

Review on Therapeutic uses of Tulsi with its Phytochemical Constituents in Different Kind of Extracts

Review Article

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Abstract

Herbal plants are considered the most significant source of medicines. These plants have been used as natural remedies since ancient times. Historically, the entire plant has been used to treat a wide range of illnesses. *Ocimum sanctum*, also known as Tulsi, is one of the most significant herbal herbs. In Indian culture, this plant is revered and employed for religious purposes. "The incomparable one" is the Sanskrit term from which the name Tulsi originates. The tulsi plant is not only used in ayurvedic medicines but also in other medicinal systems in Greek, Roman, and Unani. Apart from this, the Tulsi plant possesses different therapeutical properties due to the presence of several phytochemical constituents in its roots, stem, fruit, and leaves due to the presence of eugenol, vallinin, gallic acid, palmitic acid, oleic acid, linoleic acid, and many more. These phytochemicals are extracted from the plant and used to cure various types of diseases. Tulsi is reported to have properties like anti-ulcer, antioxidant, anti-inflammatory, anti-cancer, antidiabetic, anti-arthritis, analgesic, antistress, anti-asthmatic, antifertility, immunomodulatory, and neuroprotective activity, antimaterial activity, hepatoprotective properties, cardiac activity, antimicrobial, antidote, and wound healing activity.

Keywords: *OcimumSanctum*; *Ocimum tenuiflorum*; Phytochemicals and Theurapeutic Properties Etc

Introduction

Botanical Classification of Tulsi

Kingdom: Plantae; Division: Magnoliophyta; Class: Magnoliopsida; Order: Lamiales; Family: Lamiaceae; Genus: *Ocimum*; Species: *tenuiflorum* or *sanctum*

Botanical name: *Ocimum sanctum*; *Ocimum tenuiflorum* etc

The plants of the genus *Ocimum*, which are members of the Labiate family, are very significant due to their potential for therapeutic use among the recognized medicinal value of plants. Tulsi (*Ocimum sanctum* L.), Ram tulsi (*Ocimum gratissimum*), Dulal tulsi (*Ocimum canum*), Ban tulsi (*Ocimum basclicum*), kilimandschricum, Americanum, camphora, and micranthum are a few of the significant

species of the genus *Ocimum* that are known to have medicinal qualities and that grow throughout the world.

Common Name: *Ocimum sanctum*, Holy Basil, Devdandubhi, Apetrakshsi, Sulbha, Bahumanjri, Gauri, Bhutghani, Vrinda, Ared Tulsi, Gagger chettu, Karitulasi, Tulashi, Tulas, Kala Tulsi, Thai basil, Thiru Theezai, Sacred basil, Suvasa Tulsi, Dohsh, Tulasi, Krishna Tulsi, Krishnamul, Manjari Tulsi, Vishnu priya, St. Joseph's wort, Raihan, Shree Tulsi, Surasa etc.

Ocimum sanctum, a fragrant perennial plant in the Lamiaceae family, is also referred to as holy basil or Tulsi. It is indigenous to Australia, Malaysia, Asia, and the western Pacific, where it grows in tropical and subtropical climates. In the tropical regions of Southeast Asia, it is extensively grown. This plant has escaped

cultivation and become natural in a number of the Americas' tropical regions. This weed is both environmental and agricultural.

Tulsi is grown for its essential oil as well as for use in traditional medicine and religion. Holy basil plants or leaves are used in devotion by devotees in the Vaishnava style of Hinduism. It is also widely used as a herbal tea and frequently utilized in Ayurveda.

Traditional medicine practitioners use medicinal plants all around the world in their daily practices to treat a wide range of ailments. Different parts of *Ocimum sanctum* Linn, also known as Tulsi, such as leaves, flowers, stems, roots, seeds, and even the entire plant, are used in Indian traditional medicine systems to treat a variety of conditions, including bronchial asthma, bronchitis, malaria, diarrhea, dysentery, skin conditions, painful eye diseases, arthritis, chronic fever, insect bites, and more. Anticancer, antifertility, antidiabetic, antibacterial, antifungal, hepatoprotective, antiemetic, cardioprotective, antispasmodic, adaptogenic analgesic, and diaphoretic properties have also been attributed to *Ocimum sanctum* L. The primary active ingredient in tulsi, eugenol (1-hydroxy-2-methoxy-4-allylbenzene), has been determined to be primarily responsible for *Ocimum sanctum*'s medicinal properties. *Ocimum sanctum* L. has been used for a variety of ailments by traditional medical practitioners in India due to its great therapeutic potential and widespread occurrence; however, there is a lack of rational approaches that integrate this traditional medical practice with modern systems of medicine. Several Indian scientists and researchers have studied the pharmacological effects of steam-distilled, petroleum ether, and benzene extracts of various parts of the Tulsi plant and eugenol on the immune system, reproductive system, central nervous system, cardiovascular system, gastric system, urinary system, and blood biochemistry in the last few decades in order to establish the therapeutic uses of *Ocimum sanctum* L. in modern medicine. These studies have described the therapeutic significance of Tulsi in the management of various ailments. These pharmacological studies have established a scientific basis for therapeutic uses of this plant. [11]

