

Tulsi (OCIMUM SANCTUM): A Comprehensive Review on Phytochemistry and Therapeutic Potential

Sudarsanam Nagarjuna¹, Galaba Yamini Padmasri², Dr. B. Thangabalan³, Minraj Pokhrel⁴, Chukka Preethi⁵, Badisa Malleswari⁶, Chalamalasetty Bindu Sri⁷, Palaparathi Cherishma⁸, Lella Janaki⁹

^{1,2}Assistant Professor, SIMS College of Pharmacy

³Principal, SIMS College of Pharmacy

^{4,5,6,7,8,9}Student, SIMS College of Pharmacy

Abstract—Lifestyle related chronic diseases are the leading cause of morbidity and mortality in the world today and most of these can be prevented through Ayurveda's emphasis on healthy lifestyle practices and regular consumption of adaptogenic herbs. Of all the herbs used within Ayurveda, tulsi is preeminent, and modern science is now confirming its many beneficial effects. Accumulating evidence indicates that tulsi can act against physical, chemical, metabolic, and psychological stress by a unique combination of pharmacological actions. The protective effects of tulsi against chemical stress induced by industrial pollutants and heavy metals and physical stress induced by prolonged physical exertion, ischemia, physical restraint, and exposure to cold and excessive noise have been reported. In addition, tulsi has been found to mitigate metabolic stress through normalization of blood glucose, blood pressure, and lipid profiles and psychological stress through positive effects on memory and cognitive function and via its anxiolytic and anti-depressant properties. The broad-spectrum antimicrobial activity of tulsi against many human and animal pathogens provides a clear opportunity for its application as a hand sanitizer, mouthwash, and water purifier; in animal husbandry; wound healing; preservation of food stuffs and herbal raw material; and in traveler's health. The spiritual and practical significance of cultivating tulsi plants opens the grower to the creative powers of nature itself; organic tulsi cultivation also offers solutions to a host of serious modern problems such as food security, rural poverty, hunger, environmental degradation, and climate change. Applying tulsi in daily rituals provides a classical example of Ayurvedic wisdom in finding answers to some of our most important problems.

Index Terms—Tulsi, *Ocimum sanctum*, Plant extract, Antimicrobial, Anti-bacterial, Antifungal.

I. INTRODUCTION

The predominant cause of global morbidity and mortality is lifestyle-related chronic diseases, many of which can be addressed through Ayurveda with its focus on healthy lifestyle practices and regular consumption of adaptogenic herbs. Of all the herbs used within Ayurveda, tulsi (*Ocimum sanctum*) is prominent, and scientific research is now confirming its beneficial effects. There is mounting evidence that tulsi can address physical, chemical, metabolic and psychological stress through a unique combination of pharmacological actions. Tulsi has been shown to protect organs and tissues against chemical stress caused by industrial pollutants and heavy metals as well as physical stress caused by prolonged physical exertion, ischemia, physical restraint, and exposure to cold and excessive noise. In addition, tulsi has been shown to counteract metabolic stress through the 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. The broad-spectrum antimicrobial activity of tulsi, which includes activity against a wide range of human and animal pathogens, indicates its potential usefulness as a hand sanitizer, mouthwash, and water purifier, as well as in animal husbandry, wound healing, food preservation, and herbal raw material preservation and traveler's health. Growing tulsi plants has spiritual and practical implications which connect the grower with the creative powers of nature, and organic cultivation offers solutions to food security, rural poverty, hunger, environmental degradation,

and climate change. The use of tulsi in daily rituals is testimony to the knowledge and wisdom in Ayurvedic science and points to an ancient solution for some of the problems that face humanity in the modern era.

