

Tulsi - A Review Based Upon Its Ayurvedic and Modern Therapeutic Uses

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ABSTRACT

Herbal plants are considered as the most significant source of medicines. These herbal plants are in practice from ancient times. Traditionally, all the parts of the plant are used for curing various diseases. One of the most important herbal plants is the *Ocimum sanctum* also called tulsi. This plant is considered a sacred plant in Indian culture and used for holy purposes as well. The name Tulsi comes from Sanskrit word which means "the incomparable one". Tulsi plant is not only used in ayurvedic medicines but also used 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, anti-oxidant, anti-inflammatory, anti-cancer, antidiabetic, anti-arthritis, analgesic, antistress, anti-asthmatic, antifertility, immunomodulatory, and neuroprotective activity.

Keywords: *Ocimum sanctum*, phytochemicals, Eugenol, Tulsi, Ayurveda

INTRODUCTION

Plants are known for various medicinal properties from ancient times. The essential oils extracted from therapeutic plants are safe, economical, effective and easily available [1,2,3,4]. India is the home for more than 8000 species of vascular plant out of which 1748 are considered for their

therapeutical uses [5]. Tulsi (*Ocimum sanctum L*) is one of the most common herb used in Indian traditional system and also named as "Holy Basil", "Queen of Herbs" [6,7]. The name Tulsi comes from Sanskrit word that means "the incomparable one" [8]. In Indian culture, it is worshiped very religiously and known as "Vishnupriya". The scientific name of Tulsi is *Ocimum sanctum (Linn)* which belongs to the Labiatae family and the *Ocimum* genus is derived from the Greek word ozo which means to smell or having strong odor [9]. This plant has about 160 species in which *Ocimum sanctum*, *Ocimum gratissimum*, *Ocimum canum*, *Ocimum basilicum*, *Ocimum killimandscharicum*, *Ocimum ameicanum*, *Ocimum camphora* and *Ocimum miranthum* are therapeutically important [10,11]. There are commonly three types of Tulsi that are considered the most i.e. *Ocimum tenuiflorum* (Krishna tulsi), *Ocimum sanctum* (Rama Tulsi) and *Ocimum gratissimum* (Vana Tulsi) [12]. Numerous phytochemical constituents isolated from this plant which are responsible for their medicinal value both in modern medication system and traditional medication system i.e. Ayurveda, Unani, Siddha, Greek and Roman [13]. The presence of phytochemicals may vary in this plant because of its cultivation and harvesting procedure. In Ayurveda, it is explained as "the elixir of life" and believed to promote longevity. Our review is focused on a detailed description of Tulsi (*Ocimum L*) and its medicinal significance as per different medicinal

systems. Botanical Classification and vernacular names of *Ocimum sanctum* is given below in table no. 1 [14] and table no. 2 [15].

Table 1: Botanical Classification of *Ocimum sanctum*

Taxonomic Rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Lamiales
Family	Lamiaceae
Genus	<i>Ocimum</i>
Species	<i>Ocimum sanctum</i>