1. As Antidiabetic

For a month, rats with and without diabetes were given 1% tulsi leaf powder to investigate its effects on serum and tissue lipid profiles, uronic acid, total amino acids, and fasting blood sugar. The fasting blood sugar, uronic acid, total amino acids, total cholesterol, triglycerides, phospholipids, and total lipids were all significantly reduced, according to the data. There was a considerable reduction in total lipids, triglycerides, and cholesterol in the liver. Kidney total lipids were considerably lower. There was a notable decrease in total cholesterol and phospholipids in the heart. These findings all point to Tulsi's hypoglycemic and hypolipidemic effects in diabetic rats. [1]

Throughout history, medicinal plants have been utilized globally to cure a wide range of illnesses. About 150 species of fragrant plants, mostly found in tropical and subtropical regions of the world, belong to the genus *Ocimum* (Family: Labiatae). Numerous species in this genus are thought to have great therapeutic properties and are widely used in the traditional medical systems of many Asian, African, and South American nations. Holy basil, or tulsi (*Ocimum sanctum*), is an upright, hairy annual herb that grows in gardens and temples throughout India and the Himalayas, up to a height of 1,800 meters.

Essential oil content is high in *O. sanctum*. Eugenol (70%) was found in the essential oil by gas-liquid chromatography. [2]

It has been demonstrated that eugenol effectively inhibits lipid peroxidation. It has been discovered that lipid oxidation happens in all biological systems. Atherosclerosis and other inflammatory illnesses are among the pathological conditions brought on by the unchecked synthesis of lipid peroxides. It has long been recognized that diabetes mellitus and atherosclerosis are related. [3]

2. In Ring worm, Dog bite and Scorpion Bite Treatment

Ringworm and other skin problems can be effectively treated with Tulsi leaf paste. In traditional medicine, Tulsi has also been suggested as an antidote for insect, scorpion, and dog bites. [4-6]

Leaf extracts from *Ocimum sanctum* exhibited fungicidal as well as inhibitory effects on the dermatophytes under investigation. The plant leaf extracts and fractions' suppression of fungicidal activity may be due to secondary metabolites. These chemicals were also confirmed to be present by TLC (Thin layer liquid chromatography) and HPTLC (High pressure thin layer liquid chromatography). It is clear that this plant's potential secondary metabolite content may be the cause of its antidermatophytic action. Alkaloids, glycosides, saponins, tannins, volatile oil, and ascorbic acid are all present in *Ocimum sanctum* plant leaves. n-alkenes are present in leaf wax. Among the ingredients of essential oil include methyl chlorophyllene, camphor, β -caryophyllene, eugenol, caryophyllene camphene, and α -pinene. These metabolites may be the cause of *Ocimum sanctum*'s antidermatophytic action.[32]

3. Antifertility Agent

Additionally, *Ocimum sanctum* L. possesses antifertility properties. Both the native ladies and the Ayurvedic doctors in Kerala have reportedly used tulsi leaves for their antifertility properties. It has been observed that *Ocimum sanctum* L. leaf extracts in benzene and petroleum ether exhibit 80% and 60%, respectively, antifertility efficacy in female rats. [7,8]

It has been proposed that benzene extract from Tulsi leaves reduces spermatogenesis in male rats by slowing down the activity of sertoli cells without affecting the germ cell.[9]

O. sanctum L. extract (250 mg/kg body weight) over 48 days reduces the total sperm count, sperm motility, and forward velocity. This has a reversible anti-fertility impact. The caudal plasma of the epididymis and the seminal vesicles had lower fructose content, but the percentage of abnormal sperm raise in the caudal epididymal fluid. Two weeks after the medication was stopped, all of these values were back to normal. [24]

