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A Review On Pharmacological Effects of Tulsi (*Ocimum Sanctum*).

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ABSTRACT

This article provides an overview on the pharmacological effects, uses of various plant parts, Phytochemical constituents of Tulsi. In India, Tulsi is a plant of religious, cultural and medicinal importance from time unknown. It is also known as holy basil belongs to family Lamiaceae. Each part of the plant that is stem, leaves, roots and the whole plant, flowers is known for its medicinal properties. Tulsi has been found to protect organs and tissues against chemical stress from industrial pollutants and heavy metals, and physical stress from prolonged physical exertion, ischemia, physical restraint and exposure to cold and excessive noise. Tulsi has also been shown to counter metabolic stress through normalization of blood glucose, blood pressure and lipid levels, and psychological stress through positive effects on memory and cognitive function and through its anxiolytic and anti-depressant properties. Tulsi its wide pharmacological uses made it a most sought-after plant for scholars and researchers. In this review article we focus mainly on Cultivation, botanical description, taxonomy, medicinal uses, chemical constituents, pharmacological activities of Tulsi like anti-diabetic, hepatoprotective, analgesic activity, anti-inflammatory were discussed in detail. Various species of genus *occimum* were also mentioned, with their phytochemical constituents and pharmacological activities. This review article contains cumulative information from various research articles.

Keywords: *Occimum sanctum*, Tulsi, anti-diabetic, anti-inflammatory, analgesic activity.

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INTRODUCTION

Tulsi in Hindi or Tulsi in Sanskrit (holy basil in English) is a highly medicinal healthful aromatic herb belongs to the family Lamiaceae that is indigenous to the Indian subcontinent and been used within Ayurvedic medicine more than the 3000 years. In Ayurveda system Tulsi is usually mentioned as “ELIXIR OF LIFE” for its healing powers, and has been to treat many different health conditions. Tulsi leaf extracts are describe for treatment of respiratory illness, rheumatism & pyrexia ^[1]. Other therapeutic conditions include treatment of Epilepsy, Asthma, hiccups, cough, skin & hematological diseases, parasitic infections, neuralgia, headache wounds and inflammations ^[2] & oral conditions ^[3]. Tulsi is a scared plant of Hindus faith idolized all over India. Tulsi means that “incomparable one” and matchless one” derived from Sanskrit. Tulsi “queen of herbs” described as a scared plant and medicative plant in ancient literature.^[4] Three types of Tulsi are commonly described *Ocimum sanctum* Linn is one of most important medicinal plant known as holy basil. It is commonly available and cultivated across the India and having many therapeutic uses. Herbal medicine in many countries plays an important role in curing diseases and it is also used to treat various diseases. It is extensively used as an anti-oxidant, immune modulatory, anti-pyretic, anti-cancer, chemo preventive, radio protective, anti-hypertensive, cardio protective and anti-microbial activity. Tulsi is considered to be ubiquitous plant in India.^[5] *Ocimum tenuiflorum* (Tulsi) is an aromatic plant belongs to the family Lamiaceae. The leaves of Tulsi plant are useful during rainy season when disease like malaria and dengue. The juice extracted from Tulsi serves as a best remedy to bring down to fever. It is an essential ingredient in the preparation of ayurvedic cough syrups. It is highly getting rid of cold and flu.^[6] *Ocimum Basilicum* Linn. Popularly known as “sweet basil” used in Unani and Ayurvedic system of medicine. Basil is the important oil crop which is cultivated commercially in countries. It is popular herb valued for rich and spicy, mildly peppery flavour with trace of mint and clove been used as food ingredient for flavouring confectionary, baked foods.^[7]



Figure 1: Leaves of *ocimum sanctum* Linn.

Cultivation

Tulasi grows in tropical warm regions. It is originated and distributed and cultivated throughout country. It is cultivated 1800 above sea level.^[8] It grows naturally in moist soil. It grows widely some areas like Asia and Africa.^[9] Medicinal properties of plant depends upon the type of soil and variations in the rainfall. There are almost 150 species of *ocimum* genus in tropical region of Asia.^[10]

Botanical description

It is erect and branched fragmented erected plant attaining at a height of 30- 60 cm when matured. Leaves are simple, opposite, aromatic, branched, opposite, obtuse, elliptical with entire or sub serrate or dentate margins growing up to 5cm long.^[11] Flowers are elongate racemes in close whorls and purple in colour. The fruits are small and the seeds are yellow to reddish in colour.^[12]

Taxonomy:^[11]

Kingdom:	Plantae.
Sub kingdom:	Tracheobionta.
Super division:	Spermatophyta.
Division:	Magnoliophyta.
Class:	Magnoliopsida.
Order:	Lamiales.
Family:	Lamiaceae.
Genus:	<i>Ocimum</i>
Species:	Sanctum.
Binomial name:	<i>Ocimum sanctum</i> Linn.

