number of tumor nodule formation in LLC-injected mice. [33]

Anti-cataract effect: P. Sharma et. al. concluded that *O. sanctum* can delay as well as arrest the progress of cataractogenesis. The effect is more with higher doses. They also concluded that that daily consumption of *O. sanctum* may delay emergence of lenticular opacity. It has got promising prophylactic role and is more clear in galactosaemic cataract which is more close to diabetic cataract. Prevention of cataract may be

through a mechanism involving free radical scavenging and preventing lipid peroxidation. *O. sanctum* is also reported to have hypoglycaemic activity. This may help in arresting diabetic cataract process. [34]

Effective in oral submucous fibrosis: Srivastava A. et. al. found that paste of *O. sanctum* & turmeric in equal proportion in glycerine applied all over the oral mucosa for 15 minutes for 3 to 4 times daily was helpful in relieving the symptoms of oral submucous fibrosis (OSMF). Synergistic action of these two herbs results in higher efficacy and highly potent anti-OSMF treatment. Treatment with these drugs produces an early, sustained and significant fall in burning sensation, clinically and statistically as soon as one month." Mouth opening was also significantly improved. Results were better in severe cases reflecting its higher efficacy. [35]

Conclusion: The study concluded the various psychological & physiological advantages from consumption as edible till the prevention & treatment of various diseases with the use of holy Tulsi plant. Tulsi is a legendary herb which has been used for ages due to its religious and medicinal values. Its use in preventing diseases, protecting the food grains and treating the diseases makes it a favorite in almost every Indian family. It is used to treat day to day diseases like cough and cold, and is worshipped and used in many Hindu rituals. A store house of a variety of bioactive molecules and nutrients, it possesses a wide range of pharmacological properties and thus can be hope for the future in the preventive and curative medicine. It's very special properties like protection from cancer, radioprotection and insulin secretory effects can prove to be a blessing for the modern day society.

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