4. In Neurological Treatment

The medicinal potential of Tulsi in the treatment of neurological (e.g., convulsions and epilepsy), inflammatory, and allergy illnesses is explained by eugenol and the essential oils' ability to stabilize membranes on synaptosomes, erythrocytes, and mast cells. [4]

5. In Gastric Ulcer Treatment

The antiulcerogenic properties of eugenol and essential oil derived from Tulsi leaves have been linked to the medicinal usage of *Ocimum sanctum* L. in the treatment of gastric ulcers. [4, 10]

In experimental animal models, it was discovered that the fixed oil of *Ocimum sanctum* L. (Labiatae) had strong antiulcer efficacy against ulceration caused by aspirin, indomethacin, alcohol, histamine, reserpine, serotonin, and stress. In rats with pylorus ligation, there was also a notable reduction in gastric output and aspirin-induced stomach ulcers. The oil's antiulcer action may have been aided by its histamine antagonistic, lipoxygenase inhibitory, and antisecretory properties. It is possible to classify *O. sanctum* fixed oil as a natural medicine with anti-inflammatory and antiulcer properties. [33]

6. Antimalarial Activity

Fresh Tulsi leaves are consumed in the morning along with black pepper as a preventative measure against malaria. Research has demonstrated the antimalarial properties of an Ayurvedic mixture containing *Ocimum sanctum* L., *Allium stipitum*, *Piper nigrum*, and *Curcuma longa* against *Plasmodium falciparum* and *Plasmodium vivax*. It has been discovered that this preparation relieves clinical symptoms in 100% of patients with *Plasmodium falciparum* and 52% of individuals with *Plasmodium vivax*. [5, 6]

7. Hepatoprotective Properties

Male Wistar albino rats are protected against paracetamol-induced liver damage by oral administration of hydroethnolic leaf extract at a dose of 200 mg/kg. When comparing treated rats to untreated controls (paracetamol alone), there was a notable decrease in fatty acid degradation and a significant reduction in increased serum enzyme levels, which provided support for the findings. [12]

Ocimum sanctum leaves include components that have anti-lipoperoxidative and free radical scavenging properties: ursolic acid, flavonoids, and eugenol. Consequently, the antioxidant qualities of *Ocimum sanctum* leaves' components may be the cause of their hepatoprotective action. *Ocimum sanctum*'s hepatoprotective effect is attributed to its ability to stabilize membranes. [13]

By significantly lowering serum enzyme levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) in rats, as well as exhibiting a notable decrease in fatty liver degeneration upon histopathological examination, *Ocimum sanctum* leaf extract was found to be hepatoprotective against hepatotoxic paracetamol. [14]

8. Improve Immunity

The herb tulsi (*Ocimum sanctum* Linn.) is revered, and it's long been thought that ingesting tulsi leaf on an empty stomach boosts immunity. Tulsi's alcoholic extract has been demonstrated in experiments to modify immunity.

After 4 weeks, the Tulsi extract intervention group showed a statistically significant rise in the levels of IFN- γ ($p = 0.039$), IL-4 ($p = 0.001$), and the percentages of T-helper cells ($p = 0.001$) and NK-cells ($p = 0.017$) compared to the placebo group. These findings unequivocally demonstrate that Tulsi leaf extract has an immunomodulatory effect on healthy individuals. [15]

9. Cardiac Activity

Male Wistar rats exposed to chronic-resistant stress (6 hours per day for 21 days) were given an oral dose of 100 mg/kg of *O. sanctum*

L. hydroalcoholic extract. This prevented the myocardium's light microscopic alterations, the chronic-resistant stress-induced rise in plasma cAMP level, and myocardial superoxide dismutase and catalase activities. [16]

Superoxide dismutase, glutathione peroxidase, and reduced glutathione in the heart are not altered by isoproterenol in wester rats fed fresh leaf homogenate of *O. sanctum* L. (50 and 100 mg/kg body weight) every day for 30 days. [17]

Another study examined the effects of pre- and co-treatment of *O. sanctum* L. hydroalcoholic extract at various doses (25, 50, 75, 100, 200, and 400 mg/kg) against rat myocardial infarction caused by isoproterenol (ISO, 20 mg/kg, Sc). At doses of 25, 50, 75, and 100 mg/kg, *O. sanctum* L. significantly lowered superoxide dismutase, glutathione (GSH), and lactate dehydrogenase levels. The highest cardioprotective effect of *O. sanctum* L. was reported to occur at a dose of 50 mg/kg in this investigation. [18]

