

REVIEW ARTICLE

THERAPEUTIC USES OF *OCIMUM SANCTUM LINN* (TULSI) WITH
A NOTE ON EUGENOL AND ITS PHARMACOLOGICAL
ACTIONS: A SHORT REVIEW

P. PRAKASH* AND NEELU GUPTA**

*Department of Biochemistry,
Seema Dental College & Hospital, Barrage Road,
Rishikesh, Dehradun – 249 203, Uttranchal*

(Received on September 21, 2004)

Abstract : The medicinal plants are widely used by the traditional medical practitioners for curing various diseases in their day to day practice. In traditional systems of medicine, different parts (leaves, stem, flower, root, seeds and even whole plant) of *Ocimum sanctum Linn* (known as Tulsi in Hindi), a small herb seen throughout India, have been recommended for the treatment of bronchitis, bronchial asthma, malaria, diarrhea, dysentery, skin diseases, arthritis, painful eye diseases, chronic fever, insect bite etc. The *Ocimum sanctum L.* has also been suggested to possess antifertility, anticancer, antidiabetic, antifungal, antimicrobial, hepatoprotective, cardioprotective, antiemetic, antispasmodic, analgesic, adaptogenic and diaphoretic actions.

Eugenol (1-hydroxy-2-methoxy-4-allylbenzene), the active constituent present in *Ocimum sanctum L.*, has been found to be largely responsible for the therapeutic potentials of Tulsi. Although because of its great therapeutic potentials and wide occurrence in India the practitioners of traditional systems of medicine have been using *Ocimum sanctum L.* for curing various ailments, a rational approach to this traditional medical practice with modern system of medicine is, however, not much available. In order to establish the therapeutic uses of *Ocimum sanctum L.* in modern medicine, in last few decades several Indian scientists and researchers have studied the pharmacological effects of steam distilled, petroleum ether & benzene extracts of various parts of Tulsi plant and eugenol on immune system, reproductive system, central nervous system, cardiovascular system, gastric system, urinary system and blood biochemistry and have described the therapeutic significance of Tulsi in management of various ailments. These pharmacological studies have established a scientific basis for therapeutic uses of this plant.

Key words : tulsi medicinal plant
Ocimum sanctum Linn eugenol

*Corresponding Author

**Present Address : Research Associate (ICMR), Department of Pathology, King George's Medical University, Lucknow.

INTRODUCTION

Plants are one of the most important sources of medicines. Today the large number of drugs in use are derived from plants, like morphine from *Papaver somniferum*, Aswagandha from *Withania somnifera*, Ephedrine from *Ephedra vulgaris*, Atropine from *Atropa belladonna*, Reserpine from *Roulphia serpentina* etc. The medicinal plants are rich in secondary metabolites (which are potential sources of drugs) and essential oils of therapeutic importance. The important advantages claimed for therapeutic uses of medicinal plants in various ailments are their safety besides being economical, effective and their easy availability (1, 2). Because of these advantages the medicinal plants have been widely used by the traditional medical practitioners in their day to day practice. According to a survey (1993) 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). In traditional systems of medicine the Indian medicinal plants have been used in successful management of various disease conditions like bronchial asthma, chronic fever, cold, cough, malaria, dysentery, convulsions, diabetes, diarrhea, arthritis, emetic syndrome, skin diseases, insect bite etc. and in treatment of gastric, hepatic, cardiovascular & immunological disorders (1, 4–8).

The medicinal use of plants is very old. The writings indicate that therapeutic use of plants is as old as 4000–5000 B.C. and Chinese used first the natural herbal preparations as medicines. In India,

however, earliest references of use of plants as medicine appear in Rigveda which is said to be written between 3500–1600 B.C. Later the properties and therapeutic uses of medicinal plants were studied in detail and recorded empirically by the ancient physicians in Ayurveda (an indigenous system of medicine) which is a basic foundation of ancient medical science in India (9).