Table 1: Names of Tulsi in Local & International Languages ^[13]

S.No	Name	Language	State & Country
1.	Tulasi	Assamese	Assam / India
2.	Tulasi Kural, Kalotulsi	Bengali	West Bengal, India
3.	Tulsi, Sabji	Gujarathi	Gujarti, India
4.	Tulasi, Niyan posh	Dogri	Himachal Pradesh, India
5.	Pachacha, kunnakam	Malayalam	Kerala, India
6.	Sabja, tulasa	Marathi	Maharashtra, India
7.	bajiru, kami -meaboki	Japanese	Japan
8.	basile, sweet basil	English	England
9.	Loh lahk, y u heung choi	Chinese	China
10.	Naruk -pul, yanggajuk	Korean	Korea
11.	tulasi patta, bavariphul	Nepali	Nepal
12.	Alfabega, Albacar	Spanish	Spain

Table 2. Medicinal properties of Tulsi

S.no	Pharmacological activities	Plant parts	References
1.	Analgesic activity	Leaves & seeds	Kumar a, et al., 2015 ^[14]
2.	Antiasthamatic activity	Leaves	Singh s., et al., 1991 ^[15]
3.	Anti bacterial activity	Leaves	Mishra p. 2011 ^[16]
4.	Anti cataleptic activity	Leaves	Kayastha bl.2014 ^[17]
5.	Anti convulsant activity	Stem & leaves	Jaggi rk. 2003 ^[18]
6.	Anti – helminthic activity	Leaves	Asha mk.2001 ^[19]
7.	Anti hyperlipidaemic activity	Leaves & seeds	Suanarunsawat t.2010 ^[20]
8.	Anti hypertensive activity	Seeds	Pandey g. 2010 ^[21]
9.	Anti stress activity	Whole plant	Jyoti s. 2007 ^[22]
10.	Anti anxiety activity	Leaves	Chatterjee m.2011 ^[23]
11.	Anti depressant activity	Leaves	Chatterjee m. 2011 ^[23]
12.	Anti cancer	Leaves	Venkatachalam g, 2018 ^[24]
13.	Hepato protective activity	Whole plant & seeds	Lahon k. 2011 ^[25]
14.	Radio protective activity	Leaves	Reshma k. Et al.2005 ^[26]
15.	Neuro protective	Leaves	Kaur g. 2010 ^[27]

Medicinal uses of Tulsi:

Ocimum Sanctum Linn. Used for the treatment of a wide range of ailments in the world. ^[28] Tulsi extracts acts as a detoxifying, cleansing, purifying agent for both internal & external. Meshed leaves are good for skin. It can also use for the treatment of skin disorders, itching. Leaf extracts or fresh green leaves commonly used for tea or raw powdered and also herbal supplements. Acts like broad spectrum antibiotic shows anti-viral, anti-bacterial, anti-carcinogenic. It is commonly used for the treatment of cold, cough, flu & chest congestion. Relieves from stress and restore & improve immunity and digestion. It is highly beneficial in diabetes, cancer, chronic bronchitis. Helps in regulating uric acid & thereby elimination risks of kidney stones. Tulsi is an essential ingredient used in the preparation of Ayurvedic cough syrups. The juice of Tulsi leaves extracted are useful to bring down high fever. Tulsi has the capability to strengthen the kidneys. Tulsi helps in lowering

the cholesterol levels in blood and beneficial in kidney stones. It is the most effective remedy for cardiac diseases. Tulsi is highly useful in respiratory disorders. Aromatic plant supports the removal phlegm and catarrhal matter from the bronchial tube. Highly beneficial for treatment like headache, heart disease, stomach disorders, hepatitis, dengue, malaria, flu.^[29]