II. BOTANICAL CLASSIFICATION OF TULSI (OCIMUM SANCTUM):

Taxonomic Rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Lamiales
Family	Lamiaceae
Genus	Ocimum
Species	Ocimum sanctum

III. MORPHOLOGY

Tulsi plant yields long flowering racemes that are grouped closely in whorls. The hue of these flowers is purple, giving the plant a splash of colour. Tulsi seeds are tiny and have reddish yellow-like colour. Additionally, the plant yields small-sized fruits. Tulsi is usually planted in the rainy season because it needs moisture to grow. It takes several months to cultivate and care for it before it is ready for harvest. Tulsi is a small shrub that spreads out and grows upright. At maturity, it usually grows to a height of between 30 cm and 60 cm. The plant's leaves have a pleasing aroma with straight forward structure. The leaves are shaped like ellipses with rounded tips which are arranged in an opposite pattern along the branches. The leaf margins are dentate or toothed. The leaves range in length from 1 cm-5 cm on average. In India and Nepal, two morphotypes are mainly cultivated-green leaved and purple leaved (Gudi SK, et al)

IV. VARIETIES OF TULSI

➤ KRISHNA TULSI: OCIMUM SANCTUM



Description:

Krishna Tulsi plant, also known as Shyama Tulsi or Purple-leaved Tulsi, is a sacred plant in Hindu culture and a member of the mint family. It is an erect, branched herb that grows up to 1 meter tall with dark purple leaves and purple stem. The leaves are aromatic and slightly bitter in taste, and are commonly used in Ayurvedic medicine for their medicinal properties.

Krishna Tulsi plant requires well-drained soil and plenty of sunlight to grow. It is a hardy plant and can tolerate both high and low temperatures. The plant is considered a natural purifier and is often grown in home gardens for its air-purifying abilities.

The leaves of Krishna Tulsi plant contain essential oils, including eugenol, camphor, and thymol, which are known for their anti-inflammatory, antimicrobial, and antifungal properties. They are used in Ayurvedic medicine to treat respiratory problems, digestive disorders, and various other ailments. The plant is also believed to have a calming effect on the mind and is used in traditional medicine as a stress-relieving agent. In Hindu culture, Krishna Tulsi is considered a sacred plant and is often used in various rituals and ceremonies. The plant is believed to have spiritual powers and is believed to purify the mind, body, and soul.

Medicinal Benefits:

- i. Boosts immunity: Krishna Tulsi contains antioxidants and other compounds that help to boost the immune system and protect against infections.
- ii. Relieves respiratory problems: The essential oils in Krishna Tulsi are effective in treating

- respiratory problems such as coughs, colds, asthma, and bronchitis.
- iii. Promotes digestion: Krishna Tulsi helps to stimulate digestion and relieve digestive problems such as bloating, gas, and constipation.
- iv. Lowers stress and anxiety: The plant has adaptogenic properties that help to reduce stress and anxiety, promoting a calm and relaxed state of mind.
- v. Reduces inflammation: Krishna Tulsi contains compounds that have anti-inflammatory properties, which help to reduce inflammation in the body and relieve pain.
- vi. Fights infections: The plant has antimicrobial and antifungal properties that help to fight infections and prevent the growth of harmful bacteria and fungi.
- vii. Improves skin health: Krishna Tulsi can be used topically to treat skin infections and promote healthy skin. The plant has antiseptic and anti-inflammatory properties that help to soothe and heal the skin.

➤ RAMA TULSI: OCIMUM SANCTUM



Description:

Tulsi, also known as holy basil, is a popular herb in Ayurvedic medicine and is widely used for its health benefits. Rama Tulsi is one of the most common types of Tulsi, known for its sweet aroma and taste. It is rich in antioxidants and has anti-inflammatory properties that can help boost immunity and reduce stress levels. Spice Nest's Rama Tulsi is sourced from the best suppliers and is of high quality. It is an excellent choice for those who want to add a healthy twist to their teas or drinks.

Uses :

- i. Herbal Tea: Used to make soothing tea with calming effects.
- ii. Cooking: Adds flavour to curries, soups, and chutneys.
- iii. Aromatherapy: Essential oil used to reduce stress and enhance mental clarity.
- iv. Natural Remedy: Helps alleviate colds, coughs, and respiratory issues.
- v. Beauty: Used in skincare for acne and a healthy glow.

Medicinal Benefits:

- i. Boosts Immunity: Strengthens the immune system.
- ii. Reduces Stress: Promotes mental wellness.
- iii. Aids Digestion: Helps with bloating and digestive issues.
- iv. Anti-inflammatory: Reduces pain and inflammation.
- v. Supports Respiratory Health: Relieves cold and cough symptoms.