Table 2: Vernacular names of *Ocimum sanctum*

Vernacular Names	
English	Basilie, Sweet Basil
Hindi	Besil, Tulsi, Jangli tulsi
Chinese	Loh lahk, Yu heung choi
Middle East , North Africa	Dohsh, Schadjant, Vasub
Armenia	Shahasbram, Rehan
Bulgaria	Bosilek
Burma	Laun, Pinzainpinzin
Denmark, Greenland	Basilikum
Netherlands, South Africa	Baziel, Koningskruid
England	Basilie, Sweet Basil
Finland, Sweden, Norway	Basilika
France	Basilic sacre, Herbe royale
Georgia	Rekhani, Rehan
Germany	Indisches Basilikum
Iceland	Basilika
Italy	Basilico
Japan	Bajiru, Kami-meboki
Cambodia	Che tak, Mareah proeu
Korea	Naruk-pul, Yanggajuk
Northeast of Thailand	Saphaa, Phak i tou thai
Malaya	Kemangi, Selasi jantan
Nepal	Tulsi patta, Bavari phul
Sri Lanka	Madurutala, Mudura tulla
Spain	Alfabega, Albacar
Swedish	Basilika, Basilkaort
Vietnam	Nhu tia, Cay hung que
Assam , North-East India	Tuloxi, Tulasii
West Bengal	Tulsi, Kalotulsi, Kural
Himachal Pradesh	Tulsi, Niyam Posh
Gujarat	Sabje, Talasi
Karnataka	Karitulasi,, Tulasiya
Kerala	Pachcha, Kunnakam
North-eastern India	Mayangton, Naoshek lei
Maharashtra	Sabja, Tulasa
Orissa	Dhala tulasi, Karpura
Punjab	Tulsi
Tamilnadu	Tiruttizhai, Tiviragandam
Andhra Pradesh	Oddhi, Rudrajada
Kashmir, North India	Tulsi, Janglitulsi

Botanical Description

Ocimum sanctum belongs to the family Lamiaceae/Labiatae. Tulsi is an erect, branched, fragrant plant with height reaches upto 30-60cm when completely mature. The leaves of Tulsi are simple, inverse, elliptical, ovoid, dense or acute with entire margin. The leaves grow up to 5cm long. It

has small phyllotaxy and petiole is 2-5 cm long, slender and pubescent. The leaves of the plant mainly possess medicinal property. They are also pubescent on both sides with small glands. The stomata are present on the lower surface but also rarely present on the upper surface of leaf. The flowers of this plant consist of verticillaster inflorescence with varying color from purple to pink. Flowers are simple or branched raceme 5-30cm of height, bracts sessile, ovate, caduceus, hermaphrodite, pedicel 1-4 mm long, spreading or slightly curved. Flowering started after 136 days and continue up to 195 days and their seeds matures after 259 days. Fruit having 4-dry, 1- seeded nut lets covered in the persistent calyx; long up to 1.5mm, rugose brown, outer pericarp does not turn into mucilaginous in water. It produces small seeds which are reddish black in colour. Stem are green in newly born plant and become woody when getting older. The roots of the *Ocimum sanctum* contains various essential oil like eugenol [16,17,18,19]. Plant is shown in figure 1.



Figure 1. Tulsi (*Ocimum sanctum*)

Geographical Distribution

O. sanctum is extensively distributed in tropical and subtropical parts of Asia. The plant is indigenous to the Indian subcontinent including the Himalayas, Malaysia, Caribbean, Pacific and other parts

of Africa. In India it is cultivated in almost every state [20]. Due to some holy believes it is present around the temples and places of worship. Till now there is no data available regarding specific habitats where the species has been found naturally [21,22].

Phytochemical constituents of *Ocimum sanctum*

The leaves of *Ocimum sanctum* reported to be a rich source of volatile oil containing eugenol (71%) and methyl eugenol (20%) content. The volatile oil also consists of carvacrol and sesquiterpine hydrocarbon caryophyllene. The other chemical constituents present are phenolics, flavonoids, terpenoids and fatty acids. The seeds of plant are enriched with fixed oil (18-22%), polysaccharides mucilage and β -sitosterol. Linoleic acid is considered as the main content present in seed oil [23]. The other chemical constituents present are:

- 1. Phenolics:** The phenolic content found in OS plant consist of chlorogenic acid, vanillic acid, ocimumnaphthanoic acid, caffeic acid and menthylsalicylic glucoside that are extracted from the aerial parts of the plant [24]. The other chemical constituents present was confirmed by HPLC which comprises of gallic acid ethyl ester, protocatechuic acid, 4-hydroxybenzoic acid, gallic acid methyl ester, vanillin and 4-hydroxybenzaldehyde [25,26].
- 2. Flavonoids:** Flavonoids are considered as the main constituents which consist of methoxy flavonoids and their glycosides (cirsimartin, isothymusin, luteolin), C-glycosides flavonoids (vicenin, isovitexin, isorientin and orientin) of the OS plant [27]. The other flavones detected using atmospheric pressure chemical ionization mass spectrometry (APCI-MS) are cirsumaritin, crisilineol, isothymusin, gardenin, apigenin, eupatorin and salvigenin [28].
- 3. Phenyl propanoids Eugenol** is the main component found in the essential