In Ayurveda Tulsi (*Ocimum sanctum L.*) has been well documented for its therapeutic potentials and described as Dashemani Shwasaharni (antiasthmatic) and anti-kaphic drugs (Kaphaghna) (9). Although the traditional medical practitioners in India have been widely using this medicinal plant for management of various disease conditions from ancient time, not much is known about the mode of action of Tulsi, and a rational approach to this traditional medical practice with modern system of medicine is also not available. In last few decades several studies have been carried out by Indian scientists and researchers to suggest the role of essential oils & eugenol in therapeutic potentials of *Ocimum sanctum L.* (4, 12). Eugenol is a phenolic compound and major constituent of essential oils extracted from different parts of Tulsi plant. The therapeutic potential of Tulsi has been established on the basis of several pharmacological studies carried out with eugenol and steam distilled, petroleum ether and benzene extracts of different parts of Tulsi plant (4, 10, 12, 15, 18, 21, 23–27). The present article incorporates the names of some important plants of genus *Ocimum*, therapeutic uses of *Ocimum sanctum L.* and pharmacological actions & sources of eugenol.

Ocimum sanctum* Linn (Tulsi): A plant from genus *Ocimum

Among the plants known for medicinal value, the plants of genus *Ocimum* belonging to family Labiatae 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 (1, 4–9, 11–15, 17, 23). *Ocimum sanctum* L., known as ‘Tulsi’ in Hindi and ‘Holy Basil’ in English, is an erect softy hairy aromatic herb or undershrub found throughout India. Tulsi is commonly cultivated in gardens. Two types of *Ocimum sanctum* L. are met within cultivation: (i) Tulsi plants with green leaves known as Sri Tulsi & (ii) Tulsi plants with purple leaves known as Krishna Tulsi (14). *Ocimum sanctum* L. is held sacred by Hindus and is used as medicinal plants in day to day practice in Indian homes for various ailments (12).

Therapeutic uses of *Ocimum sanctum* Linn (Tulsi)

Several medicinal properties have been attributed to *Ocimum sanctum* L. (16–27). Different parts of Tulsi plant e.g. leaves, flowers, stem, root, seeds etc. are known to possess therapeutic potentials and have been used, by traditional medical practitioners, as expectorant, analgesic, anticancer, antiasthmatic, antiemetic, diaphoretic, antidiabetic, antifertility, hepatoprotective, hypotensive, hypolipidmic

and antistress agents. Tulsi has also been used in treatment of fever, bronchitis, arthritis, convulsions etc.

Aqueous decoction of Tulsi leaves is given to patients suffering from gastric and hepatic disorders (12, 14). Herbal preparations containing *Ocimum sanctum* L. have been suggested to shorten the course of illness, clinical symptoms and biochemical parameters in patients suffering from viral hepatitis (12). The leaf juice of *Ocimum sanctum* L. along with Triphala is used in Ayurvedic eye drop preparations recommended for glaucoma, cataract, chronic conjunctivitis and other painful eye diseases. The juice of fresh leaves is also given to patients to treat chronic fever, dysentery, hemorrhage and dyspepsia (12, 14). A decoction of Tulsi leaves is a popular remedy for cold (12, 14). Tulsi leaves also check vomiting and has been as anthelmintic (4).

As a prophylactic against malaria, fresh Tulsi leaves are taken with black pepper in the morning (14). Ayurvedic preparation containing *Ocimum sanctum* L., *Allium stivum*, *Piper nigrum* and *Curcuma longa* has been shown to possess antimalarial activity against *Plasmodium vivax* and *Plasmodium falciparum* (12). This preparation has been found to relieve the clinical symptoms in 52% of *Plasmodium vivax* patients and 100% of *Plasmodium falciparum* patients (12). A decoction of the root of Tulsi plant is given as a diaphoretic in malarial fever (14). As far as its antimalarial effect is concerned Tulsi extracts and essential oil have also been found to possess insecticidal and larvicidal activities against mosquitoes (12). *Ocimum sanctum* L. also possesses

antifungal activity against *Asperigillus niger* (12). Aqueous extract of Tulsi is found effective in patients suffering from viral encephalitis (12).

Aqueous decoction of whole plant lowers the blood sugar (glucose) level and is said to control diabetes mellitus (23). Paste of Tulsi leaves are found effective in the treatment of ring-worm and other skin diseases (4, 12, 14). Tulsi has been also recommended for use as antidote for dog bite, scorpion bite and insect bite in traditional system of medicine (4, 12, 14). The fresh leaves and flower tops of *Ocimum sanctum L.* have been used as antispasmodic agent (as smooth muscle relaxant) (4, 12). The seeds are mucilaginous and demulcent and are given in disorders of the genitourinary system (12). The leaves of Tulsi plant have also been shown to possess good anti-stress (adaptogenic), analgesic, anti-hyperlipidemic, antioxidant potentials in experimental animals (10, 12, 21, 22, 26, 27). Leaves and seeds of Tulsi plants have been reported to reduce blood and urinary uric acid level in albino rabbits and possess diuretic property (25). Gastric ulceration and secretion are reported to be inhibited by Tulsi in albino rats (4, 24).

