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An Overview On Pharmacological Activities Of Tulsi (Ocimum Sanctum)

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ABSTRACT:This article provide us the view on the various use of different parts and it's pharmacological effects and phytochemical constituents of Tulsi. In Indian Tulsi had historically held in religious, cultural, and therapeutic significance . It belongs to the family Lamiaceae. Each and every part of the plant have the medicinal properties. Tulsi has been shown to protect organs and tissues from both chemical and physical stress, including that caused by extended physical activity, ischemia, physical restraint, exposure to cold, and excessive noise. Chemical stress is caused by industrial pollutants and heavy metals. Tulsi is also shown to ease psychological stress by improving memory and cognitive performance, as well as metabolic stress by bringing blood sugar, blood pressure, and lipid levels back to normal by it's antidepressant and anxiolytic qualities. Tulsi became a highly sought-after plant for academics and researchers due to its diverse pharmacological properties. In this review we gone focus mainly on the cultivation, taxonomy, medical uses, chemical constituent and their various pharmacological activities of Tulsi. various species of Ocimum are mentioned with their phytochemical constituents and pharmacological activities.

Keywords :Antidepressant, Ocimum sanctum, antidepressant, anxiolytic, cognitive.

INTRODUCTION :

Tulsi, also known as holy basil or tulsi in Hindi or Sanskrit, is a highly beneficial aromatic herb native to the Indian subcontinent and a member of the Lamiaceae family. It has been used for more than three thousand years in Ayurvedic treatment. Tulsi is generally referred as the "ELIXIR OF LIFE" in the Ayurvedic system due to its therapeutic properties and has been used to cure a variety of health conditions. Tulsi leaf extracts are recommended for the treatment of respiratory illnesses, rheumatism, and other conditions like cold(Jamshidi N et al, 2017) .Also it is used in treatment of other condition like Epilepsy, Asthma, hiccups, cough, skin and hematologicaldisease, parasitic infection, neuralgia, headache wounds and inflammation (Nadkarni KM, 2004) and oral condition(Hebbar SS et al, 2004). The sacred plant known as Tulsi is worshipped by Hindus all over India.Tulsi is a Sanskrit word that means "unmatchable one"& "incomparable one".In ancientliterature, the "queen of herbs" tulsi is characterised as a scared plant and a medicinalplant(Vijaylakshmi P et al, 2015).There are three distinct varieties of tulsi. sanctum ocimum One of the most significanttherapeutic plants is linn, sometimes known as holy basil. It is widely available and grownthroughout India, and it has numerous therapeuticuses. In many nations, herbal medicine is utilised to treat a variety of illnesses as well as to prevent sickness. It has a wide range of applications including anti-oxidant, immunological modulator, antipyretic, anti-cancer, chemo preventative, radio protective, anti-hypertensive, cardio protective, and anti-microbial activity. In India, tulsi is thought to be a native herb (Kavyashree et al, 2019) .The Lamiaceae family includes the aromatic plant Ocimum tenuiflorum, also known astulsi. The leaves of the Tulsi is highly useful in the rainy season for disease like malaria and dengue.The juice extracted from the plant is used in treatment to bring down the fever and it contain active ingredient that required in the preparation of cough syrup. And also it is used to treat cold and flu(Kumar KP et al, 2019) .It is also used in Unani and Ayurvedic system as "sweet basil" for preparation of medicine. It is a well-liked herb used to flavour baked goods and confections. It has a rich, spicy, gently peppery flavour with hints of mint and clove (Bilal A et al, 2019).

Leaves and flowers of ocimum sanctum

CULTIVATION :

In warm, tropical climates, tulasi grows. It was created, was exported, and was grown all over the nation. It is cultivated 1800 feet above sea level(Bhooshitha AN et al,2020).In damp soil, it develops naturally. In several places, including Asia and Africa, it grows widely(Kumar et al, 2012).Depending on the type of soil and climate, and also by amount of rainfall a plant's medicinal characteristics changes. In Asia's tropical regions, there are 150 species of ocimum genus (Kayastha BL, 2014).

Botanical description:

It is erected and branched plant that attain of height of 30-60 cm of height when it is matured. It's leaves are grown up to 5cm long(Joseph B and Nair VM, 2013) that are simple, opposite, aromatic, branched, elliptical with entire or sub-serrate or dentate margins. Flower are elongate racemes with purple in colour. It consist of small fruits and seeds are in yellow to reddish colour(Buddhadev et al, 2014).