oil of OS leaves. The other phenyl propanoids derivatives are ociglycoside or eugenyl- β -D-glucoside, ferualdehyde, citrusin C and dehydrodieugenol were extracted from the leaf part of the OS plant [29].

- 4. Neolignans:** The methanolic extracts of OS plant possess to have neolignans constituents consist of Tulsinol A to Tulsinol G which are formed by polymerization of eugenol content [29].
- 5. Terpenoids:** The terpenoids reported in OS plant are sesquiterpenoids (β -caryophyllene and 4,5- epoxy-caryophyllene), abietane diterpenoid (carnosic acid), ursane triterpenoids(ursolic acid, urs- 12-en-3 $3\beta,6\beta,20\beta$ -triole-28-oic acid and oleanane triterpenoids (oleanic acid, β -Amyrin-glucopyranoside) [8]. The most abundant constituent found by HPTLC and UPLC-ESI-MS/MS is ursolic acid [30]. Other terpenoids constituents isolated were β -caryophyllene, elemene, α -humulene, α -caryophyllene, germacrene, trans- α -bergamotene and 5 β -hydroxycaryophyllene [31].
- 6. Coumarins:** There are three coumarins constituents extracted from tulsi plant named aeculetin, aesculin and ocimarin [32].
- 7. Steroids:** he steroid components present are β -sitosterol, β -sitosterol-3-O β -D-glucopyranoside, stigmasterol and campesterol which are extracted from the stem and leaves of OS [33].
- 8. Essential oil:** The essential oil extracted from leaves of OS plant is mainly composed of terpenoids which include phenolic acid, esters, aliphatic aldehydes, bicyclic terpenoids, acyclic monoterpenoids and sesquiterpenoids. The chemical composition varies from region to region depend upon its cultivation, harvesting, climatic

conditions. The major phytochemicals present in essential oil are eugenol or methyl eugenol and methyl chavicol which is responsible for the antimicrobial and anthelmintic property [34]. The other constituents present in essential oil are, β -caryophyllene, β -caryophyllene oxide and germacrene D [35].

9. Fixed oil (non-volatile oil): The fixed oil isolated from OS seeds constitute 18.22% which is mainly composed of linoleic acid (66.1%), which possess anti-inflammatory, hypotensive, chemopreventive anticoagulant properties [36]. The other constituents present are stearic acid (2.1%), oleic acid (9.0%), palmitic acid (6.94%) and, α -linolenic acid (15.7%) which are extracted from the leaves of OS leaves [37].

10. Fatty acid derivatives: The fatty acid derivatives extracted from the roots and leaves of the OS plant are cerebrosides. Also, palmityl glucoside and sanctumioic acid present in OS leaves are responsible for mosquitocidal property [38].

Traditional and Modern View on plant

A. Folk View of Tulsi (*Ocimum sanctum*)

Tulsi (*Ocimum sanctum*) is considered a medicinal plant from ancient times. The literature indicates that the medicinal use of plants is as old as 4000-5000 BC. The natural herbal preparation of medicines was firstly done by the Chinese. In India, the Tulsi plant was formulated into medicine between 3500-1600 BC. Later the therapeutic uses were studied and recorded empirically by the ancient physicians [39].