Chemical Constituents

Fresh leaves and stems of *Ocimum Sanctum* extract yielded some phenolic compounds (anti-oxidant) such as Cirsilineol, Circimaritin, isothymusin, apigenin & rosameric acid and quantities of eugenol. Leaves of *Ocimum sanctum* contains 71% eugenol & 20% methyl eugenol 0.7% volatile oil. Oil contains carvacrol and sesquiterpene hydrocarbon caryophyllene.^[30] Alkaloids, glycosides, saponins are also present citric acid, maleic acid, tartaric acid are present in very less amount.^[29] Leaves contain 0.9% volatile oil. It is bright yellow in colour. Stems and leaves of the plant contains active compounds like flavonoids, saponins, triterpenoids.^[31] *Ocimum basilicum* Linn contains – (-) linalool 30 -40%, 8- 30% eugenol, and methyl chavicol (15- 27%). Minor basil oil constituents are (+) – delta – cadinene, 3- alpha humulene, citral and (-)- trans caryophyllene.^[32] Thai basil oil contains methyl chavicol (93.0%), eugenol (41.5%), gamma caryophyllene (23.7%) and methyl eugenol (11.8%) as major important compounds.^[29]

Table 3: Represents Pharmacological Importance of Various Parts of the Plant of *Ocimum Species*

S. No	Species Name	Plant Part	Chemical constituent	Pharmacological Activity	References
1.	<i>occimum sanctum</i>	leaves and buds ^[33]	eugenol	anaesthetic activity, anti -microbial, anti inflammatory action, anti-carcinogenic effects.	Khalil aa, et al., 2007 ^[34]
		herbs, leaves, flowers	linalool	anti-microbial, anti-inflammatory, analgesics, anti hyperalgesia	peana at, et al., 2008 ^[35]
2.	<i>occimum americanum</i>	herbs, leaves, flowers. ^[36]	linalool	anti microbial, anti -oxidant, anti diabetic	peana at, et al., 2008 ^[35]
		Whole plant	Volatile oils, tannins, flavonoids	anti oxidant, anti bacterial, anti fungal	maddi R. 2017 ^[37]
3.	<i>ocimum basilicum</i>	herbs, flower & leaf tissues ^[38]	phenolic acids:, rosmarnic acid	anti-viral, anti-bacterial anti inflammatory, anti oxidant	al-dhabi na. 2014 ^[39]
		leaves and seeds	terepenoids	anti- inflammatory, anti-oxidant, anti cancer, antiseptic, astringent, anti plasmodial	cox-georgian d.2019 ^[40]
4.	<i>ocimum amicorum</i>	leaves, bark, stem, root, stumps branches ^[41]	camphor	anti microbial, anti-viral anti tussive	chen w, vermaak i. 2013 ^[42]
		seeds	linoleic acids	anti-carcinogenic	chen zy.1997 ^[43]
5.	<i>ocimum camphechinaum</i>	leaves and buds	eugenol	Anaesthetic activity, anti-microbial, anti inflammatory, anticarcinogenic effects	khalil aa, et al.,2007 ^[34]
		herbs, leaves, flowers	linalool	anti microbial, anti oxidant, anti diabetic	peana at, et al., 2008 ^[35]
6.	<i>ocimum gratissimum</i>	seeds	thymol & eugenol	anti- inflammatory, antioxidant anaesthetic activity, anti-microbial.	nagoor meeran. 2017 ^[44]
		leaves	oleanolic acid	anti tumuor,	ayeleso tb. 2017 ^[45]
7.	<i>ocimum kilimandscharicum</i>	leaves	alpha pinene	analgesic activity, anti-bacterial, anti-cancer, anti-cataleptic, anti-fungal, anti-fertility, anti-depressant, anti-anxiety	narwal s.2011 ^[46]
		Seeds	linoleic acid	anti-ulcer activity, anti-hypertensive, anti-pyretic	kadian r.2012 ^[47]
8.	<i>ocimum minimum</i>	herbs, leaves, flowers	linalool	anti-microbial, anti-oxidant, anti-diabetic	peana at, et al., 2008 ^[35]
		leaves and buds	eugenol	anaesthetic activity, anti-microbial, anti-inflammatory, anticarcinogenic effects	khalil aa, et al., 2007 ^[34]