BOTANICAL CLASSIFICATION : (Garodia et al, 2005).

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Lamiales
Family: Lamiaceae
Genus: Ocimum
Species: Sanctum
Binomial name: Ocimum Sanctum Linn

Names of Tulsi in Local & International Languages(Pattanayak et al, 2010).

S.No	Name	Language	State/Country
1.	Tulasi	Assamase	Assam/India
2.	Rudrajada,Tulasi	Telugu	Andhra pradesh
3.	Bajiru	Japanese	Japan
4.	Sweet basil	English	England
5.	Tulasipatta	Nepali	Nepal
6.	Yanggajuk	Korean	Korea
7.	Albacar	Spanish	Spain
8.	Lohlahk	Chinese	China
9.	Indisches Basilicum	German	Germany
10.	Kalotulsi,kural	Bengali	West Bengal

PHARMACOLOGICAL ACTIVITIES OF TULSI :

S.No	Pharmacological Activites	Plant parts	References
1.	Analgesic activity	Leaves/seeds	Kumar a, et al., 2015
2.	Anti bacterial activity	Leaves	Mishra p, et al., 2011
3.	Anti cancer activity	Leaves	Venkatachalam g, et al., 2018
4.	Anti convulsant activity	Stem/Leaves	Jaggirk, et al., 2003
5.	Anti hypertensive activity	Seeds	Pandey g, et al., 2010
6.	Anti depressant activity	Leaves	Chatterjee m, et al., 2011
7.	Anti stress activity	Whole plant	Jyoti s, et al., 2007
8.	Anti fungal activity	Leaves	Balakumar Sa, et al.,2011
9.	Anti inflammatory activity	Leaves	Mrutyunjay M Mirjeet,et al., 2014
10.	Anti diabetic activity	Leaves, stem, root	Parasuraman S, et al.,2015
11.	Anti arthritic activity	Seed	Aftab ahmad et al., 2018
12.	Anti oxidant activity	Leaves, stem, root.	B Ramesh et al.,2010
13.	Cardio protective activity	Leaves, stem, root	Meenu Sharma , et al., 2001
14.	Anti pyretic activity	Leaves	V Balakrishna, et al., 2017
15.	Immunomodulatory activity	Leaves	Anjana goel, et al.,2010
16.	Anti nociceptive activity	Leaves	N Khanna, et al ., 2003

Medicinal Uses of Tulsi :

Linn's Ocimum Sanctum, used worldwide as a therapy for a variety of diseases(Balakrishna et al, 2017). Tulsi Extracts have internal and exterior cleansing, purifying, and detoxifying properties. Leaves of Tulsi are meshed and used for the treating of itching and skin condition. Green leaves that are young that are used in tea, raw powder, and herbal supplements. They have the broad spectrum antibiotic and also shows anti-viral, bacterial, carcinogenic. These are commonly used for the treatment of cold, Flu, and also for chest congestion. Also increase the immunity and digestion process in body. It is highly used for the diabetes, cancer, chronic bronchitis. They help in regulation of uric acid and there by elimination risks of kidney stones and also help in strengthen the kidney. The extract or juice used to treat high fever. It will help in lowering the cholesterol levels in blood and effectively remedy for cardiac disease. This Aromatic plant supports the removal phlegm and catarrhal matter from the bronchial tube and highly beneficial treatment for headache, heart disease, stomach disorder, hepatitis, dengue, malaria, flu(Upadhyay et al, 2017).

Chemical constituents:

The stems and leaves of Ocimum Sanctum extract yielded some phenolic compoundused as anti-oxidant such as Cirsilineol, Circimaritin, isothymusin, apigenin&rosameric acid and quantities of eugenol.Leaves of Ocimum Sanctum contains 71%of eugenol and 20% of methyl eugenol and 0.7% of volatile oil. Oil contains carvacroland sesquiterpene hydrocarbon caryophyllene (Devi PU, 2001).Alkaloids, glycosides, saponins arealso present citric acid, maleic acid, tartaric acid are present in very lessamount (Upadhyay et al, 2017) 0.9% volatile oil in leaves. It is bright yellow in colour. It consist of active compounds like flavonoids, saponins, triterpenoids (Rahman S et al, 2011). Ocimumbasilicum 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 (Zheljazkov et al, 2008). Thai basil oil contains methyl chavicol (93.0%), eugenol (41.5%), gamma caryophyllene (23.7%) and methyl eugenol (11.8%) as major important compounds (Upadhyay et al, 2017).