➤ VANA TULSI: - OCIMUM GRATISSIMUM



Description:

Tulsi Vana (Holy Basil) is native to India, Sri Lanka, Java and the northern and eastern parts of Africa. It is one of four main forms of Tulsi that are generally recognized and cultivated for religious and medicinal purposes - they all have similar values. Tulsi Vana is a ceremonial plant of Indian spiritual tradition. It is perennial, woody bush basil that can grow up to 2m high with highly aromatic, slightly hairy green leaves with a strong clove scent and spicy flavour. Tulsi Vana must be protected from frost and in temperate

areas it can be grown as an annual. It will do well in pots, prefers full sun and will tolerate dry conditions.

Culinary uses: The leaves are infused for tea and are used for flavouring.

Parts used: leaves, seeds and oil. Harvest just before flowering for medicinal use - it can be frozen for later use as well as be dried.

Medicinal uses:

Tulsi Vana improves immunity and contributes to a general sense of well-being. A tea made with the leaves tastes good and provides gentle stimulation to body, mind and spirit - it enhances physical and mental endurance and increases assimilation of oxygen and nutrients to the bloodstream. The strong antioxidant activity slows the aging process and helps prevent and treat cancer, heart disease, arthritis, diabetes and dementia. It normalizes both blood pressure and cholesterol levels and will help to overcome coughs colds, flu and fever and assists digestion. Tulsi Vana is warming, has antiseptic qualities, clears bacterial infections, strengthens the immune system and is considered to be a tonic and

adaptogenic. Tulsi Vana is an excellent wellness drink to help quit drinking coffee.

V. CHEMICAL CONSTITUENTS

Tulsi has a very complex chemical makeup that includes numerous nutrients and substances that are biologically active. Standardisation of tulsi's active ingredient is a complex process because of its botanical origins and intrinsic biochemical complexity. Eugenol and ursolic acid, the two most well-known active ingredients in tulsi leaves are the source of essential oil. Other than ursolic acid, the main components found and extracted from tulsi are non-existent. Both male and female rats and mice are susceptible to the compound's antifertility effects. Ursolic acid inhibits spermatogenesis, lowers sperm count and has anti-estrogenic properties. Eugenol is a phenolic compound that is extracted from the various parts of tulsi plant and is a major component of the essential oil. Structural representation of chemical constituents:

