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Review Article

Tulsi (*Ocimum sanctum*): Health Benefits and Nutritional Wonders

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Abstract

Tulsi (*Ocimum sanctum*) also known as holy basil, is a sacred herb in India and is widely used in Ayurvedic medicine. Tulsi, also known as Holy Basil, has been used for centuries due to its medicinal properties and its ability to enhance health and well-being. It possesses remarkable analeptic effects that promote healing of both the mind and body. Tulsi is abundant in antioxidants and exhibits anti-inflammatory, antimicrobial, and immunomodulatory properties. It is commonly employed for treating various ailments, such as respiratory infections, digestive issues, and skin disorders. Additionally, it is renowned for its capacity to alleviate stress and anxiety, enhance cognitive function, and support longevity. Tulsi is a versatile herb available in different forms, including tea, capsules, and extracts. It can also be applied topically for skincare purposes or used in aromatherapy to induce relaxation and reduce stress. Extensive research has indicated numerous health benefits associated with tulsi, including its ability to reduce inflammation, improve cardiovascular health, and lower the risk of certain types of cancer. Furthermore, it has been found to positively influence the immune system, thereby bolstering overall health and wellness. In conclusion, Tulsi is a potent herb offering a broad spectrum of health benefits. Its versatility and effectiveness have made it a popular choice among those seeking to enhance their overall health and well-being.

Keywords: Tulsi; Anti- Inflammatory; Analeptic Effect; Antioxidant; Antimicrobial; Immunomodulatory

Introduction

Figure 1

Tulsi, with its origins in the Indian subcontinent, holds deep cultural significance in India, where it is revered as a sacred plant [1]. Renowned for its health-promoting effects and medicinal value, Tulsi occupies a prominent position in Ayurvedic herbal medicine. Ancient sages recognized Tulsi as a revitalizing adaptogen and antistress agent, attributing it with the potential to enhance health and longevity. In indigenous Ayurvedic medicine, various parts of the Tulsi plant, including its leaves, seeds, and roots, have been utilized for their therapeutic properties.

Tulsi leaves and inflorescence oil have gained widespread recognition for their diverse range of benefits, including their expectorant, analgesic, anti-emetic, and antipyretic properties [1]. These properties contribute to the alleviation of respiratory symptoms, pain relief, prevention of nausea, and reduction of fever. Furthermore, Tulsi is known for its stress-relieving and anti-inflammatory effects, and it has been regarded as an anti-asthmatic, hypoglycemic, hepatoprotective, hypertensive, hypolipidemic, and immunomodulatory agent. Additionally, Tulsi is considered an expectorant, analgesic, and antipyretic, further contributing to its therapeutic value.

Tulsi is traditionally renowned for its medicinal properties, and it is available in two varieties: Black Tulsi (Krishna Tulsi) and Green Tulsi (Ram Tulsi). Tulsi contains essential oils such as eugenol, as well as other compounds like thymol and ursolic acid [2]. Eugenol possesses antioxidant properties and inhibits lipid peroxidation [3]. Extracts of Tulsi leaves containing 70% ethanol have shown significant decreases in blood glucose levels in normal rats, rats with high blood glucose due to glucose feeding, and diabetic rats induced by STZ [4,5]. The reduction in blood glucose levels was ap-

proximately 91.55% and 70.43% compared to tolbutamide in normal and diabetic rats, respectively.

Tulsi is primarily grown in tropical and warm regions and is cultivated throughout India, including in the Himalayas up to an altitude of 1800m, as well as in temples and gardens [5,6]. It is also grown in various areas of Asia and Africa and naturally thrives in moist soil. The size, form, and medicinal properties of the plant depend on the soil type and variations in rainfall. The Ocimum genus encompasses around 150 species found in tropical regions of Asia, with cultivation primarily driven by their medicinal properties. Tulsi finds utility in the treatment of various ailments such as cold, cough, malaria, dengue, bronchitis, asthma, sore throat, influenza, heart disorders, eye diseases, mouth infections, insect bites, stress, kidney stones, and more.