Heart lipid membrane peroxidation resulted from the drug-induced oxygen radicals that were produced in the heart cells. It has been discovered that ursolic acid (UA), which was extracted from *Oryza sanctum* L., protects against lipid peroxidation caused by Adriamycin (ADR). In liver and heart microsomes, protection with UA was 13 and 17%, respectively. It rose to 69% when combined with oleanolic acid (OA) that was extracted from *Eugenia jumbolata*. [19]

10. Antioxidant

Hypoxanthine xanthine oxidase and OPPH assays based on high-performance liquid chromatography (HPLC) were used to assess the antioxidant capacity of essential oils produced by steam hydrodistillation from *O. sanctum* L. *O. sanctum* L. demonstrated a considerable antioxidant ability in the hypoxanthine xanthine oxidase experiment ($IC_{50} = 0.46 \mu\text{L/ml}$). [20]

In a different investigation, the *O. sanctum* L. aqueous extract dramatically boosts the activity of antioxidant enzymes like superoxide dismutase and catalase levels in the extract-treated group relative to the control. [21]

In male albino rabbits, *O. sanctum* L. aqueous extract inhibits the hypercholesterolemia-induced erythrocyte lipid peroxidation activity in a dose-dependent way. Significant protection against peroxidative damage caused by hypercholesterolemia is also given to aorta and liver tissue through oral feeding. [22]

Yanpallewaret *al.* investigated the impact of a methanolic extract of *O. sanctum* L. leaves on long-term hypoperfusion and cerebral reperfusion injury. The pretreatment of *Ocimum sanctum* L. (200 mg/kg/day for 7 days) inhibited the increase in superoxide dismutase and lipid peroxidation that was brought on by reperfusion. During reperfusion, the pretreatment with *Ocimum sanctum* L. also stabilized the tissue total sulfhydryl group levels. [23]

11. Antimicrobial

In their investigation, Singh *et al.* hypothesized that *O. sanctum* L. fixed oil's greater linoleic acid concentration would be a factor in the oil's antibacterial efficacy. *Staphylococcus aureus*, *Bacillus pumilus*, and *Pseudomonas aeruginosa* are the three bacteria to which the oil demonstrates good antibacterial activity; *S. aureus* the most susceptible organism. [25]

Geeta *et al.* found that, when tested using the agar diffusion method, the aqueous extract of *O. sanctum* L. (60 mg/kg) demonstrated broad zones of inhibition against *Klebsiella*, *E. coli*, *Proteus*, *S. aureus*, and *Candida albicans*, in comparison to the alcoholic extract. A broader zone for *Vibrio cholerae* was seen in the alcoholic extract.[26]

12. Wound healing activity

The efficacy of *O. sanctum* L. aqueous extract on wound healing in rats was assessed by Shetty *et al.* Because of the higher percentage of wound contraction, researchers looked at the wound-breaking strength in the incision wound model, the epithelization duration, and the percent wound concentration in the excision wound model. The treatment of abnormal healing, such as keloids and hypertrophic scars, may benefit from the usage of *Ocimum sanctum* L. [27]

The effects of dexamethasone-depressed healing and normal wound healing were studied in relation to an ethanolic extract of *O. sanctum* L. leaves. Along with a considerable rise in wet and dry granulation tissue weight and granulation tissue breaking strength, the extract also considerably boosted wound contraction, wound epithelialization speed, and wound breaking strength. In every wound healing model, the extract also dramatically reduces the anti-healing properties of dexamethasone.[28]

Composition of Tulsi

Metal and Heavy Metal contents of Tulsi: The micro (Co, Cu, Fe, Ni, Mn, and Zn) and macro (K, Na, Ca, and Mg) minerals found in the stem and leaves of *Ocimum sanctum* were identified, according to Vidhani *et al.* The dry weight basis concentration of these elements is expressed in parts per million. In comparison to other medicinal plants, the micromineral values of Mn and Zn are higher at 61.75 and 32.38 ppm, however the macromineral values of K, Na, P, and Mg in the leaves are the same at 0.62, 0.74, 1.10 ppm, and traces of Mg for leaves, respectively. In order to demonstrate the possible hazard that heavy metals pose to animals and humans that eat the plants themselves or products derived from them, the amount of heavy metals in the plants was examined. The five elements Cd, Cr, Pb, As, and Hg that have been found in plant leaves are the subject of this study's examination. It was discovered that the leaves have extremely high measurable amounts of As and Cr. Cr and As levels in *O. sanctum* leaf digest were 3.67 and 3.54 ppm, respectively.[29]

| S.No. | Micronutrients | Concentration (PPM) |
|-------|----------------|---------------------|
| 1 | Mn | 61.75±2.06 |
| 2 | Zn | 32.38±1.42 |
| 3 | Cu | 14.48±0.72 |
| 4 | Mo | 0.58±0.21 |
| 5 | Ni | 5.64±0.37 |
| 6 | Li | 0.59±0.07 |
| 7 | Al | Trace |
| 8 | Mg | Trace |
| 9 | Cd | ND |
| 10 | Cr | 3.67±0.020 |
| 11 | Pb | 1.17±0.045 |
| 12 | As | 3.54±0.304 |
| 13 | Hg | 0.37±0.051 |