The plant is a part of religious belief around the world, especially in India. Although there is no literature available on basil in the Bible [40], the plant is said to have grown at the site of Christ's crucifixion [41]. It is mainly sanctified in Hindu Folklore. The plant is known to be the manifestation of the goddess, Tulsi was raised from her

embers. There are many stories regarding the Tulsi, but the well-known comes from Shiva Purana. Once Indra and Bri haspati went to meet lord Shiva at the Kailash mountain and their way was blocked by a sage. The sage was Shiva himself. Lord Shiva transforms his look with tangled hair and a resplendent face just to test Indra and Bri haspati. Indra did not recognize the lord Shiva and got furious that the man was not moving out their way. To move him out of his way Indra threatened him with his thunderbolt. Lord Shiva became infuriated upon this deed and got angry. Due to his anger, his third eye got opened to kill Indra but at the same, the Bri haspati recognized lord Shiva. He requested Shiva to pardon Indra. Lord Shiva was convinced by Bri haspati and propelled the fire from his eye towards the ocean. The collision of fire and ocean took the form of a boy who was named Jalandhara. Jalandhara grew up powerful and become a king of demons by Guru Sukra. He got married to Vrinda, who was the daughter of demon Kalanemi. Bhruhu made him against Lord Vishnu as well as other gods. A battle occurred between Jalandhara and Vishnu which reminded inconclusively. Influenced by the bravery of Jalandhara, Vishnu asked him in ksira sagara and as accepted by lord Vishnu, in the absence of all gods got defeated by Jalandhara. Devas did not want to be governed by Jalandhara. The Devas consulted with sage Narada to meet Jalandhara. But he illustrated the beauty of Kailasa in his visit. Sage Narada then continued to describe Shiva's residence and the beauty of goddess Parvati [42]. Listening to this Jalandhara disguised himself as Shiva and went to Parvati just to trick her. Parvati identified him and endeavored to strike him but Jalandhar ran away. After this Parvati went to Lord Vishnu and requested him to trick Vrinda just like Jalandhar does. Vrinda was very virtuous to Lord Vishnu for the restoration of Jalandhara's destruction by Shiva. Hearing this, Vrinda embraced Jalandhara who is Vishnu in reality. When Vrinda realized the fact she cursed Lord

Vishnu that somebody would seize his wife (which was later done in Ramayana) and also become the stone. Just honoring his real devotee, he accepted the curse and appears as the stone named Saligrama sila in the Gandika river in Nepal. In the end, Vrinda stepped into the fire to immolate herself. When Jalandhara came to know about his wife's death, he became angry and turn into a battlefield. Hence Jalandhara was killed by Lord Shiva. Hid soul merged with Shiva just like Vrinda's soul had merged with Parvati. Vrinda is as late named as Tulsi because of her faithfulness and her denotion towards lord Vishnu. In her suffering, Tulsi ended up her life and Lord Vishnu affirmed that she would be "worshipped by women for her faithfulness" [43,44]. Thus in Hinduism, it may be considered as the symbol of love, eternal life, purification, and protection. Also, it is used in burial ceremonies for purification [45].

B. Ayurvedic View on Tulsi (*Ocimum sanctum*)

Tulsi is also called "the elixir of life" because it promotes longevity. Every part of the plant. It possesses some therapeutic property and is also used in the Ayurveda and Siddha systems of medicines. Tulsi is considered as the earliest herbs known to humanity, which act as a medicine for the prevention and cure of many diseases mainly common cold, headache, cough, flu, earache, fever, colic pain, sore throat, asthma, hepatic diseases, malaria fever, wound insomnia, arthritis, digestive disorder, night blindness and influenza. The intake of the leaves of Tulsi recover lesions and act as memory enhancer [46,47]. Rasa panchak of Tulsi is given in Table No. 3 [48].