Morphology

The Tulsi plant is a compact shrub that grows upright and branches out. When fully mature, it typically reaches a height of about 30 to 60 cm. The plant's leaves are simple in structure and emit a pleasant aroma. They are arranged in an opposite pattern along the branches, and each leaf is elliptical in shape with a rounded tip. The margins of the leaves are toothed or dentate. The average length of the leaves is up to 5 cm.

The Tulsi plant produces elongated racemes of flowers, which are arranged closely in whorls. These flowers are purple in color, adding a vibrant touch to the plant. The seeds of Tulsi are small and have a yellowish hue, resembling radishes. The fruits produced by the plant are also small in size. Tulsi is typically planted after the rainy season, as it requires a moist environment to thrive. It is cultivated and cared for over a few months before it is ready for harvest.

Taxonomy

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Lamiales
Family: Labiatae

Figure 2

Tulsi as per ayurveda

Tulsi (*Ocimum sanctum)* holds a revered position in Ayurveda, the traditional Indian system of medicine, as a highly valued medicinal herb [7]. Tulsi belongs to the Labiatae family and is characterized by its square stem and aromatic nature. Ayurvedic remedies frequently utilize extracts of Tulsi to address various health conditions, including the common cold, headaches, digestive disorders, inflammation, heart disease, poisoning, and malaria. Tulsi can be consumed in different forms, such as herbal tea, dried powder, fresh leaves, or combined with honey or ghee. Additionally, Tulsi juice is consumed for its therapeutic benefits.

To prepare Tulsi juice, different parts of the Tulsi plant, including leaves, tender branches, tender roots, seeds, and flowers, are collected. These aerial parts are meticulously cleaned using pure flowing water. Subsequently, they are crushed using a mortar and pestle to form a paste. The paste is then placed in a thin cotton cloth and pressed to extract the pure Tulsi juice.

Tulsi holds significant importance in Ayurvedic medicine, with its uses rooted in traditional knowledge and practices. However, it is important to note that individual results and specific dosages may vary.

Properties of Tulsi

- It is an antipyretic agent.
- It is an anti-inflammatory agent.
- It posses antiemetic property.
- Reduces the blood sugar level
- Reduces blood pressure level.
- It possesses hypolipidemic (lowers cholesterol) activity
- It is an analgesic agent.
- It has anti-asthmatic activity
- It is an hepatoprotective agent
- It is an anti-stress agent.
- It posses anticarcinogenic property.

Chemical constituents of Tulsi

Figure 3

The size and potency of Tulsi can indeed vary depending on factors such as climate, nourishment, and soil conditions. Additionally, different varieties of Tulsi may exhibit variations in size and potency. Tulsi has been found to possess antioxidant properties [5,8] as well as a hypolipidemic effect [5,9].

Chemically, Tulsi contains various constituents that contribute to its medicinal properties. Some of the components found in Tulsi include

- **Alkaloids:** Tulsi contains alkaloids, which are nitrogenous organic compounds known to have physiological effects.
- **Fats:** Tulsi may contain small amounts of fats or lipids, which serve as a source of energy and contribute to the plant's composition [7]. A diet containing 1%of tulsi leaf powder for 1 month wasgiven to normal and diabetic rats were given a diet result shows a significant decrease in fasting blood sugar, total cholesterol, uronic acid, total lipids, glycerides, total amino acids [5,10].
- **Carbohydrates:** Tulsi contains carbohydrates, which are essential for energy production and various metabolic processes.
- **Proteins:** Tulsi contains proteins, which are important macromolecules involved in various cellular functions.
- **Glycosides:** Tulsi contains glycosides, which are compounds consisting of a sugar molecule attached to a non-sugar component.
- **Phenols:** These are organic compounds with antioxidant properties. They play a great role in protecting against oxidative stress and inflammation
- **Saponins:** Tulsi contains saponins, which are natural compounds with detergent-like properties. They posses antimicrobial and anti-inflammatory effects.
- **Tannins:** Tulsi contains tannins, which are polyphenolic compounds that can have astringent properties. They may contribute to the flavor and potential health benefits of Tulsi [7].
- **Terpenes:** Terpenes which are aromatic compounds responsible for the characteristic aroma of tulsi plants. They may have various biological activities and contribute to the aroma of Tulsi.

