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## A Review on Phytoconstituents of *Ocimum (Tulsi)*

### Review article

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### Abstract

The use of plants as sources of medicines are human substance has been in vogue since antiquity. Large numbers of plants are utilized in various systems of medicine practiced in India and local health traditions for the treatment of human diseases since time immemorial. Among the plants known for medicinal value, the plants of genus *Ocimum* belonging to family *Lamiaceae* are very important for their therapeutic potentials. Tulsi is the legendary 'Incomparable one' of India, is one of the holiest and most cherished of the many healing and healthy giving herbs of the orient. Traditionally, Tulsi is taken in many forms: as an herbal tea, dried powder, fresh leaf, or mixed with Honey or Ghee. For centuries, the dried leaves of Tulsi have been mixed with stored grains to repel insects. Many research and studies suggest that Tulsi may be a COX-2 inhibitor, like many modern painkillers, due to its significant amount of eugenol. The chemical composition of Tulsi is highly complex, containing many nutrients and other biological active compounds. These constituents significantly vary with time, cultivation process and storage. The nutritional and pharmacological properties of the whole herb in natural form, result from synergistic interaction of many different active phytochemicals, consequently, the overall effects of Tulsi cannot be fully duplicated with isolated compound or extracts. Recent studies have shown new promising pharmacologically active chemical constituents from this ancient phytomedicine. The present review summarizes the comprehensive information concerning the traditional use, Ayurvedic properties and Phytochemistry of *Tulsi*.

**Keywords:** *Ocimum*, COX-2 inhibitor, eugenol, Ayurvedic properties, Phytochemistry

### Introduction

The use of plants as sources of medicines are human substance has been in vogue since antiquity (1). According to a survey of World Health Organization (WHO), the practitioners of traditional system of

medicine treat about 80% of patients in India, 85% in Burma and 90% in Bangladesh (2, 3). India harbours about 15 percent (3000-3500) medicinal plants out of 20000 medicinal plants of the world (4). The medicinal use of plants is very old. The writings indicate that therapeutic use of plants is as old as 4000–5000 B.C. (5). Large numbers of plants are utilized in various systems of medicine practiced in India and local health traditions for the treatment of human diseases since time immemorial. Most of these medicinal plants have been identified and their uses

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are well documented by different authors (12).

The genus *Ocimum* comprises more than 150 species and is considered as one of the largest genera of the *Lamiaceae* family (13), Tulsi is described as sacred (6) and medicinal plant in ancient literature (7). The name Tulsi is derived from 'Sanskrit', which means "matchless one" (8). Among the plants known for medicinal value, the plants of genus *Ocimum* are very important for their therapeutic potentials. *Ocimum sanctum* L. (Tulsi), *Ocimum gratissimum* (Ram Tulsi), *Ocimum canum* (Dulal Tulsi), *Ocimum basilicum* (Ban Tulsi), *Ocimum kilimandscharicum*, *Ocimum ammericanum*, *Ocimum camphora* and *Ocimum micranthum* are examples of known important species of genus *Ocimum* which grow in different parts of the world and are known to have medicinal properties (9, 10, 11).

All *Ayurvedic* herbs are defined by their *Ayurvedic* properties, these properties include:

1. Categorized according to: easily digestible or difficult to digest: *Guna*
2. What is its taste? sweet, sour, salty, pungent, bitter and astringent: *Rasa*
3. Process of digestion, metabolism and assimilation: *Vipaka*
4. How strong is the effect of the herb on the stomach: *Virya*
5. What action in the body does the food stimulate: *Karma*

Each Herb is described in the ancient text this way to point the way to the person so they understand the effect the herb will have on the particular body type and what is to be expected from the herb.

