

PHARMACOLOGICAL AND THERAPEUTIC EFFECTS OF *OCIMUM SANCTUM*

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Article Received on 14/06/2016

Article Revised on 05/07/2016

Article Accepted on 26/07/2016

ABSTRACT

Herbal drugs and their products are an imperative source of medicine globally. *Ocimum Sanctum* Linn, commonly known as Tulsi has been used in traditional systems of medicine since ages. The medicinal herb has been considered as a sacred plant by the Hindus in the Indian subcontinent. *Ocimum Sanctum* has been suggested to possess a number of pharmacological actions like antifertility, anticancer, antidiabetic, antimicrobial, hepatoprotective, analgesic, anti-inflammatory and antithyroid actions. The present review article highlights about the phytoconstituents present in the plant alongwith the pharmacological effects exhibited by the plant.

KEYWORDS: Herbal drugs, *Ocimum Sanctum*.**INTRODUCTION**

Herbal drugs have been considered as a major source of medicines from ancient times and that is why a large number of drugs are derived from plants in the existing world.^[1] Numbers of advantages like low side effect profile, easy availability, low cost and safety profile makes the herbal drugs as the primary choice of the medical practitioners. *Ocimum Sanctum*, commonly known as 'Tulsi' is widely distributed in India, the availability of which ranges from the Himalayas to the Andaman and Nicobar Islands. 'Tulsi' is a Sanskrit word which means "the incomparable one" and has a very special place in the Hindu culture.^[2-3] This plant has been known to belong to Lamiaceae family which is native throughout the Old World tropics and cultivated for religious and medicinal purposes. The aromatic volatile oil present in *Ocimum Sanctum* has been known to contain phenols, terpenes, aldehydes, alkaloids, glycosides, saponins and tannins.^[4-5] Tulsi plant has been known to possess a number of medicinal properties not only in Ayurveda and Siddha but also in Greek, Roman and Unani systems of medicines. *Ocimum Sanctum* L. has been widely accepted to possess anticancer, antidiabetic, antimicrobial, hepatoprotective, analgesic, antifertility, anti-inflammatory, anti ulcer and antihypertensive actions.^[6-8] Also, *Ocimum Sanctum* Linn has been recommended for the treatment of various diseases like bronchial asthma, malaria, diarrhea, dysentery, skin diseases, chronic fever and insect bite.^[9-10] The present review article highlights about the chemical constituents present in the plant and its parts. Also, the pharmacological and therapeutic profile of *Ocimum Sanctum* is discussed in the review.

EPIDEMIOLOGY AND TAXONOMY OF OCIMUM SPECIES

Ocimum L., commonly named Basil is a member of the Lamiaceae family. Basil has been known to belong to the genus *Ocimum*, derived from the Greek word *ozo* which means to smell, in reference to the strong odors of the species within the genus. Initially, the five species of *Ocimum* were listed by Linnaeus.^[11] The taxonomical classification can be documented as kingdom plantae, subkingdom tracheobionta, superdivision spermatophyte, division magnoliophyta, class magnoliopsida, subclass asteridae, order lamiales and family lamiaceae. The genus *Ocimum* has been found to be widespread over Asia, Africa, Central and Southern America.^[12] A number of countries have been found to produce basil oil all over the world like Albania, Hungary, Israel, Comoros, Pakistan, Egypt, Bulgaria and India. Tulsi is considered as a sacred plant in India and is found in two forms: dark or Shyama (Krishna) Tulsi and light or Rama Tulsi. Krishna tulsi has been reported to possess greater medicinal value and is commonly used for worship. Moreover, tulsi is found in India in the form of various species which include *Ocimum basilicum* Linn., *Ocimum canum* Sims., *Ocimum gratissimum* Linn., *Ocimum kilimandscharicum* Guerke., *Ocimum Sanctum* Linn. and *Ocimum viride* Willd.^[13]

CHEMICAL CONSTITUENTS OF OCIMUM SANCTUM

The presence of essential or volatile oil provides specific aromatic odour to *Ocimum Sanctum* which is mainly concentrated in the leaf. The aromatic volatile oil present in *Ocimum Sanctum* mainly contains phenols, terpenes and aldehydes. Apart from volatile oil, the plant also has been reported to contain alkaloids, glycosides, saponins

and tannins.^[14] It has been reported that a number of bioactive molecules and nutrients have been found in *Ocimum Sanctum* L., the quantity of which depends on the nature of soil alongwith the harvesting, processing and storage techniques. The essential oil from the leaves of *Ocimum Sanctum* has been found to possess α -Thujene, Octane, Nonane, α -pinene, β -pinene, Toluene, Camphene, Sabinene, Dimethyl benzene, Myrecene, Ethyl benzene, Limocene, p-cymene, Terpinolene, Alloocimene, Butyl-benzene, α -cubebene, Linalool, Eugenol, Methyl eugenol, β -elemene, Lactate, β -caryophyllene, Iso-eugenol, α -guaiene, α -amorphene, α -humulene, γ -humulene, α -terpeneol, Isoborneol, Carvacrol, Borneol, α -selinene, β -selinene, α -murolene, Cadinene, Calamene, Geraneol, Nerolidol, Iedol and Elemol.^[15-16] Also, the alcoholic extract of the aerial parts of the plant have been found to contain Urosolic acid, Apigenin, Luteolin, Isorientin, Orientin, Molludistin, Stigmasterol, Triacontanol ferulate, Vitexin, Isovitexin, Aesculetin, Aesculin, Chlogenic acid, Galuteolin, Circineol, Gallic acid, Procatechuic acid, Caffiec acid and Chlorogenic.^[15,17] Further, Palmitric acid, Stearic acid, Linolenic acid, Oleic acid, Sitosterol and Hexourenic acid have been reported to be present in the fixed Oil from the seeds of *Ocimum Sanctum*.^[17-18]

