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Pharmacological Properties Of Tulsi: A Review

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ABSTRACT

Tulsi is very useful herb because of the wide range of properties it possesses. In addition to being considered as a holy plant, it is used for its medicinal values for thousands of years by the people all over the globe. The traditional healers use the plant for various ailments. In Ayurveda, tulsi is considered to pacify *kapha-vata* and vitiate *pitta*, and is used in the treatment of various disorders viz. respiratory tract diseases, fevers, eye diseases and depression. Recent research authenticates the claims of Ayurveda regarding pharmacological properties of the plant. Various studies conducted to study and establish the pharmacological properties of tulsi show that it has numerous pharmacological properties, many of which, like radioprotection and anticancer, can prove to be very important for the human race in this age of industrialization.

INTRODUCTION

Tulsi has been considered as sacred and medicinal plant in ancient Indian literature. The name *Tulsi*, which means "the matchless," has been derived from Sanskrit language; and the Latin name of the plant is *Ocimum sanctum* (Linn), and it belongs to family Lamiaceae. On religious grounds *tulsi* finds its place in almost every Indian home. It is worshipped very religiously and finds its use in many Hindu rituals. It is also known as *Vishnupriya* because it is supposed to please Lord Vishnu. Its English name is Holy basil. Other than its religious value, it has long been used traditionally for its medicinal uses. It is a popular home remedy for bronchitis, catarrhal fever, hiccough, ophthalmic disorders, gastric disorders, liver diseases, lumbago, sciatica, wounds, psychosomatic stress disorders and genitourinary disorders[1,2]. *Tulsi* is cultivated throughout India, though the plant grows in wild in the tropics and the wild regions. Two types of the plant have been described, the *vanya* (wild) and the *gramya* (grown at home).

Tulsi (Ocimum sanctum) is branched sub-shrub, is erect and attains a height of 30-60 cm. It has a hairy stem with simple opposite, elliptic, oblong, obtuse or acute green or purple leaves which are strongly scented. Its flowers are small, purplish, arranged in elongate racemes in close whorls. Fruits small and the seeds are reddish-yellow in colour. The plant is bitter and acrid[2,3]. Dried leaves of *tulsi* have been used for centuries to repel insects from stored food grains by mixing them with the food grains[4].

Paste of leaves of *tulsi* with *maricha* (Piper nigrum) powder is very useful in ringworm manifestation on topical application. Chewing the leaves of *tulsi* mitigates the infections of the gums. Ears aches are well relieved by instillation of fresh juice of fresh leaves. Instillation of fresh juice in nostrils relieves sinusitis and headache. Massage with juice of fresh leaves improves sensation of skin by improving the circulation beneath the skin. Tea prepared with leaves is very common and effective household remedy for cough, cold, indigestion and reduced appetite. Seeds of *tulsi* soaked overnight in water to which sugar is added, when

consumed in morning are beneficial in diarrhoea[5]. Whole plant, including roots, leaves and seeds is used for medicinal uses[6].

As per Ayurvedic concept it has been mentioned to pacify *kapha vata*, vitiates *pitta*, and is helpful in treatment of *hikka, kaas*, dysponea, pleurodynea, eliminates fetor and is detoxifying[7]. It has also been mentioned as curative of *shwas[8], krimi* and is good appetizer and digestive-stimulant[9]. Basil cures *kushtha*, dysurea, blood disorders and is good for heart health[10]. It is also useful in *ashmari* and eye diseases[11]. It has been advised to use *tulsi* with honey in *kaphaj kaas[12]*. In acute *netrakopa, swaras* of *tulsi* along with honey should be applied as *anjan[13]*.
Milk should not be consumed with or soon after taking *tulsi* because these two are mutually *viruddha* (incompatible) and may produce skin disorders if consumed together[14].

HEALTH BENEFITS OF TULSI

Various uses of the holy basil are as follows.

1. Cough:
As it possesses potent expectorant property, it is important constituent of many Ayurvedic cough syrups. It helps to mobilize mucous in bronchitis and asthma. Decoction of *tulsi* leaves or even chewing some *tulsi* leaves can prevent and treat flu. *Tulsi* is an important constituent of *Mukta panchamrit Ras* used to treat cough and cold[15].

2. Respiratory Disorders:
Decoction of *tulsi* leaves with honey and ginger juice is an excellent remedy for influenza, bronchitis, asthma and cough and cold.