Pharmacological Importance of Various Parts of the Plant of *OcimumSpecies*

S.No	Species Name	Plant Part	Chemical constituent	Pharmacological Activity	References
1.	*Occimum sanctum*	leaves and buds (Zheljazkov et al, 2008).	Eugenol	anaesthetic activity, anti -microbial, anti inflammatory action, anti-carcinogenic effects.	Khalil aa, et al., 2007
		herbs, leaves, flowers	linalool	anti-microbial, anti-inflammatory, analgesics, anti hyperalgesia	peana at, et al., 2008
2.	*Occimum americanum*	herbs, leaves,flowers (Sarma et al, 2011).	linalool	anti microbial, anti -oxidant, anti diabetic	peana at, et al., 2008
		Whole plant	Volatile oils, tannins, flavonoids	anti oxidant, anti bacterial, anti fungal	maddi R. 2017
3.	*Ocimum basilicum*	herbs, flower &leaf tissues (Dris et al, 2007)	phenolic acids:, rosmarnic acid	anti-viral, anti-bacterial anti inflammatory, anti oxidant	al-dhabina. 2014
		leaves and seeds	terepenoids	anti- inflammatory, anti-oxidant, anti cancer, antiseptic, astringent, anti plasmodial	cox-georgian d.2019
4.	*Ocimum amicorum*	leaves, bark, stem, root, stumps branches(Gupta et al, 2010)	camphor	anti microbial, anti-viral anti tussive	chen w, vermaaki. 2013
		seeds	linoleic acids	anti-carcinogenic	chen zy.1997
5.	*Ocimum camphechinaum*	leaves and buds	eugenol	Anaesthetic activity, anti-microbial, anti inflammatory, anticarcinogenic effects	khalil aa, et al.,2007
		herbs, leaves, flowers	linalool	anti microbial, anti oxidant, anti diabetic	peana at, et al., 2008
6.	*Ocimum gratissimum*	seeds	thymol & eugenol	anti- inflammatory, antioxidant anaesthetic activity, anti-microbial.	nagoor meeran. 2017
		leaves	oleanolic acid	anti tumuor,	ayeleso tb. 2017
7.	*Ocimum kilimandscharicum*	leaves	alpha pinene	analagesic activity, anti-bacterial, anticancer, anti-cataleptic, anti-fungal, anti-fertility, anti-depressant, anti-anxiety	narwal s.2011
		Seeds	linoleic acid	anti-ulcer activity, anti-hypertensive, antipyretic	kadian r.2012
8.	*Ocimum minimum*	herbs, leaves, flowers	linalool	anti-microbial, anti-oxidant, anti-diabetic	peana at, et al., 2008
		leaves and buds	eugenol	anaesthetic activity, anti-microbial, antiinflammatory, anticarcinogenic effects	khalil aa, et al., 2007

REPORTED ACTIVITES :

Anti inflammation Activity:

We utilised adult albino rats weighing between 1800 and 200 g. Carrageenan-induced paw oedema carried anti-inflammatory for this activity. The placement of the rats into two groups, each with six rats, was done at random. By providing Group 1 nothing but water, they are used as the control group. Group 2 received test material in doses of 500 mg/kg, with 10 mg/kg of diclofenac sodium serving as the reference standard for comparison (Winter et al, 1962). Followed by oral delivery of the test materials for 30 minutes, animal's left hind paws are subsequently given an injection of 1% carrageenan. Following injection, the volume of paw oedema was determined at intervals of 0, 1, 2, 3, and 4. The right hind paw serves as a guide.

Anti oxidant Activity:

The goal of the current investigation was to evaluate the antioxidant (both enzymic and nonenzymic) effects of a hydroalcoholic extract of Ocimum sanctum leaves on albino rats exposed to cadmium-induced damage. Oral administration of cadmium as CdCl 2 (6.0 mg/kg body weight) led to significant evaluation of LPO levels and there will be decrease of SOD, CAT, GPx, reduce GSH and vitamin C. Ocimum sanctum extract was administered in doses of 100 mg per kilogramme of body weight and 200 mg per kilogramme before and after cadmium intoxication, respectively. This resulted in a considerable decrease in LPO levels and a significant increase in SOD, CAT, GPx, GSH, and ascorbate levels (Ramesh et al.,2010). According to the results, delivering Wistar albino rats an oral dose of Ocimum sanctum extract significantly protects them from cadmium-induced toxicity.