REPORTED ACTIVITIES

Anti – Diabetic Activity

Healthy adult male Wistar albino rats weighing between 18 to 20g were used for experiment. Diabetes mellitus was induced overnight fasted rats by single interperational injection freshly prepared 50 mg\ kg BW STZ, followed by 120 mg\kg nicotinamide 0.1 M citrate buffer (p^H 4.5). After 24 hours of diabetes mellitus induction, the rats were given 5% w\ v of glucose solution (2ml \kg) to prevent hypoglycaemic mortality.^[48] Diabetes was confirmed after 48hours of induction by measuring the fasting blood glucose level using tail vein blood sample. Rats with fasting blood glucose of more than 200mg\dl considered as diabetes and used for the further study. ^[49,50] Diabetic animals are divided into 4 groups. Group 1(normal control) group 2(diabetic control) animals. Animals of group 3 were treated with 0.25mg of glibenclamide and animals of group 4 & 6 were treated with hydrochloric extract of *Ocimum Sanctum* were selected for toxicology study. ^[48] The standard and test drug were suspended 0.5% CMC administered once daily through oral gavage for 21 days. Blood samples were collected on 7th and 14th day of experiment and used for the estimation of blood glucose with glucometer.^[51] Throughout the study experimental animals variations were monitored at regular intervals. At the end of study i.e., 21st day blood samples were withdrawn from the experimental animals by retro orbital plexus puncture serum was separated and used bio chemical analysis.

Analgesic Activity

Young Swiss Albino mice aged about 4-5 weeks weight of 25 – 30 gm & Adult Albino rats' weight of 1800 – 200 gm were used. The analgesic activity was done on hot plate method. Mice were allocated into 4 groups consist 10 animals in each cluster. The mice of each are placed within the beaker on the hot plate to obtain responses to electrical heat produced pain. Licking of paws and jumping out of the beaker was taken as sign of animal's response to heat induced pain. ^[53] The time taken for the rat to lick the paws and jumping was monitored before treatment. The test drug Ketorolac 2.5 mg\kg or ethanol extract of *Ocimum Sanctum* at the doses of 250 and 500 mg \kg body weight was given orally.^[52] 30 minutes after treatment the reaction time of each group mice were evaluated again five times individually in one hour interval and calculated.

Anti – Inflammatory

Adult Albino rats weight of 1800 – 200 gm were used. Anti – inflammatory activity was carried by carrageenan – induced paw edema method. Rats were randomly allocated into two groups each consists of six animals. Group 1 is considered as control by giving them only water. Group 2 was given test material 500 mg\kg while Diclofenac sodium at 10mg\kg was used as reference standard

for comparison.^[54] For half an hour after oral administration the test materials then 1% carrageenan is injected to the left hind paw of animals. The volume of paw edema was calculated at 0, 1,2,3,4 intervals using plethysmometer after administration. The right hind paw act as a reference.

Hepato Protective Activity

Healthy albino rats of Wistar strain both male and female weighing about 100- 200g. The test drug is *Ocimum Sanctum* leaves (OSE) extract and the standard hepato protective drug is Silymarin.^[55] Albino rats weighing about 150- 200g were allocated into five groups. Group 1 & 2 are normal and considered as controls. To group 3,4, 5 the alcoholic extract of *Ocimum Sanctum* leaves extract 200mg/kg BW\day, silymarin 100 mg/kg BW\day & OSE 100 mg/kg BW\day + silymarin 50 mg/kg BW\days respectively for ten days. Hepato toxicity was induced in group 2,3,4,5 of animals on the eighth day with Paracetamol 2g\ kg. it was evaluated by performing an assay of serum proteins, albumin globulin ratio, alkaline phosphate and liver histopathology. The rats were sacrificed on 10th day under deep ether anaesthesia and the liver samples were excised and washed with normal saline. The liver was fixed immediately in 10% formalin solution.^[56] The result was presented by mean and standard error mean for each group. The standard group was compared with control group by ONE WAY ANOVA. ^[56]

CONCLUSION:

It is evident that Tulsi is a medicinal plant of great importance because of its varied application in medicine, hence can be corroboratively known as “Queen of Herbs”. The huge survey of literature showed that *Ocimum sanctum* has many pharmacological activities. Tulsi is useful against stress; it increases stamina and increases systemic use of oxygen by body; strengthens immune system, reduces inflammation, protects from radiation reduces aging; supports the lungs, liver, and heart it exhibits antibiotic, anti-viral, and anti-fungal, anti-oxidant properties. Number of plants have been used in Ayurveda ancient medicine to cure ailments including common cold, cough, headache, flu, asthma, fever, sore throat, bronchitis, malaria, influenza, skin diseases, night blindness, diarrhoea, digestive disorders. Tulsi act as an adaptogen that helps the body & mind to encounter different physical, chemical emotional and infectious stresses, and restore physiological functions. So, it can be concluded that Tulsi is a traditionally and clinically proved medicinal herb for both its application and efficacy. Further it is used for herbal preparations.

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