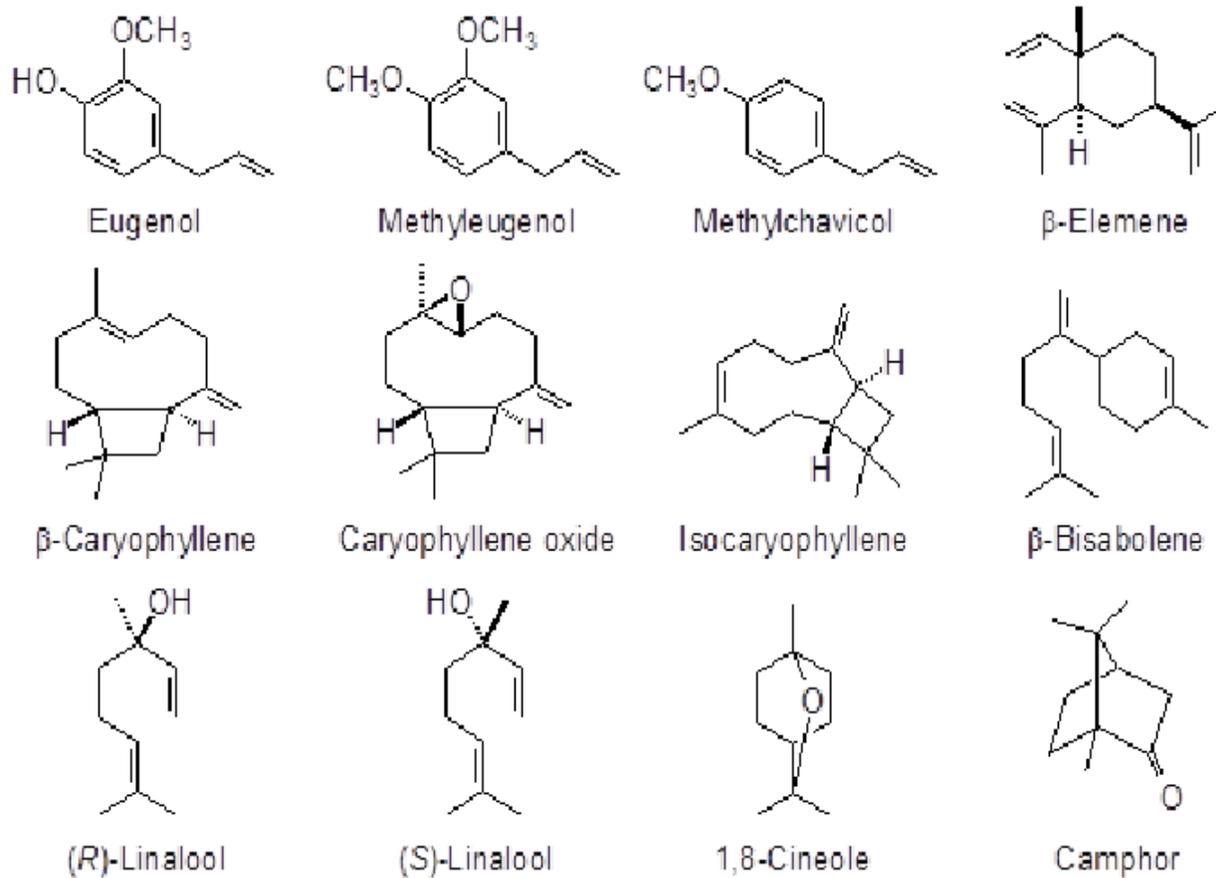


Figure 1: Structural representation of chemical constituents

VI. MECHANISM OF ACTION OF TULSI

Tulsi plant contains variety of constituents in its different parts, including flavonoids, triterpenoids, saponins and tannins. Eugenol is found as the volatile oil in its leaves. Certain constituents have demonstrated a pivotal role in the management and cure of diseases by modulating various bio-logical activities. The following is a description of tulsi's mode of action for managing illness curing; greater concentration of reactive oxygen produces oxidative stress and damages macromolecules, which leads to pathogenesis. Tulsi plant's antioxidant activity, on the other hand, neutralizes free radical potentiality. The plant also scavenges free radicals and protects against cellular damage. Furthermore, extracts with concentrations of 100 µg/ml exhibited hydro-gen peroxide (20.12%), hydroxyl radicals (12.68%) and superoxide radicals (21.68%) scavenging activity, according to methods for scavenging these three types of radicals. Tulsi functions as anti-inflammatory agent and may help lower inflammation by modifying different genes. Antibacterial drug resistance is a serious health issue that requires a solution. A natural compound has a major part in stopping the growth of bacteria or killing them by breaking their cell walls. Tulsi plant has demonstrated anti-gonorrheal efficacy against clinical isolates of methicillin-resistant *Staphylococcus aureus* that produces beta-lac-tamase and against multi-resistant strains of *Neisseria gonorrhoeal* (Alma-toroid SA, et al., 2020).

VII. MEDICINAL PROPERTIES

- i. Antimicrobial
- ii. Anti-diarrheal
- iii. Anti-oxidant
- iv. Anti-cataract
- v. Anti-inflammatory
- vi. Chemo-protective
- vii. Radio-protective
- viii. Hepato-protective
- ix. Neuro-protective
- x. Cardio-protective
- xi. Anti-diabetic
- xii. Anti-hypercholesterolemia
- xiii. Anti-hypertensive
- xiv. Anti-carcinogenic

VIII. MEDICINAL USES OF TULSI

1. Boosts Immunity:

Tulsi has abundant amounts of antioxidants and micronutrients that help fight common ailments like cold, flu, fever, asthma, etc. Chewing Tulsi leaves or drinking water boiled with Tulsi proves useful in relieving the symptoms of sore throat and cold. Moreover, Tulsi leaf benefits include curbing the growth of some cancer-causing cells and HIV cells, thus preventing life-threatening illnesses. >>>Read about: Ways to Build Immunity to Fight Common Diseases in India

2. Heals Infections:

For centuries, Tulsi has been used in curing wounds and infections owing to the combination of antiviral, antifungal, antibacterial, and antifungal properties in the plant. It also has anti-inflammatory properties that help in reducing inflammation and healing wounds quickly.