Table 3: Rasa Panchak of Tulsi (*Ocimum sanctum*)

Sanskrit/English	Sanskrit/English
Virya/Potency	Katu/Astringent
Vipak/Metabolic property	Katu,Tikt/Astringent,bitter
Guna/Physical property	Laghu,Ruksha/Light,Dry
Rasa/Taste	Tikt,Katu/Bitter,Astringent

Action (Karma) of Tulsi: Doshas are the mind-body type and there are 3 main doshas Vata, Pitta, and Kapha, each of which is

derived from the five elements. In Ayurveda "Doshas" shows the activity of physical, emotional and mental characteristics. According to Ayurveda, the medicine works on the dynamic state to maintain balance between body, mind and environment. Tulsi reduces Kapha (Water and earth component) and Vata (Air component) Dosha (disorder) and increases Pitta (Fire and water component) [49]

Properties of Tulsi (*Ocimum sanctum*) [50]

Abhiyantar Pachansanathan (अभ्यंतर – पाचनसंस्थान): It works on the GIT, Dipana (appetizer), Pachana (digestive), Jwaraghna (antipyretic), Krimighna (wormicidal) and also kills the parasites.

Satambhikaran (सतम्भीकरण): Used for the treatment of chronic fever

Dashemani Shwasaharni (दशमनी शवसहरनी): Used as an anti-asthmatic medicine.

Sondrayavardhak (सौंदर्य वर्धक) It enhance beauty and also used in beauty products.

Raktavah Sansthan (रक्त वाह संस्थान): It increases the blood circulation and Raktashodhak (Blood purifier).

Taapkaram (तापक्रम): Used for the treatment of malaria and severe fever.

C. Modern View

The use of Herbal medicines is in practice since ancient times. People prefer herbal medicines over allopathic medicines due to their fewer side effects and are considered as safest medicines as compared to allopathic medicines [51,52]. To meet the demand of people, adulteration rises in the herbal drug industry which ultimately affects the health of people. The major drawback of allopathic medicines is that it generally works on suppressing the symptoms of the disease while Ayurveda medicines work on holistic approach. The holy plant Tulsi (*Ocimum sanctum*) contains various therapeutic properties and is used in various Ayurveda products which are available in the market to treat various

diseases and also used in cosmetics preparation.

Reported Therapeutic Uses of *Ocimum sanctum*

There are several reports on the use of natural materials sources like plants, bacteria, fungi, yeast and honey. *Ocimum sanctum* is also considered as a wide source for the modern or herbal formulation. Various studies (like in-vivo, in-vitro) have been done for the therapeutical uses of Tulsi. Those reported studies are shown below:

- 1. Analgesic:** It was reported that the oil extracted from *Ocimum sanctum* plant possesses analgesic activity. This study was carried out in mice using acetic acid-induced writhing methods, tail flick, tail clip and tail immersion. From the results, it was clear that the inhibitory activity of the oil is due to the combined inhibitory effect of acetylcholine, histamine and prostaglandin [53].
- 2. Anti-oxidant:** The experimental study on streptozocin-induced diabetic rats showed the antioxidant activity of *O. sanctum*. It was reported that the leaves of this plant contain hydroalcoholic extract which is responsible for the anti-oxidant property. When the leaves of *O. sanctum* were provided with streptozocin-induced diabetic rats for 30 days, it was found to improve the activity of antioxidant enzyme catalase and reduce the plasma level of thiobarbituric acid in the vital organs like kidneys and liver [54].
- 3. Anti-ulcer:** It was reported that the *O. sanctum* plant possesses to have antiulcer activity against histamine, aspirin, reserpine, serotonin aspirin indomethacin in rats [55]. The experiment was performed in Wistar rats where it was found that the aqueous extract of *o. sanctum* protects against ethanol-induced gastric ulceration [56].
- 4. Anti-arthritis:** In order to find out the anti-arthritis activity, the experiment was conducted in a mice model where it was found that the oil extracted from the seeds of *o. sanctum* possesses anti-arthritis activity against turpentine oil-induced joint pain [57].
- 5. Anti-pyretic activity:** The fixed oil of OS was tested against typhoid-paratyphoid A/B vaccine-induced pyrexia in rats and it was found that the oil extracted from the plant exhibit antipyretic activity.
- 6. Antitussive:** It was reported that the aqueous and methanolic extracts of the OS plant showed antitussive activity when studied in guinea pigs [58].
- 7. Hepatoprotective:** It was reported that the leaf extract of the *O. sanctum* plant possesses significant hepatoprotective activity when studied against paracetamol-induced liver damage against albino rats [59].
- 8. Anti-stress:** It was reported that the leaves of *O. sanctum* possess antistress activity when studied in rabbits [60].
- 9. Anti-plasmodial:** It was studied that the root and leaf extract of *O. sanctum* showed antiplasmodial activity because of the presence of ethanolic extract mainly flavonoids, phenols, saponins, alkaloids, glycosides proteins, resins, steroids, triterpenoids [61].
- 10. Memory Enhancer:** To study the antimentia and anticholinesterase activity, the aqueous and alcoholic extract of the leaves of *O. sanctum* were studied in rats. Atropine, cyclosporine, and electroshock were used to activate dementia. It was reported that the inactive restraint was used to assess memory [62].
- 11. Immunomodulatory:** It was studied that leaves of *O. sanctum* increase the RBCs, WBCs hemoglobin and antibodies production without affecting other biochemical activities when tested in mice [63].
- 12. Chemopreventive:** It was reported from various studies that the oil extracted from seeds of *O. sanctum* showed chemopreventive activity against