The leaves of *Ocimum sanctum L.* are said to have abortifacient effect in women (5, 11, 16). *Ocimum sanctum L.* has also got antifertility effect (16–20). In Kerla the local women as well as the Ayurvedic physicians have been reported to use the leaves of Tulsi for antifertility effect (16). The benzene and petroleum ether extracts of leaves of *Ocimum sanctum L.* have been reported to produce 80% and 60% antifertility activity respectively in female rats (16,

17). In male rats benzene extract of Tulsi leaves has been suggested to reduce spermatogenesis by retarding the sertoli cell activity without affecting the germ cells (18). The role of sertoli cells in the maturation of spermatogenesis is well known. The seeds of *Ocimum ammericanum* have been found to possess antifertility activity in women when given along with *Actinopteris radiate* (17). The leaves of *Ocimum canum* (known as 'Dulal Tulsi' in Hindi) have been shown to possess anti-implantation activity in experimental albino rats (12, 17).

Ursolic acid, one of the major constituents of the Tulsi leaves, has been suggested to possess antifertility effect in rats of both sexes and in male mice (12). Ursolic acid because of its anti-estrogenic effect reduces spermatogenesis and causes a decrease in sperm counts (12). Several other pharmacological effects, such as anti-tumor, hepatoprotective, anti-inflammatory (oral & topical), anti-ulcer, antimicrobial, anti-hyperlipidemic, and anti-viral activities, have also been attributed to ursolic acid (28).

Pharmacological actions of eugenol

Several studies have shown that steam distilled essential oils extracted from fresh leaves of *Ocimum sanctum L.* have therapeutic importance. The therapeutic potential of the essential oils extracted from fresh leaves of *Ocimum sanctum L.* has been found to be largely due to eugenol (major constituent of the essential oil) which is a phenolic compound (1-hydroxy-2-methoxy-4-allylbenzene) (4, 12, 30). In order to understand the mode of action of *Ocimum*

sanctum L., to explain its therapeutic potentials in management of various disease conditions and to establish its use in modern medicine, several investigations have been carried out to study the pharmacological actions of the eugenol, essential oils (extracted from Tulsi leaves) & extracts of Tulsi on immune system, central nervous system, gastric system, reproductive system, blood biochemistry etc. in experimental animals (4, 10, 12, 15, 18, 21, 23–27). Eugenol and the essential oils have been found to reduce raised blood sugar, triglyceride & cholesterol levels and activities of LDH, GPT, GOT and alkaline phosphatase (diagnostic clinical enzymes) in blood serum explaining the therapeutic potentials of *Ocimum sanctum* L. as antidiabetic, cardioprotective, hypolipidemic and hepatoprotective agent. Eugenol has been well shown to possess the vasorelaxing action on rabbit arterial tissue indicating its therapeutic importance as a vasodilator (29).

Eugenol and the essential oils have also been observed to possess membrane stabilizing properties on synaptosomes, erythrocytes and mast cells which account for the therapeutic potentials of Tulsi in management of neurological (e.g. convulsions & epilepsy), inflammatory and allergic disorders (4). The therapeutic use of *Ocimum sanctum* L. in treatment of gastric ulcer has been attributed to antiulcerogenic action of eugenol and essential oil extracted from Tulsi leaves (4, 24). Lowering of uric acid level by extract of Tulsi leaves and eugenol claims the therapeutic potential of *Ocimum sanctum* L. in treatment of rheumatoid arthritis (4, 25). Eugenol and the essential oils have also

been shown to be immunostimulant claiming the therapeutic potential of *Ocimum sanctum* L. in immunological disorders associated with immunosuppression (4, 12).

Essential oils extracted from the leaves of *Ocimum sanctum* L. has been found to inhibit in-vitro growth of *E. coli*, *B. anthracis* and *P. aeruginosa* showing its antibacterial activity (12). Tulsi also has anti-tubercular activity and inhibits in-vitro growth of *M tuberculosis* (12). The essential oils extracted from Tulsi leaves also possess anti-fungal and anti-viral activity (12).