### **Properties and Action:**

*Rasa: Katu, Tikta, Kasaya*

*Guna: Laghu, Ruksa, Tikshna,*

*Virya: Usna*

*Vipaka: Katu*

*Karma: Dahakarta, Vranashdhaka, Hardya, Karmighna, Kaphahara, Pittahara*

### **Tulsi as an Ayurvedic medicine**

Tulsi's extracts are used in *Ayurvedic* remedies for common colds, headaches, stomach disorders, inflammation, heart disease, various forms of poisoning, and malaria. Traditionally, Tulsi is taken in many forms: as an herbal tea, dried powder, fresh leaf, or mixed with Honey or Ghee. Essential oil extracted from *Karpoora Tulsi* is mostly used for medicinal purposes and in herbal toiletry. For centuries, the dried leaves of Tulsi have been mixed with stored grains to repel insects. Many research and studies suggest that Tulsi may be a COX-2 inhibitor, like many modern painkillers, due to its significant amount of eugenol (1 – hydroxygen, 2 – methoxy – 4 – allylbenzene)

Researches also give Tulsi to be effective for diabetes, by reducing blood glucose levels. The same study showed significant reduction in total cholesterol levels with Tulsi.

Another study showed that Tulsi's beneficial effect on blood glucose levels is due to its antioxidant properties. Tulsi also shows some promise for protection from radiation poisoning and cataracts.

The use of Tulsi for purification and as a medicine is widespread household medicine throughout India. Many Hindus — along with the ancient tradition of *Ayurveda* — believe that the healing properties of sacred herbs such as Tulsi were given by the Lord Himself, and can be used as a medicine out of reverence. Some important species of *Ocimum* are comprised here with some of their



beneficial uses and phytochemical constituents.

### ***Ocimum americanum:***

General uses of importance- It represents an important source for essential oils and is used in food, perfumery and cosmetic industries. *O. americanum* L. is also grown in parts of India for flavor and fragrance industry and as a source of natural camphor, since the plant was introduced there from Kenya in the Second World War (27) *Ocimum americanum* L. (syn. *O. canum* Sims) is a resilient shrub unattacked by most plant pests and animal predators. *O. americanum* L. is used in the traditional system of medicine to treat conjunctivitis, malaria and headache. It has been reported in Somalia for its essential oils, flavones and triterpenic acids and is used for flavouring foods and in traditional medicine. In South Africa, it is often referred to as camphor basil (22,23, 24). In Zimbabwe, its traditional uses range from flavour and fragrance, to insect repellence and as a preservative for corpses (24-26).

### Phytochemistry of species-

Terpenes, the main constituents of essential oils, play an important role in insect communication systems offering prospects of opportunities for manipulating pests (28). In the light of this, investigations on essential oils and their isolates have revealed their great potential as insect and pest control agents (28). The monoterpene 1,8-cineole, which is a constituent of the oil here analysed has been shown to be involved in cases of both direct plant defence(29,30), and pollination (30). It has also been reported in allopathic effects as toxic, deterrent or inhibitory compounds (31), repellency and toxicity against three storage pests; *Callosobruchus maculatus* F., *Rhyzoperthadominica* F., and *Sitophilus oryzae* L. (32). This oil contains mainly oxygenated monoterpenes which

accounted for 71.24% of the oil with 18 components identified, while the non-oxygenated ones represent about 5.76% of the oil. This oil presented a very complex monoterpene fraction. The sesquiterpene and aliphatic hydrocarbons represent 8.13 and 3.58% of the total oil, respectively. Within this sesquiterpene fraction, only 1.1% was oxygenated. However, *O. americanum* oil with 10 components is qualitatively rich in aliphatic hydrocarbons but not quantitatively (33).

### ***Ocimum basilicum-***

General uses of importance- *Ocimum basilicum* L. (sweet basil) is an annual herb which grows in several regions all over the world. The plant is widely used in food and oral care products. The essential oil of the plant is also used as perfumery (35). The leaves and flowering tops of sweet basil are used as carminative, galactagogue, stomachic and antispasmodic medicinal plant in folk medicine (36, 37). Antiviral and antimicrobial activities of this plant have also been reported (38, 39). There are many cultivars of basil which vary in their leaf color (green or purple), flower color (white, red, purple) and aroma (40). Basil is one of the most important medicinal and aromatic plants because of the continuous and increase demand of its products from the local and international markets. Basil essential oil is extensively used for flavoring food stuffs such as souces, vinegars, pickles, ketchups, beverages, condiments and confectionery goods. Basil essential oil is also important part of toiletry products such as mouth washes and dental creams. In perfumery basil essential oil is used for compounding certain popular perfumes and jasmine blends. Basil is also recognized as a febrifuge and antimalarial plant, infusion of the plant is used for gouty joints, cephalalgia and gargle for foul breath. Relief in irrigation for throat, earache and ring worm is also well known properties of