PHARMACOLOGICAL POTENTIAL OF *OCIMUM SANCTUM* LINN

Ocimum Sanctum has been reported to posses various pharmacological effects like antioxidant, antimicrobial, anticancer, antihypertensive, anti-toxic, analgesic, anti-inflammatory, anticoagulant and anti-thyroid.^[6-8] The phenolic compounds like cirsilineol, cirsimaritin, isothymusin, apigenin, rosmarinic acid, and eugenol from the leaf extract of *Ocimum Sanctum* showed potent antioxidant activity.^[19-20] The aqueous extract of *Ocimum Sanctum* showed inhibited growth for Klesbiella, E. coli, Proteus and Staphylococcus aureus; whereas the alcoholic extract showed growth inhibition for Vibrio cholera, confirming the antimicrobial potential of the herb.^[21] Further, the alcoholic extract of the leaves of *Ocimum Sanctum* showed an inhibitory effect on chemically induced skin papillomas in mice, showing its anticancer effect.^[22] Also, the tulsi plant has been reported to poosess potent antihypertensive effect which can be evidenced by the fact that the fixed oil from *Ocimum Sanctum* produced hypotensive effect in anaesthetized dog due to its peripheral vasodilator action. The oral administration of *Ocimum Sanctum* extract showed protection against mercuric chloride-induced toxicity in Swiss albino mice, confirming the anti-toxic effect of the plant.^[23] The volatile of *Ocimum Sanctum* show potent analgesic effect in a model of acetic acid-induced writhing in mice in a dose dependent manner.^[20,24] *Ocimum Sanctum* has been reported to possess significant anti-inflammatory activity which can be confirmed by the fact that the fixed oil from the plant extract showed reduction in inflammatory activity against leukotriene and arachidonic acid induced paw oedema in rats.^[25] The fixed oil from *Ocimum Sanctum*

has been known to possess anti-aggregatory action on platelets which can be confirmed by the fact that the fixed oil from the plant extract prolonged the blood clotting time in an experimental model.^[26] Moreover, *Ocimum Sanctum* leaf extract showed potential decrease in the concentrations of serum T3, T4 in the male mouse, confirming its anti-thyroid potential. In addition, various plant extracts and volatile oil from *Ocimum Sanctum* has been well reported to possess anti-diabetic, anti-stress, anti-ulcer, anti-fertility, hepatoprotective and immunomodulatory effects, accounting to the potent pharmacological profile of the plant.^[6,20] The oral extract of *Ocimum Sanctum* showed significant lowering of blood sugar in normal, hyperglycemic and streptozotocin-induced diabetic rats, confirming the anti-diabetic potential of the plant extract.^[27-28] The whole plant extract of *Ocimum Sanctum* increased the physical endurance of swimming mice alongwith prevention of the stress induced ulcers in rats and mice, that may be attributed to the potent anti-stress activity of the plant.^[29] The fixed oil of *Ocimum Sanctum* showed potent antiulcer activity against aspirin, indomethacin, alcohol (ethanol 50%), histamine, reserpine, serotonin or stress-induced ulcers in rats, accounting for the anti-ulcer effect of the plant. Also, *Ocimum Sanctum* has been reported to possess anti fertility effects which can be evidenced by the fact that the long term feeding of *Ocimum Sanctum* leaves to adult male and female albino rats alongwith normal diet showed decreased sperm count, sperm motility and weight of male reproductive organs.^[30] Moreover, the cold water extract of *Ocimum Sanctum* showed significant prevention against carbon tetrachloride induced liver damage in albino rats, that further evidenced the hepatoprotective potential of the plant.^[31] Furthermore, the chemoprotective potential of the plant can be confirmed by the fact that the administration of the plant extract in mice showed decrease in the elevated levels of reduced GSH in liver, lung and stomach tissues, confirming the chemoprotective potential of the plant.^[20,28]

THERAPEUTIC POTENTIAL OF *OCIMUM SANCTUM* LINN

Ocimum Sanctum has been widely accepted to posses a number of medicinal properties. Different parts of the plant have been known to possess therapeutic potentials e.g. leaves, flowers, stem, root and seeds. The traditional medical practitioners have used *Ocimum Sanctum* as expectorant, analgesic, anticancer, antiasthmatic, antiemetic, diaphoretic, antidiabetic, antifertility, hepatoprotective, hypotensive, hypolipidmic and antistress agents.^[9-10] Moreover, tulsi has also been used in treatment of fever, bronchitis, arthritis, convulsions etc. The aqueous decoction of Tulsi leaves is given to patients suffering from gastric and hepatic disorders.^[32] Also, 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. In addition, 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.^[33] A decoction of the root of Tulsi plant is given as a diaphoretic in malarial fever. Paste of Tulsi leaves are found effective in the treatment of ring-worm and other skin diseases.^[9,32] The seeds are mucilaginous and demulcent and are given in disorders of the genitourinary system. Additionally, Tulsi has been also recommended for use as antidote for dog bite, scorpion bite and insect bite in traditional system of medicine.^[9,32-33]

CONCLUSION

“Tulsi” can be considered as a potent herb which is used by the humans from ancient times. Various chemical constituents present in various parts of the plant showed potent antioxidant, antibacterial, anti-diabetic, anti ulcer, anti fertility, hepatoprotective and chemoprotective effects by virtue of which it can be concluded that *Ocimum Sanctum* is a traditionally and clinically proved medicinal herb for use. However, a number of studies have proved the pharmacological and therapeutic potential of the plant but still further studies are needed in order to completely explore the medicinal use of the plant in order to benefit the human fraternity.

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