Anti fungal Activity:

Analyze the Ocimum sanctum leaves' antifungal effects on dermatophytic fungus. Here in this the activity is done by 38ANCCLS method.200mg/ml conc of Ocimum sanctum leaves extract shows minimum inhibitory concentration (MIC) and minimum fungicidal concentration MFC against clinically isolated dermatophytes. They posses anti fungal activity against clinically isolated dermatophytes at the concentration of 200mg/ml. Ocimum sanctum has the antifungal activity, and the leaf extract has the source that are useful for dermatophytic infection (Balakumar Sa, et al.,2011).

Anti – Diabetic Activity:

Healthy male adult Wistar albino rats are used in this experiment of 18 to 20g weight. Diabetes mellitus was induced in overnight fasted rats by giving them the single interpretational injection of freshly prepared 50mg\ kg BW STZ, followed by 120 mg\kg nicotinamide 0.1M citrate buffer of [Ph4.5]. To prevent the hypoglycaemic mortality (Parasuraman et al, 2015) in rats after 24hours of diabetic mellitus induction by giving them 5% w\v of glucose solution(2ml/kg) For the purposes of the study, rats with fasting blood glucose levels greater than 200 mg/dl were classified as having diabetes (Petchi et al, 2014 and Rabbani et al, 2010).Diabetic Animals are divide into 4 groups. Group 1(normal control) group 2(diabetic control) animals. 0.25mg of glibenclamide are given to the group 3 and animals of group 4 & 6 were treated with hydrochloric extract of Ocimum Sanctum were selected for toxicology study (Kadian et al, 2012).The 0.5% CMC suspension of the standard and test substance was given once daily for 21 days via oral gavage. On the seventh and fourteenth days of the trial, blood samples were taken and utilised to estimate blood glucose using a glucometer (Petchi et al, 2013).Throughout the experiment monitored is done at the regular interval of time. At the end of the experiment day that is of 21 st day the blood sample is drawn from experimental animals by retro orbital plexus puncture serum was separated and used bio chemical analysis.

Immunomodulatory Activity:

To determine how Ocimum sanctum leaf aqueous extract affects IL-2 cytokine production in vivo and in vitro as well as how it affects the overall blood picture, including T and B cells. Ocimum sanctum aqueous crude extract of leaves is given to the albino Wistar rats for 20 days. Then the spleen cells of rats are harvested and assayed for IL-2 production by using sandwich ELISA and by mRNA expression methods. For the in vitro studies aqueous leaf extract of ocimum sanctum given in the different concentration (25-500 µg/mL) were added to the culture plates containing of ConA stimulated splenocytes. Analysis of density gradient purified lymphocytes as well as traditional methods for total and differential leukocyte count and haemoglobin level were carried out to examine the overall impact on the blood picture. It showed that the ability of spleen cells to release IL-2 was dramatically increased (P 0.001) in the rats treated with Ocimum sanctum leaves extract. Investigation in vitro revealed that IL-2 production was controlled. Blood study showed leucocytosis and augmentation of T& B lymphocytes by 25% approximately (Anjana goel, et al.,2010). Additionally, there was a 4-5% increase in haemoglobin levels. As evidenced by the increase in IL-2 production, aqueous Ocimum sanctum leaves extract have stimulatory effects on T & B lymphocytes, especially on the Th1 subset of lymphocytes.

Cardioprotective Activity:

Healthy albino Wistar rats were used for the experiment. Myocardial infarction was induced in rats by using 200 mg/kg ISO subcutaneously twice, separated by 24 hours. Alterations in lactate dehydrogenase (LDH), antioxidant markers, and morphological and

histological changes were examined. A dose of 200 mg/kg ISO showed significantly altered metabolic markers and caused mild cardiac necrosis (Meenu Sharma , et al., 2001).The effects of pre- and co-treatment with a hydroalcoholic extract of Ocimum sanctum (OS) at various doses (25, 50, 75, 100, 200, and 400 mg/kg) were examined in rats with myocardial infarction. Os significantly decreased levels of glutathione (GSH), superoxide dismutase (SOD), and LDH at doses of 25, 50, 75, and 100 mg/kg. Os was found to have the greatest cardioprotective effect at a dose of 50 mg/kg.