basil extract (41). The leaves of basil are used in folk medicines a tonic and vermifuge, and basil tea taken hot is good for treating nausea, flatulence, and dysentery. The oil of the plant has been found to be beneficial for the alleviation of mental fatigue, colds, spasm, rhinitis, and as a first aid treatment for wasp stings and snakebites (42). *O. basilicum* extracts have been shown to display important effects at cellular level, including the platelet anti-aggregant property and inhibitory activity against HIV-1 reverse transcriptase. In addition, infusions of *O. basilicum* are used in traditional medicine to decrease plasma lipid content in some Mediterranean areas such as the Eastern Morocco (43).

#### Phytochemistry of species-

In *O. basilicum* from Bangladesh, linalool and geraniol are reported as the main components (44). In the oils, obtained from aerial parts of *O. basilicum* grown in Colombia and Bulgaria, linalool and methyl cinnamate are reported as major components of volatile oils respectively (45,46). Linalool and methyl eugenol are the main components of the essential oils of *O. basilicum* cultivated in Mali and Guinea (47). The observed differences may be probably due to different environmental and genetic factors, different chemotypes and the nutritional status of the plants as well as other factors that can influence the oil composition. Mixture of methyl chavicol and linalool comprise 72.5% of the oil of *O. basilicum* L. cv. purple. The results of this study indicate that the composition of volatile oil of purple balm cultivated in Iran is similar to those which are reported from Nigeria. On the other hands, geraniol and neral were not detected in the oil of purple balm and the green basil was characterized by high content (46.1%) of citral (geraniol and neral). For determination of probable chemotypes further investigations would be required.

Glycosidically bound volatile compounds could be interesting as hidden potential of antioxidant compounds in basil or in other plants. Since volatile compounds can be released from nonvolatile glycoside precursors by enzymatic or chemical pathways during manufacturing process, these compounds can be considered as potential precursors of antioxidant substances in plant material and may contribute to the total antioxidant capacity of plants.

#### *Ocimum sanctum*

General uses of importance- *Ocimum sanctum* Linn. popularly known as the holy basil or *Tulasi* in India is a home remedy for various illnesses. Traditionally, the fresh fruit and leaf juice were commonly used in the treatment of cough as demulcent, mild upper respiratory tract infection, general stress syndrome, worm infestations, superficial fungal infections, and also as a diuretic (48). This plant has been evaluated pharmacologically for immunomodulatory, antistress, antimicrobial, anti-inflammatory, antiasthmatic, hypoglycemic, hypotensive and analgesic activities and found to be effective in varying degrees in the animal models. The plant has also shown significant anti-oxidant activity (50). *O. sanctum* is reported to be well tolerated upto a dose of 5–7 g/day for 3 months except for constipation in few cases (8). The crude forms of the plant and the extracts are used singularly or in combination with other herbs as a cough remedy and expectorant based on the traditional experience. An infusion of leaf had been used as anti-spasmodic in gastric disorders of children. A concoction of root of *Tulasi* is still being used as a diaphoretic in malarial fevers in remote areas. The seeds are mucilaginous and demulcent and are given in different ailments of genito-urinary system (53). *Tulasi* is good for heart, stimulates digestion, reduces breathing difficulties and cough (54). It has



also been used in the treatment of snake-bite and scorpion-stings described in ancient texts by *Charaka* and *Sushruta*. Thus, every part of the plant has useful application. Even today people use different parts of this plant for treatment of various ailments based on traditional knowledge. A polyherbal formulation containing *Tulsi* along with other plant extracts such as *Withania somnifera*, *Tribulus terrestris* and *Shilajeet* treated animals showed reduction in various induced stress related outcome results and was comparable with the proven adaptogen *Ginseng* (52).

