

# Ocimum Basilicum (basil/tulsi): a herbal sustainable treasure and its therapeutic potency

## Abstract

Basil is a good source of free radical scavenging compounds that have their traditional medicinal applications that may be successful for future modern medical applications and personal care as well. *Ocimum basilicum* (Basil) has long been revered for its culinary allure, but its medicinal benefits are equally remarkable. *Ocimum basilicum* is known for its bioactive therapeutic metabolites. Basil is used in Ayurveda and in traditional medicine to treat digestive system disorders like stomach ache, fever and diarrhoea, kidney infections. Various vegetative parts of *Ocimum* species were explored by researchers to test their anti-inflammatory and antinociceptive potential. Holy basil is also found to contain eugenol oil that may be helpful to treat hypertension. Basil essential oils and its phytochemical compounds were found to exhibit excellent antimicrobial activity against a wide range of Gram-negative and Gram-positive bacteria, yeast, and mold. The analysis of antimicrobial properties was also confirmed that *Ocimum basilicum* essential oils have excellent inhibiting activity by showing growth inhibition zones ranging from 9.67 to 15.33 mm in Gram-positive microbes and Gram-negative microbes including inhibition zone ranging from 5.33 to 7.33 mm in yeast. Observed lowest minimal inhibition concentration (MIC) of *Ocimum basilicum* essential oils was 3.21  $\mu\text{L/mL}$  against Gram-negative *Azotobacter chroococcum* and Gram-positive *Micrococcus luteus*. Notable highest insecticidal activity was also found against *Pyrrhocoris apterus* that caused the death of 80% of individuals globally. As a result, *Ocimum basilicum* essential oils have potent broad spectrum of activity, so that its various extracts can become safe and sustainable herbal choice to preserve fruit and vegetables against plant pathogenic infections. Hence, this discrete review is strived to explore basil's safe and sustainable therapeutic approaches in combating microbial and viral infections, oxidative stress including improving metabolic disorders, cognitive improvement, strengthening the immune system, oral health and skin wellness.

**Keywords:** basil leaves, tulsi, *Ocimum basilicum*, herbal therapeutics, medicinal herbs

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## Introduction

*Ocimum basilicum* (Basil or Tulsi) is well known traditional medicinal plant in Southeast Asia from ancient times used as potent anti-inflammatory, analgesic, antipyretic, antidiabetic, hepatoprotective, hypolipidemic, antistress, and immunomodulatory agent. *Ocimum basilicum* (Basil or Tulsi) is an herbaceous plant of the Lamiaceae family and have been explored for their medicinal properties for many decades worldwide that mentioned well in Ayurvedic and Chinese medicinal scripts.<sup>1,2</sup> Nowadays, various novel herbal antimicrobial medicines are exploring to treat microbial, fungal and viral infections. Plant derived phytochemical therapy has been proposed to treat diabetes and *Ocimum basilicum*; Hail *Ocimum* extract and its total flavonoids are found to be one of them to be used as an anti-diabetic traditional medicine.<sup>3</sup> High level of reactive oxygen species in the body are found to cause oxidative stress of tissues and organs that lead to pathogenesis of many chronic diseases especially cancer and cardiovascular diseases. *Ocimum basilicum* essential oil are explored to confirm the presence of methyl chavicol (70.93%), linalool (9.34%), epi- $\alpha$ -cadinol (3.69%), methyl eugenol (2.48%),  $\gamma$ -cadinene (1.67%), 1,8-cineole (1.30%) and (*E*)- $\beta$ -ocimene (1.11%). Hence, basil essential oil and its constituent methyl chavicol and linalool are found to elicit a neuronal response in female adults of *M. domestica* and adult female flies demonstrated up to 80% oviposition deterrence and reduced preference to food source laced with basil essential oils and methyl chavicol.<sup>4</sup> The multifaceted therapeutic potential of basil leaves and its other vegetative parts were explored to address present health challenges globally. According to latest finding of researcher and clinicians, the antiradical and

antimicrobial properties of basil are attributed due to the presence of bioactive compounds like essential oils such as linalool, and methyl chavicol including high content of 1,8-cineole, estragole, vicenin, citronellol, limonene eugenol, anthocyanins and flavonoids.<sup>5</sup> *Ocimum basilicum* flowers and leaves are used to prepare various infusion, syrup, decoction, as a sudorific, stimulant, carminative, diuretic, and febrifuge agent and used to treat bronchitis and coughs. Hence, herbal therapy was proposed as most potent traditional medicinal treatment along with allopathic treatments used against many microbial and fungal diseases in Ethiopia.<sup>6</sup>