Plant sources of eugenol

Eugenol has great importance in pharmaceutical industry and usually extracted from clove buds (known as 'Laung' in Hindi) of *Eugenia caryophyllata* Thumb, belonging to family Myrtaceae, and from leaves and barks of *Cinnamomum zeylanicum* Breyn (known as 'Dalchini' in Hindi), belonging to family Lauraceae (14, 30). The clove buds and leaves & bark of plant Dalchini are rich sources of eugenol containing about 70–85% and 20–50% eugenol respectively (30). Although these plant sources are rich in eugenol but because of their higher prices the commercial extraction of eugenol from them is costly. In contrast to these sources *Ocimum sanctum* L. (Tulsi) and *Ocimum basilicum* (Ban Tulsi) are cheaper sources for commercial extraction of eugenol (30). The aerial parts (leaves, flowers & stem) of these plants contain essential oils with good percentage of eugenol (12, 30). The leaves of *Ocimum sanctum* L. are chief source of essential oils followed by the inflorescence and stem, however, flowers contain more

essential oils than leaves in *Ocimum basilicum*. The roots and fruits of these plants are almost completely devoid of any essential oil (12, 30). The essential oil extracted from the Tulsi leaves by steam distillation largely contains eugenol. The other important constituents of the essential oil are carvacrol, methyl eugenol, caryophyllene etc. (30). Quantitative variations have been seen in the composition of essential oils of *Ocimum sanctum L.* growing in different parts of India (12, 30). The percent of eugenol in essential oil of *Ocimum sanctum L.* varies from 40% (in Jammu) to 71% (in Assam) (30). Seasonal variation has also been observed in composition of essential oil extracted from Tulsi leaves (12, 30). In month of November, *Ocimum sanctum L.* has been found to yield maximum amount of eugenol (30).

To produce eugenol-rich *Ocimum* variety, scientists of Regional Research Laboratory (RRL), Jammu, have developed

a hybrid strain of *Ocimum gratissimum L.* using recurrent selection (FCA) technique of breeding and named it as "Clocimum" (31). This "Clocimum" variety contains 60–65% eugenol and has been released by RRL to private parties for commercial multiplication on the field for production of eugenol. In RRL, Jammu, another heterotic F1 strain of *Ocimum* has been developed and named as "Clocimum-3c". This is an improved Eugenol-rich *Ocimum* variety containing 90–95% eugenol (31). This variety has also been released to the private and commercial farmers under the trade name RRL-og-1.

ACKNOWLEDGEMENTS

Authors thankfully acknowledge the keen interest and the support offered by Mrs. Seema Gupta, Chairperson, and Prof. J. N. Jaiswal, Principal, Seema Dental College & Hospital, Rishikesh, in preparation of this manuscript.

REFERENCES

1. Atal CK, Kapoor BM. Cultivation and utilization of medicinal plants (Eds. PID CSIR), 1989.
2. Siddiqui HH. Safety of herbal drugs-an overview. *Drugs News & Views* 1993; 1(2): 7–10.
3. WHO survey. In medicinal plants (Eds. Haq. I.) *Hammad Foundation Press*, Karachi, 13, 1993.
4. Sen P. Therapeutic potentials of Tulsi: from experience to facts. *Drugs News & Views* 1993; 1(2): 15–21.
5. Chopra RN, Chopra IC, Handa KL, Kapoor LD. Indigenous drugs of India (Published by UN Dhar, Pvt. Ltd., Calcutta) 1993.
6. Chopra RN, Nayar SI, Chopra IC. Glossary of Indian Medicinal Plants (Published by CSIR, New Delhi) 1956.
7. Satyavati GV, Raina MK, Sharma M. Medicinal Plants of India (Published by ICMR, New Delhi), 1976.
8. Nadkararni AK, Nadkarni KM. Indian Materia Medica (Published by Popular Prakashan Pvt. Ltd., Bombay) 1976.
9. Sirkar NN. Pharmacological basis of Ayurvedic therapeutics. In: Cultivation and utilization of medicinal plants. Editors: Atal CK and Kapoor BM (Published by PID CSIR) 1989.
10. Khanna N, Bhatia J. Action of *Ocimum sanctum* (Tulsi) in mice: possible mechanism involved. *J Ethnopharmacology* 2003; 88(2–3): 293–296.
11. Kirtikar KR, Basu BD. In: *Ocimum sanctum* in Indian Medicinal Plants (Published by LB Basu, Allahabad) 1965.