These constituents present in Tulsi contribute to its medicinal and therapeutic properties. The exact composition of Tulsi can vary depending on the specific variety, growing conditions, and plant maturity.

The oil components are volatile terpenes and phenols. The essential oils are eugenol (a major pharmacological component), methyl eugenol, methyl ether camphene, caryophyllene, decylaldehyde, ursolic acid, xanthomicrol, alpha- pinene, beta- pinene, salinene, terpinene-4-ol, caffeate, myrecenol, nerol, thymol, rhymol, juvocimene acid and terpene- urosolic acid.

Nutritional Constituents of Tulsi

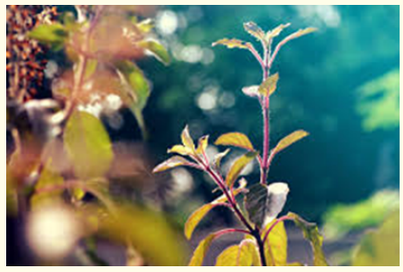

Figure 4

Principle Nutrient value Percentage of RDA (Nutritive value per 100g.)

- Energy 23 Kcal
- Cholesterol 0 mg
- Protein 3.15g
- Carbohydrates 2.65g
- Total Fat 0.64g
- Dietary Fibre 1.60g
- Crypto-xanthin-ß 46 µg
- Lutein-zeaxanthin 5650 µg
- Carotene-ß 3142 µg

Tulsi leaves are rich in Vitamin A (carotene, 2.5 mg/100g) of fresh Tulsi leaves, Vitamin C (85mg/100g) and minerals (calcium, 0.5 to 3.5 mg/100g). These are present in an organic easily digestible form. Iron and zinc are also present in the leaves. Manganese and Sodium are found in leaves as trace elements. Consuming 1g of dried Tulsi leaves provides 8.5 mg of natural Vitamin C. This is superior to synthetic Vitamin C as the absorption is much higher the bioavailability of the natural Vitamin C is much greater than that of the synthetic form.

Misconception about Mercury in Tulsi

Figure 5

There is a prevalent misconception that Tulsi leaves contain mercury, which leads to advice against chewing them due to potential harm to the teeth. However, this information is incorrect. Scientific research has demonstrated that Tulsi leaves do not contain mercury, and in fact, Tulsi has been found to offer protection against mercury poisoning [11]. Moreover, Tulsi is known for its positive impact on oral health, including improving oral hygiene, treating mouth ulcers, and strengthening teeth [12]. Therefore, chewing Tulsi leaves is not detrimental to dental health; rather, it can provide beneficial effects on oral well-being.

Medicinal uses

Figure 6

Natural immunity booster

According to Santwani., *et al.* (2023), Tulsi, also known as holy basil, has been shown to enhance the immune system. It is rich in vitamin C and zinc, which act as natural immune boosters, aiding in the prevention of infections. Additionally, Tulsi exhibits antimicrobial properties, including antibacterial, antiviral, and antifungal effects, which contribute to its ability to fend off various infections. Research has demonstrated that extracts derived from Tulsi leaves can augment the activity of T helper cells and natural killer cells, thereby improving the overall immune response.

Reduces fever (antipyretic) and pain (analgesic)

Basil leaves are sought after for their immunomodulatory and antimicrobial properties. Tulsi, or holy basil, exhibits antipyretic and diaphoretic activity, stimulating sweating and assisting in normalizing elevated body temperature during fever. Furthermore, Tulsi possesses potent antibacterial and antiviral properties, which aid in combating infections.