#### Phytochemistry of species-

The leaves of *Ocimum sanctum* contain 0.7% volatile oil comprising about 71% eugenol and 20% methyl eugenol. The oil also contains carvacrol and sesquiterpine hydrocarbon caryophyllene. Fresh leaves and stem of *Ocimum sanctum* extract yielded some phenolic compounds (antioxidants) such as cirsilineol, circimaritin, isothymusin, apigenin androsameric acid, and appreciable quantities of eugenol. Two flavonoids, viz., orientin and vicenin from aqueous leaf extract of *Ocimum sanctum* have been isolated (56,57,58). Ursolic acid, apigenin, luteolin, apigenin-7-O-glucuronide, luteolin-7-O-glucuronide, orientin and molludistin have also been isolated from the leaf extract (59). *Ocimum sanctum* also contains a number of sesquiterpenes and monoterpenes viz., bornyl acetate, elemene, neral, and -pinenes, camphene, campesterol, cholesterol, stigmasterol and -sitosterol (60.) The fixed oils of *Ocimum sanctum* revealed the presence of five fatty acids – stearic, palmitic, oleic, linoleic, linolenic acids. It is a good source of beta carotene, vitamin C and calcium. It also contains volatile oil (1% including eugenol, linalool, estragol, methyl chaviol, methyl cinnamate, cileole and other terpenes), tannins, camphor, flavanoid (like luteolin, orientin, vicenin),

triterpene; urolic acid, Zinc, manganese and sodium are also found using high resolution gamma ray spectrometry (61). Essential oils of *Tulsi* have antibacterial, antifungal and antiviral properties. (62, 63, 64)

#### Pharmacological Activities:

The leaves are demulcent, diaphoretic & expectorant in bronchitis, cough, cold & cough & fever. It is an insecticide antihelminthic & deodorizer & also has been used as laxative, stimulant & anti-inflammatory, cardiotoxic & blood purifier in hepatic disorders. It can be used for indigestion, diminished appetite & all types of malaise. The oil may applied externally for chronic ulcers, inflammation and skin disorders. (65, 66, 67) The therapeutic calibers of essential oils extracted from the fresh leaves of *Ocimum sanctum* has been claimed due to the presence of eugenol which is the major constituent of essential oils a phenolic compounds (1-hydroxy -2-methoxy-4-allyl benzene). It is well reported that significant activity of eugenol, essential oil components extracted from *Tulsi* leaves on immune system, gastric system, Central nervous system, blood chemistry etc. In experimental animals eugenol shows antidiabetic, triglyceride cholesterol decreasing action & other diagnostic clinical enzymes in blood serum LDH, GPT, GOT & alkaline phosphatase describing the therapeutic potentials of *Ocimum sanctum* as antidiabetic, hypolipidemic, hepatoprotective agent. Eugenol also shows vasodilator effect on rabbit arterial tissues (67). *Ocimum* as a whole as a whole plant is used in ulcers, maggots in wounds, pneumonia, anthrax, indigestion, tympanitis (inflammation of inner ear), pain in abdomen, stoppage of urination, liver, constipation, fluke, stomach pain, cannabis poisoning, opacity of cornea, tachycardia, sore eyes, sprains. The leaves are used in bleeding, eye disease and udder infections & wound



healing in ruminants (68). The ethanolic extract of Tulsi leaves lead to marked lowering of blood sugar in normal glucose fed hyperglycaemic & streptozocin induced diabetic rats. (69).

### Conclusion

In conclusion it is to be found that the various *Ocimum* species found are very much distinguished from each other. All the species are possessing different pharmacological activities. The huge variation in the chemical composition is there. The literature will serve as a guideline for the researchers in future work related to the complex phytochemistry of the genus *ocimum*.

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