subcutaneously injected 20 methylcholanthrene induced fibrosarcoma tumors in Swiss albino mice. It was injected 20 methylcholanthrene induced fibrosarcoma tumors in Swiss albino mice. It was found that the survival rate of mice was enhanced and tumor spread rate delayed in seed oil supplemented mice which showed its chemopreventive property [64,65].

13. Antidepressant and Antianxiety: The ethanolic extract of *O. sanctum* were tested in swiss mice. It was found that the plant extract possesses antidepressant and antianxiety properties and can act as a therapeutic drug against these disorders [66].

14. Antiemetic: It was reported that the leaves of Tulsi possess antiemetic properties and used to treat vomiting diarrhea [67].

15. Anti-fertility: The tulsi leaves were reported to have antifertility property. The experimental study was carried out in albino rats where the model was treated with benzene extract of tulsi leaves for 48 days. Results showed a decrease in sperm count and sperm motility [68,69].

16. Anti-inflammatory: The presence of fatty acids in the tulsi plant possesses anti-inflammatory activity. The main fatty acid responsible for the anti-inflammatory activity is linoleic acid which is capable of blocking the cyclo-oxygenase and lipoxygenase pathways [70].

17. Antithyroidic: It was reported that the leaf extract of tulsi leaves acquire antithyroid activity which changes the T3, T4 concentration when tested in male mice [71].

18. Anti-helminthic: The in-vitro study showed that the eugenol content and essential oil extracted from tulsi leaves possess antihelminthic properties. In the *Caenorhabditis* model [72].

19. Antihyperlipidemic and Cardio-protective: The reported study has

shown that fixed oil of OS decrease high serum lipid concentration and show cardioprotective and antiatherogenic actions against hyperlipidemia when tested in high fat(HF) rat [73].

20. Antifungal: It was studied that the linalool and methyl chavicol content extracted from the essential oil of tulsi leaves showed antifungal property against clinically isolated dermatophytes [74].

CONCLUSION

Herbal plants are used in Indian for treating and curing various disease because of their high value. Tulsi (*Ocimum sanctum*) is considered a holy plant. It is mainly used for medicinal purposes and also as an herbal tea. It is used in Ayurveda, Sidha, greek, roman and Unani medicinal systems. It was reported in various research studies that the *Ocimum sanctum* plant contain therapeutical properties including antiulcer, antistress, antifertility, antiasthmatic, analgesic, antidiabetic, anti-inflammatory, antioxidant, antimicrobial and neuroprotective activity. Conclusively from various repeated scientific studies that the Tulsi plant has great medicinal importance and is used worldwide to treat various diseases.

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