## Herbal therapeutic potency of *Ocimum basilicum* (Basil or Tulsi)

*Ocimum basilicum* (Basil or Tulsi) were found to contain rich concentration of phytochemicals including essential oils (eugenol, linalool, and methyl chavicol), phenolic compounds and alkaloids that contribute to its diverse medicinal properties and biological activities.<sup>7</sup> Minimal boiling, stir-frying, steaming, oven-baking and microwaving can intact the bio accessibility of vitamins content, minerals content and pigments volume concentration, phenolic components like rutin, rosmarinic acid, and quercetin of basil (*Ocimum basilicum* L.) leaves.<sup>8</sup> Eugenol and linalool are major basil essential oils that showed broad-spectrum antimicrobial properties in previous findings.<sup>9,10</sup> Methyl chavicol (estragole) of basil leaves was found to showed significant anti-inflammatory and analgesic properties.<sup>11</sup> Basil's antioxidant properties are explored for high concentrations of polyphenols present in its extracts like flavonoids, phenolic acid and tannins.<sup>12</sup> The mode of action of antiradical/antioxidant activity involves scavenging of

Reactive Oxygen Species (ROS) by flavonoids such as quercetin and kaempferol and phenolic acids such as rosmarinic acid and caffeic acid. It is resulted in reducing oxidative stress and contribute to the overall health benefits of basil extracts. Basil was also studied for terpenes and terpenoids which found to have potent analgesic and anti-inflammatory effects.<sup>6,13</sup>

*Ocimum basilicum* (Basil or Tulsi) has been exploited from ancient times for its potent antimicrobial properties due to containing essential oils and phenolic compounds. Eugenol shows great antibacterial properties not only against gram-positive but also gram-negative bacteria.<sup>6,12</sup> Similarly, linalool has been shown to possess potent antifungal properties, making it effective against fungal infections. Basil leaves are found to have methyl chavicol, also known as estragole that exhibits antimicrobial activity against various pathogenic microbes and fungi.<sup>12,13</sup> In addition to essential oils, basil are explored for high concentration of quercetin and kaempferol, rosmarinic acid and caffeic acid that exhibit potent antimicrobial activities. Eugenol present in basil extracts are found to exhibit strong antiradical activity and anti-apoptotic potential to protect protecting cells from oxidative stress-induced damage.<sup>6,9,14</sup>

Linalool (floral and spicy terpene alcohol) present in *Ocimum basilicum* (Basil or Tulsi) is found to possess notable antimicrobial and antifungal properties against wide range of bacteria, including Gram-positive and Gram-negative strains. Hence, linalool used in preparation of topical cream, ointment and oral formulation to treat microbial infections that found to exhibit anti-inflammatory properties to aid in symptoms of swelling and inflammation at the wound site. It is also observed further to facilitate the healing process by stimulating cellular proliferation, collagen synthesis and alleviating symptoms associated with acne, eczema, and dermatitis.<sup>12,13</sup>

## Future outlook of clinical implications of *Ocimum basilicum* (Basil or Tulsi)

Hence, vegetative parts of *Ocimum basilicum* (Basil or Tulsi) were found to have excellent concentration of essential oils which proved its clinical and medical implications. In addition, it proved more sustainable holistic approach into safe and cost effective synthesis of herbal therapeutic preparations for maintaining well-being of human health in their daily lives as religious based health remedies.<sup>14</sup> Furthermore, future outlook for basil in healthcare is found to appear more promising with continued research endeavours and innovative approaches that emerge as non-toxic and cost effective alternatives in promoting health and mental wellness.<sup>16,17</sup> Researchers have found plaque inhibitory effect of holy basil based mouth wash that can be likely to have ability to kill dental plaque periodonto pathogens *P. intermedia* and *F. nucleatum* in vitro study.<sup>18</sup> Many previous preclinical studies have also observed that Basil or Tulsi possess notable concentration of phytochemicals like eugenol, rosmarinic acid, apigenin, myretenal, luteolin,  $\beta$ -sitosterol, and carnosic acid. Therefore, Basil or Tulsi based herbal preparations can be safe and helpful in preventing chemical-induced DNA damage causing skin cancer, liver cancer, oral cancer and lung cancer due to its high antioxidant activity by altering gene expressions, inhibiting angiogenesis and metastasis as potent anti-apoptotic agent due to having various phytochemicals like eugenol, rosmarinic acid, apigenin, and carnosic acid. The aqueous extract of Basil or Tulsi and its flavanoids, orintin, and vicenin are found to protect mice model against  $\gamma$ -radiation-induced sickness and mortality by selectively protecting the normal tissues against the tumoricidal effects of radiation.<sup>19</sup>

## Conclusion

*Ocimum basilicum* (Basil or Tulsi) has been emerged as more potent herbal therapeutic alternative with its rich religious culinary and medicinal history. Hence, this discrete and brief review is explored all through the medicinal dynamism of *Ocimum basilicum* (Basil or Tulsi) for its bioactive components, nutritional contents, phytochemical composition, antimicrobial, antioxidant, anti-inflammatory and anti-apoptotic properties to combat various clinical manifestations and complications.<sup>20</sup> Hence, *Ocimum basilicum* (Basil or Tulsi) can might be considered best sustainable realm of religious based natural health remedies to get propose as new frontiers in safe and contemporize healthcare practices as well as promoting its sustainable agricultural cultivations.

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## Conflicts of interest

The author declares that there are no conflicts of interest.

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