Data were expressed on dry weight basis (29)

Phytochemical study of Tulsi in Different Kind of Extract

In Aqueous, Methanolic and Ethanolic Extract

The experiment was carried out by Borah and Biswas independently for methanol, ethanol, and distilled water after 50g of dried Tulsi powder was added to the thimble of the Soxhlet apparatus. The yield percentages were 8%, 7%, and 5%, respectively, weight per weight. According to the study, tulsi leaf extract contains a variety of secondary metabolites, including phenol, terpenoid, glycoside, carbohydrate, tannin, flavonoids, saponins, and fatty acids. The quantitative investigation revealed that Tulsi leaves contain a significant amount of phenols, with percentages ranging from 1.6 to 7.6. As a result, the percentages of flavonoids and alkaloids varied from 1.56 to 2.24 and 0.91 to 1.28, respectively. Three primary ingredients were found from the GC-MS analysis of the methanolic extract: α -Farnesene, Benzene, 1, 2-dimethoxy- 4-(2-propenyl), Eugenol, and Cyclohexane, 1, 2, 4-triethenyl. Antiseptic, analgesic, anti-inflammatory, antibacterial, antistress, immunomodulatory, hypoglycemic, hypotensive, and antioxidant qualities are known to be present in these phytochemicals. Therefore, using tulsi as a herbal

| Phytochemicals | Aqueous extract | Methanol extract | Ethanol extract |
|---------------------------|-----------------|------------------|-----------------|
| Protein | - | - | - |
| Carbohydrate | - | + | + |
| Phenol | + | + | - |
| Tannin | - | + | + |
| Flavonoid | + | + | + |
| Saponin | - | + | + |
| Glycosides | + | + | + |
| Steroid | - | - | - |
| Terpenoid | - | + | + |
| Alkaloid | + | + | + |
| Anthraquinone | - | - | - |
| Fixed oils and fatty acid | - | + | - |
| Test for lactones | - | - | - |

Presence (+), Absent (-) (30)

remedy has greater advantages than using a chemically manufactured medication. [30]

In Acetone Extract: (Leaf)

As stated by Naik LS *et al.* in 2015, the findings of their investigation verify the existence of components that are recognized to possess both physiological and therapeutic properties. A summary is provided of the phytochemical properties of the *ocimumtenuflorum* leaf extract under investigation. The findings show that the leaves of *Ocimumtenuflorum* contain compounds that are medicinally active,

| S.No. | Phytochemicals | Inference |
|-------|----------------|-----------|
| 1 | Tannins | - |
| 2 | Pholabatannin | + |
| 3 | Saponins | + |
| 4 | Terpinoides | + |
| 5 | Glycosides | + |
| 6 | Steroids | + |

Presence (+), Absent (-) (31)

including alkaloids, terpenoids, steroids, flavonoids, phenol-betaine, and glycosides. However, this plant lacked saponins.

Conclusion

This review provides broad information about the therapeutic properties and phytochemical properties of Tulsi (*Ocimum sanctum*). On the basis of the above discussion, we can say that Tulsi has the ability to be used as an anti-ulcer, antioxidant, anti-inflammatory, anti-cancer, antidiabetic, anti-arthritis, analgesic, antistress, anti-asthmatic, antifertility, immunomodulatory, neuroprotective, antimicrobial, hepatoprotective, cardioprotective, antimicrobial, antidote, and wound healer. And these properties may be due to the presence of different phytochemicals (Alkaloids, Tannins and Phenolic compounds, Terpenoids and phytosterols, Saponins, Flavonoids, Glycosides, Carbohydrates, Steroid, Anthraquinone, Fixed oils and fatty acid and Pholabatannin etc.) and minerals (Mn, Zn, Cu, Mo, Ni, Li, Al, Mg, Cd, Cr, Pb, As and Hg). This proves the therapeutic importance of Tulsi.

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