3. Eye Disorders:
Muktadi Mahanjana prepared from various herbs including *tulsi* is used in Ayurvedic treatment of *pittaj* eye disorders such as corneal ulcer, cataract, pterygium etc[16].

4. Depression:
Tulsi has been used in depression and other psychiatric disorders. *Manasmitra vatkam,* which contains *tulsi*, is used for depression, lack of sleep and other psychiatric disorders[17].

5. Fever:
Tulsi is used to treat fever. *Tribhuvankirti ras[18]* which is processed in juice of *tulsi* is used to treat fever.

PHARMACOLOGICAL PROPERTIES OF *TULSI:*

1. Effective in dental plaque and gingival inflammation:
Ocimum sanctum has demonstrated good efficacy as an anti-caries agent[19,20]. P. Agarwal *et al.* observed that *Ocimum sanctum* extract at 4% concentration was optimum as an antibacterial agent against bacterial flora of the oral cavity[19]. In another study *Ocimum sanctum* has demonstrated similar effect on plaque and gingivitis when compared with the Chlorhexidine without the side effects of the latter[21]**.** The stem and leaves of *Ocimum sanctum* contain a variety of constituents
that may have anti-bacterial activity, including saponins, flavonoids, triterpenoids and tannins that form high molecular weight complexes with soluble proteins in saliva, increase bacterial lysis on the tooth surface and saliva, and also interfere with bacterial adherence mechanisms on tooth surfaces[22,23].

2. Antibacterial properties:
O. sanctum has demonstrated anti-gonorrheal efficacy against multiresistant strains of *Neisseria gonorrhea[23]*. Agarwal P, Nagesh L, Murlikrishnan demonstrated the antibacterial property of *O. sanctum* against *Streptococcus mutans*. They observed the maximum antibacterial potential at the 4% concentration which was as effective as 0.2% Chlorhexidine and Listerine in reducing the levels of *Streptococcus mutans*[19]. In another study it has shown its antimicrobial property against *S. mutans, S. aureus* and *E.*

faecalis[24]. Singh et al[25] in his study suggested that higher content of linoleic acid in *O. sanctum* L. fixed oil shows good antibacterial activity against *Staphylococcus aureus, Bacillus pumius* and *Pseudomonas aeruginosa,* where *S. aureus* was the most sensitive organism. In another study it was observed that the aqueous extract of *O. sanctum* L. at a dose of 60 mg/kg show wide zones of inhibition against *Klebsiella, E. coli, Proteus, S. aureus* and *Candida albicans* when studied by agar diffusion method. Alcoholic extract showed wider zone of inhibition for *Vibrio cholerae*[26]. It has also been reported that ether extract of the leaves of *O. sanctum* possesses antibacterial activity against *Escherichia coli, Staphylococcus aureus,* and *Mycobacterium tuberculosis*[27,28].

3. Ameliorative properties:

O. sanctum is reported to possess ameliorative properties. In an experimental study, histomorphological observations from rats administered *O. sanctum* and meloxicam indicated hepatoprotective role of *Ocimum sanctum* against meloxicam toxicity at low dose level and thus confirmed the hepatoprotective action of *Ocimum sanctum*. In the same study it was also found that the stomach and intestinal sections from rats receiving meloxicam and extract of *Ocimum sanctum* did not show any microscopic lesions in the stomach and intestine, where as gastric hemorrhages and intestinal ulceration due to meloxicam toxicity were seen in the rats receiving meloxicam alone[29]. In another study it was reported that *Ocimum sanctum* has anitulcerogenic properties against ulcerations induced by aspirin in rats[30]. It was reported that clinical symptoms like diarrhoea which appeared during meloxicam administration, did not appear in the rats which were given *Ocimum sanctum* along with meloxicam. Serum biochemical parameters of rats given meloxicam alone were elevated, whereas those of *Ocimum sanctum* treated rats were not elevated, indicating its protective action[29].

4. Antidiabetic propertis:

O. sanctum has been reported to possess very good anti diabetic properties. The anti-diabetic activity of hydroalcoholic extract of *O. tenuiflorum* against streptozotocin and nicotimanide induced diabetes in rats was found to be significant at the dose levels of 250 and 500 mg/kg body weight and this effect was comparable with glibenclamide[31]. Hyperglycaemia was shown to be reduced in alloxan diabetic rats when administered ethanol extract of *O. sanctum* in both acute and long-term feeding studies[32]. In another study by J M A Hannan *et. al.* prominent insulin-secretory effects were noted in the rat pancreas perfused with the ethanol extract and three partition (ethylacetate, butanol and aqueous) fractions of *O. sanctum*. Similar effects were found in acute insulin-release studies using isolated rat islets[33].