Anti convulsant Activity:

On a mildly modified Murashige and Skoog's (MS) medium, callus cultures from the stem of O. sanctum were induced and supplemented with 2,4-dichlorophenoxyacetic acid (2,4-D, 1-2 ppm) and kinetin (kn, 1 ppm). Using the maximum electroshock (MES) model, several extracts of the stem, leaf, and stem callus of O. sanctum were investigated for their Extracts of stem, leaf, and stem calli in ethanol and chloroform were successful in avoiding tonic convulsions brought on by transcorneal electroshock.ability to inhibit the convulsive effects of the common medication phenytoin (Jaggi k, et al., 2003).

Antiulcer activity:

Healthy albino rats of both male and female, weighing about 200–400 g The cold restrain method is used to induce gastric ulcers. Rats were randomly allocated into two groups. The test drug is aqueous leaf extract of Ocimum Sanctum, is administered to one group at a dose of 100-200 mg/kg for 7 days; this group serves as the "normal or test" group, while the standard antiulcer drug, ranitidine, is administered to the second group with distilled water as a control; this group serves as the "standard'.The test group was compared with the standard group for antiulcer activity. Tulsi leaf extract had a 68.85% and 65.66% ulcer prevention rate at doses of 100 mg/kg and 200 mg/kg, respectively (Ayesha et al, 2017). A significant reduction in the ulcer scores and ulcer index of gastric mucosa in rats was used as evidence to show the antiulcer effect of Ocimum sanctum.

Antipyretic activity :

30 albino rats weighing between 120 and 150 g were divided into five groups, and each group contains six rats. Group 1 (n = 6) was administered with 1 ml of normal saline, and it serves as the control group; group 2 was administered with brewer's yeast alone, and it serves as the inducer group; group 3 was administered with 150 mg/kg of paracetamol, and it serves as the standard group; and groups 4 and 5 were administered with 100 mg/kg and 300 mg/kg of Ocimum sanctum, respectively, and they serve as the test groups. To cause fever in all the test animals, a 20% suspension of 10 ml/kg of Brewer's yeast was subcutaneously injected. After 18 hours, the animals were given Ocimum sanctum (100 mg/kg or 300 mg/kg) and paracetamol (standard group, 150 mg/kg) orally. The rectal temperature was also collected. Over the course of four hours, the rats' body temperatures were recorded transrectally. When compared to group two (20 mL/kg, brewer's yeast), groups 4 and 5 (100 mg/kg and 300 mg/kg of Ocimum sanctum) significantly decreased yeast-induced pyrexia. When compared to group two (20 ml/kg, brewer's yeast), group three (paracetamol, 150 mg/kg) similarly exhibits a sizable reduction (V Balakrishna, et al., 2017). These findings imply that Ocimum sanctum extract has a strong antipyretic effect and that this activity may be mediated by inhibiting the release of prostaglandins and inflammatory mediators.

Anti nociceptive pathway :

Young Swiss albino mice, either male or female, weighing between 20 and 30 g, were used to assess the analgesic potential of an alcoholic leaf extract of Ocimum sanctum (OS, Tulsi). Models of nociception used included the GAA-induced writhing test and the radiant heat-induced tail flick. The dosage of OS (50, 100, 200 mg/kg, i.p., and 50, 100, 200 mg/kg, p.o.) significantly decreased the number of writhes in the glacial acetic acid (GAA)-induced writhing test. Additionally, OS (50, 100 mg/kg, i.p.) lengthened the mice's tail withdrawal delay (Ayesha et al, 2017). The tail flicking and number of writhes of mice are continuously examined for nociception or analgesic activity every 5 minutes.

CONCLUSION :

Ocimum sanctum has many pharmacological activities. Due to its ability to prolong life, tulsi is frequently referred to as "the elixir of life". Ayurveda and Siddha Systems of Medicine use various plant parts to treat and prevent a variety of diseases, including the common cold, headache, cough, flu, earache, fever, colic pain, sore throat, hepatic diseases, malaria fever, as an antidote for snake bite and scorpion sting, flatulence, fatigue, skin conditions, wounds, insomnia, arthritis, digestive disorders, and night terrors. The leaves help calm the nerves and improve memory. Tulsi is also used traditionally because it aggravates vata, pita, and kapha, and the chewing of tulsi leaves prevents ulcer formation and mouth infections. So, it can be concluded that tulsi is used for herbal preparations because of its wide therapeutic and traditional applications.

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