Reduces stress and pressure

According to Santwani., *et al.* (2023), Tulsi acts as a stress booster agent. Tulsi leaves contain Ocimumosides A and B, which are compounds known for their stress-reducing effects and their ability to maintain equilibrium in neurotransmitters like serotonin and dopamine within the brain. Furthermore, Tulsi's anti-inflammatory properties contribute to the reduction of both inflammation and blood pressure.

Reduces cold, cough and other respiratory disorders

Tulsi, commonly known as holy basil, possesses advantageous compounds like camphene, cineole, and eugenol that contribute to the alleviation of symptoms related to cold, cough, and respiratory disorders [1]. These compounds play a role in reducing chest congestion and providing relief. Notably, the combination of Tulsi leaf juice with honey and ginger has been found to be effective in managing conditions such as bronchitis, asthma, influenza, cough, and cold.

Anti-carcinogenic agent

Tulsi, also known as holy basil, exhibits promising anti-carcinogenic properties, as supported by research [1]. Key attributes of Tulsi include its antioxidant content, which helps neutralize free radicals known to cause cell damage and potentially contribute to cancer development. Tulsi extracts have been found to exert anti-tumor effects by inhibiting the growth of cancer cells and inducing programmed cell death (apoptosis) in various cancer cell types. Furthermore, Tulsi aids in modulating the immune system, enhancing the activity of immune cells against cancer cells and protecting DNA from mutations that could lead to cancer.

Compounds present in Tulsi, such as eugenol and rosmarinic acid, contribute to its anti-carcinogenic effects. Studies have demonstrated the potential of Tulsi in preventing the development of breast, lung, liver, and oral cancer. Tulsi extracts have also shown cytotoxic effects on cancer cells in laboratory studies and inhibit angiogenesis, the process of new blood vessel formation that supports tumor growth. Additionally, Tulsi compounds have exhibited chemo-preventive properties by inhibiting the activation of carcinogens.

Moreover, Tulsi enhances the efficacy of cancer treatments like chemotherapy and radiation therapy while reducing their side effects. Its antioxidant activity protects against DNA damage caused by environmental toxins and carcinogens. Regular consumption of Tulsi tea or supplementation may contribute to a reduced risk of cancer development.

Diabetic Mellitus

Tulsi, also known as holy basil, has a longstanding history in Ayurvedic medicine for its potential role in managing diabetes mellitus. According to Santwani., *et al.* (2023), Tulsi is believed to contribute to the regulation of blood glucose levels by enhancing insulin secretion from the pancreas and improving insulin sensitivity. Its antioxidant properties help reduce oxidative stress, which is known to contribute to complications associated with diabetes.

The combination of Neem and Tulsi extracts has demonstrated the ability to lower blood sugar levels [1]. Moreover, Tulsi's anti-inflammatory effects may improve insulin sensitivity and alleviate inflammation associated with diabetes.

Research suggests that Tulsi may also have a positive impact on lipid profiles by reducing cholesterol and triglyceride levels. However, further studies are required to fully understand the effectiveness and safety of Tulsi in diabetes management. These properties, nonetheless, indicate the potential of Tulsi as a natural supplement to support overall diabetes control. It is important to consult a healthcare professional for personalized advice to ensure appropriate diabetes management.

Gastrointestinal disorder

Tulsi plays a role in managing gastrointestinal disorders [1]. It possesses carminative properties that aid in digestion and alleviate bloating, promoting healthy digestive function. Additionally, Tulsi leaves have been found to be effective in treating loss of appetite.

The anti-inflammatory properties of Tulsi are beneficial in managing inflammation within the gastrointestinal tract. This can provide relief from symptoms associated with conditions like gastritis and inflammatory bowel disease, thereby supporting gastrointestinal health.

Tulsi also exhibits antimicrobial activity, particularly against certain bacteria and fungi, which can help combat infections in the gastrointestinal system. Moreover, Tulsi has the potential to promote a healthy gut microbiota by fostering the growth of beneficial bacteria and inhibiting the proliferation of harmful bacteria. This balance of microbial populations is essential for maintaining gastrointestinal health.