5. Genoprotective properties:

Identification and subsequent use genoprotectant could prove useful in occupational and therapeutic settings where genotoxic chemicals are used or where exposure occurs. An investigation carried out to study genoprotective effects of *O. sanctum* indicates that the pre-treatment of rats with *O. sanctum* extract at 50 mg/kg per day for 21 days has a significant positive effect in the mitotic index (MI) depression caused by chlorpyrifos. *O. sanctum* also had a genoprotective effect on the chromosomal aberrations (CA%). It was also found out that *O. sanctum* extract caused a significant decrease in CA% in *in vitro* lymphocyte cultures[34]. The genoprotective effect of *O. sanctum* is associated with the presence of its flavonoids, such as orientin and vicenin, which take part in scavenging reactive intermediates that are capable of binding to proteins and DNA[35].

6. Hepatoprotective properties:

In an experimental study, *O. sanctum* extract was found highly effective as hepatoprotective. In this study administration of the alcoholic extract of *ocimum sanctum* leaves showed significant hepatoprotective activity in terms of improvement in LTF's and the histopathological examination. Synergistic effect was seen when *O. sanctum* extract and Silymarin were administered together. Better hepatoprotection was seen with *O. sanctum* extract alone than the simultaneous use *O. sanctum* extract and Silymarin.[36]. In another investigation it was observed that values of serum enzyme were significantly reduced in animals receiving *O. sanctum* extract and paracetamol than those given paracetamol alone indicating that the degree of hepatic cell damage was of lesser magnitude in *O. sanctum* extract treated group[37].

7. Memory booster properties:

Ocimum sanctum possesses nootropic as well as anticonvulsant activity[38]. Harshad O. Malve *et.al.* reported the memory enhancing effect of *O. sanctum* along with *Phyllanthus emblica* and *Tinospora cordifolia.* It was noted that plant drugs could reverse the cyclosporine induced memory impairment. This effect of the plant drugs was also found to be comparable to the modern agents. In the cyclosporine induced amnesia the effect was better than piracetam[39.] In another study *Ocimum sanctum* extract have demonstrated potent memory improving activity on Zonisamide-induced cognitive impairment in mice. By co-administering OS and Piracetam, the adverse effect produced by Zonisamide can be minimized to a greater extent without compromising on its antiepileptic potency[40]. Dokania *et al. (*2011)[41] revealed that there was enhancement of memory in mice when intraperitoneal injection of *O. sanctum* water extract was given and they proposed that this effect might be due to its antioxidant activity. Hydroalcoholic extract of *O. sanctum* has also been reported to enhance memory in restraint stress induced memory impaired rats[42]. In another study on *Ocimum basilicum* extract, it was concluded that antioxidants such as terpenoids, flavonoids and tannins, and their property to scavenge reactive oxygen species can be responsible for improvement of memory retention and retrieval[43].

8. 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 and 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[44].

9. 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[45].

10. 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[46].

11. Radioprotective activity:

Mahesh Subramanian *et. al.* reported a new polysaccharide (OSP) from *O. sanctum* as an efficient water soluble antioxidants that can prevent oxidative damages to lipids, DNA and splencocytes 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 γ -radiation induced lethality[47]. Orientin and 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[48].

12. 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[50]. Reghunandanan *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[51].

13. Anticancer properties:

Study by Bhartiya US *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*[52]. 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[53].

14. 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[54]. Prevention of cataract may be through a mechanism involving free radical scavenging and preventing lipid peroxidation[55]. *O. sanctum* is also reported to have hypoglycaemic activity[32]. This may help in arresting diabetic cataract process.

15. Effective in oral submucous fibrosis:

Adit Srivastava *et. al.* found that paste of *O. sanctum* and 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 sub mucous 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[56].

CONCLUSION:

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 favourite 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. Its very special properties like protection from cancer, radioprotection and insulin secretary effects can prove to be a blessing for the modern day society. Therefore further research is required to establish these pharmacological actions of tulsi so that the human is benefitted to the maximum.

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