3. Purifies the Blood:

The sacred plant is also known to purify the blood, reflecting healthy skin. Also, Tulsi tea benefits can work wonders for one's overall health by flushing out toxins and cleansing the digestive system. The benefits of drinking Tulsi water are also plenty if we consume it regularly.

4. Cures Insect Bites:

Some skin infections, such as ringworm or insect bites, can be treated easily using fresh Tulsi leaves. Apply the juice of Tulsi leaves on the affected area. Holy basil has natural analgesic qualities and helps control inflammation and pain

5. Lowers Blood Pressure:

Hypertension patients can get significant health benefits as consuming Tulsi leaves benefits a person by lowering high blood pressure and cholesterol levels. Holy basil is a powerful medicine for headaches, anxiety, depression, lack of sleep, and symptoms of high blood pressure.

6. Treats Respiratory Disorders:

The polluted environment takes a toll on the lungs' health, resulting in respiratory problems like asthma and bronchitis. Tulsi acts effectively on the respiratory system. Also, steam inhalation with Tulsi leaves benefits in clearing the congestion.

7. Maintains Blood Sugar Level:

People having Type-2 diabetes can immensely benefit from Tulsi leaves. The ancient herb proves beneficial in not only regulating blood glucose levels and reduce the damaging effects. That is, consuming Tulsi in any form will improve the metabolism process and help the body process carbohydrates and fats

IX. SIDE EFFECTS OF TULSI

Despite being called the 'Golden remedy of Ayurveda,' Tulsi leaves have some side effects too! Some of them are mentioned below:

1. Adverse effects on pregnant woman:

Tulsi leave may cause the contraction of the uterine walls, which would be very dangerous and can even leads to miscarriage. To be on the safer side, it is advised to pregnant woman to stop consuming Tulsi leaves during the pregnancy period.

2. Negative impact on fertility:

Consuming Tulsi is found to have a negative impact on the fertility of both males and females. It may lower sperm count and also harm the reproductive system of women who are trying to conceive. However, more research is still required for confirming this claim.

3. Caution for diabetic people:

Tulsi is found to lower blood glucose levels. Therefore, it must be used with utmost care for diabetic patients if they are already taking glucoselowering medicines. Tulsi may further lower the blood glucose level to dangerous levels.

4. Interconnection with blood thinners:

Tulsi should not be consumed by the people who are prescribed anti-clotting medicines as Tulsi is a known blood thinner. It is a good home remedy for someone who is not taking blood-thinning medicines, but together with blood thinners, it may adversely affect an individual's health.

5. Liver damage:

Tulsi is infused with a chemical compound called Eugenol. A small amount of Eugenol is good for liver health, but too much of it can cause damage to the liver, convulsions, and rapid heartbeat.

6. Diarrhoea and nausea:

Some people may experience diarrhoea or nausea after consuming Tulsi for the very first time. Therefore, it is advised to start adding small quantities of Tulsi in the diet first and then gradually increase its consumption over time.

X. PHARMACOLOGICAL ACTIVITIES

S.NO	Therapeutic activity	Extract used	Parts used
1	Anti-stress	Ethanolic	Whole plant (dried)
2	Anti-inflammatory	Methalonic/aqueous	Leaves
3	Anti-fungal	Methalonic/Ethanolic	Leaves
4	Anti-fertility	Benzene	Leaves
5	Hepatoprotective	Ethanolic/aqueous	Whole plant (aerial)
6	Anti-diabetic	Ethanolic/aqueous	Leaves
7	Anti-ulcer	Ethanolic/aqueous	Leaves
8	Anti-microbial	Ethanolic	Leaves
9	Anti-psychotic	Methanolic/leaves paste	Leaves
10	Anti-cancer	Ethanolic	Root

XI. CONCLUSION

Life threatening infections caused by the frequency similarly, the emergence of pathogenic microorganisms has increased worldwide, and is becoming an important cause of morbidity and

mortality in immunocompromised patients in developing countries like our India. Results on bactericidal effect revealed that the leaf extracts of *O. tenuiflorum* showed antibacterial property in varying degrees against the selected pathogens used. Conclusion: The present Findings clearly indicated

O. tenuiflorum leaves possess the capabilities of being a good candidate in the search for natural antibacterial agents against diseases caused by both gram-positive and gram-negative pathogenic strains.

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