12. *Ocimum sanctum*. The Indian home remedy. In: Current Medical Scene, March-April 1992 (Edited and published by S. Rajeshwari, Cipla Ltd., Bombay Central, Bombay).
13. Sanyal, PK. Homeopathic Pharmacy in India. In: Cultivation and utilization of medicinal plants. Editor: Atal CK and Kapoor BM (Published by PID CSIR) 1989.
14. Pandey BP, Anita. In: Economic Botany (Published by Chand and Company Ltd., Ramnagar, New Delhi), p. 294, 1990.
15. Gupta SK, Prakash J, Srivastava S. Validation of claim of Tulsi, *Ocimum sanctum* Linn as a medicinal plant. *Indian J Experimental Biology* 2002; 40(7): 765-773.
16. Batta SK, Santhakumari G. The antifertility effect of *Ocimum sanctum* and Hibiscus Rosa Sinensis. *Indian J Medical Research* 1971; 59: 777-781.
17. Nagarajun S, Jain HC, Aulakh GS. Indigenous plants used in fertility control. In: Cultivation and utilization of medicinal plants. Editors: Atal CK and Kapoor BM (Published by PID CSIR) 1989, p. 558.
18. Reghunandana R, Sood S, Reghunandana V, Mehta RM, Singh GP. Effect of *Ocimum sanctum* Linn (Tulsi) extract on testicular function. *Indian J Medical Research* 1995; 49(4): 83-87.
19. Vohra SB, Garg SK, Chaudhary RR. Antifertility screening of plants III. Effect of six indigenous plants on early pregnancy in albino rats. *Indian J Medical Research* 1969; 57: 893.
20. Khanna S, Gupta SR, Grover SK. Effect of long term feeding of Tulsi. *Indian J Experimental Biology* 1986; 24: 302-304.
21. Bhargava KP, Singh N. Antistress activity of *Ocimum sanctum* Linn. *Indian J Medical Research* 1981; 73: 443-451.
22. Ray A. Recent trends in stress research: Focus on adaptogenesis. Proc. XXXVIIIth Conference of Indian Pharmacological Society held at Punjabi University, Patiala, Nov. 23-26, 1995, p. 68.
23. Nagarajun S, Jain HC, Aulakh GS. Indigenous plants used in the control of Diabetes. In: Cultivation and utilization of medicinal plants. Editors: Atal CK and Kapoor BM (Published by PID CSIR) 1989, p. 584.
24. Mnadal S, Das DN, Dey K, et. al. *Ocimum sanctum* Linn - A study on gastric ulceration and gastric secretion in rats. *Indian J Physiol Pharmacol* 1993; 37: 91-92.
25. Sarkar A, Pandey DN, Pant MC. A report on the effect of *Ocimum sanctum* (Tulsi) leaves and seeds on blood and urinary uric acid, urea and urine volume in normal albino rabbits. *Indian J Physiol Pharmacology* 1990; 34: 61-62.
26. Sethi J, Sood S, Seth S, Thakur A. Protective effect of Tulsi (*Ocimum sanctum*) on lipid peroxidation in stress induced by anemic hypoxia in rabbits. *Indian J Physiol Pharmacology* 2003; 47(1): 115-119.
27. Sarkar A, Pandey DN, Pant MC. Changes in the blood lipid profile level after administration of *Ocimum sanctum* (Tulsi) leaves in the normal albino rabbits. *Indian J Physiology Pharmacology* 1994; 38(4): 311-312.
28. Liv J. Pharmacology of oleanolic and ursolic acid. *J Ethnopharmacology* 1995; 49: 57-68.
29. Nishijima H, Uchida R, Kimiko K, Kawakami N, Ohkuba T, Kitamura K. Mechanisms mediating the vasorelaxing action of eugenol, pungent oil, on rabbit arterial tissues. *Jpn J Pharmacology* 1999; 79(3): 327-334.
30. Mukherji S.P. *Ocimum* - a cheap source of Eugenol. Science Reporter 1987, p. 599. 31. Eugenol-rich *Ocimum* variety released. In: CSIR NEWS (Published by PID CSIR, New Delhi), 1995; 45: 256.