Furthermore, Tulsi's status as an adaptogen helps the body cope with stress. As stress can negatively impact gastrointestinal health, Tulsi's stress-reducing properties may indirectly support digestive function.

Prevention of premature ageing

Tulsi, also known as holy basil, is rich in essential oils, vitamin C, vitamin A, and phytonutrients. These constituents possess potent antioxidant properties that play a crucial role in protecting the body against premature aging. By effectively neutralizing harmful free radicals and combating oxidative stress, the antioxidants present in tulsi help maintain youthful skin and prevent the signs of premature aging.

Respiratory disorders

Tulsi provides therapeutic advantages in the treatment of respiratory disorders. Combining a decoction of Tulsi leaves with honey and ginger has proven to be an effective remedy for respiratory diseases, asthma, influenza, coughs, and colds. Furthermore, the extraction of eugenol from Tulsi leaves has exhibited vasorelaxant properties on rabbit arterial tissue, suggesting its potential as a therapeutic vasodilator.

Heart disorders

Tulsi has demonstrated positive impacts on heart health, effectively helping to prevent cardiovascular disorders by lowering blood lipid levels, reducing the risk of ischemia and stroke, mitigating hypertension, and harnessing its potent antioxidant properties [1]. It has been observed that Tulsi treatment leads to a notable decrease in fasting and post-prandial blood cholesterol levels, as well as mean total cholesterol levels [5,13].

Pharmacological activity

Figure 7

Tulsi, due to its rich composition of bioactive compounds, exhibits a wide range of pharmacological activities, making it a deeply studied herb with significant medicinal properties [7]. Its antioxidant properties help combat oxidative stress and protect cells from damage, while its anti-inflammatory effects make it useful in mitigating inflammatory conditions. Tulsi's bioactive compound, eugenol, has been shown to have a vasodilator effect on rabbit arterial tissues.

The antimicrobial properties of Tulsi inhibit the growth of various bacteria, viruses, and fungi, making it beneficial in addressing microbial infections and promoting overall health. It can help prevent respiratory infections, skin disorders, and gastrointestinal issues caused by microbial pathogens. Additionally, Tulsi exhibits immunomodulatory effects, enhancing immune function and aiding the body's defense against infections and diseases.

Tulsi's adaptogenic properties help the human body cope with stress and promote overall well-being. It regulates stress hormones, improves mental clarity, and induces relaxation. Moreover, Tulsi shows potential in fighting against cancer by inhibiting the growth and spread of cancer cells. It also possesses chemopreventive and radioprotective activities.

The pharmacological activities of Tulsi include antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, adaptogenic, and potential anticancer effects. These properties align with its traditional use in Ayurvedic medicine and emphasize its potential as a valuable natural remedy for various health conditions. Ongoing studies continue to explore and fully understand the therapeutic potential of Tulsi.

Conclusion

Tulsi, also known as holy basil, has played a significant role throughout history, encompassing its medicinal properties, cultural significance, and spiritual value.

Renowned for its antioxidant, anti-inflammatory, and adaptogenic properties, Tulsi holds a prominent position in Ayurvedic medicine. It is commonly used to address respiratory disorders, digestive ailments, and conditions related to stress. Scientific studies indicate that Tulsi can enhance the immune system, alleviate inflammation, and contribute to overall well-being.

Within Hindu culture, Tulsi holds a sacred status and is often cultivated in homes and temples. It is regarded as a representation of the goddess Tulsi, symbolizing purity, protection, and spiritual elevation. Tulsi leaves are incorporated into religious ceremonies, rituals, and prayers, believed to cleanse the environment and repel negative energies.

In summary, Tulsi is an exceptional herb with diverse health benefits and cultural significance. Its therapeutic properties and spiritual associations have firmly established it as an integral component of traditional practices and alternative medicine. Whether valued for its healing attributes or revered for its spiritual symbolism, Tulsi continues to be highly esteemed by numerous individuals.

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