

# Pharmacological Review of Neem and Tulsi as Natural Remedies

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**Abstract**—Azadirachta indica, often known as neem or "dogonyaro" in Nigeria, is a plant with a variety of applications in the fields of agriculture, medicine, and ecology. Antiplasmodial, antitrypanosomal, antioxidant, anticancer, antibacterial, antiviral, larvicidal, and fungicidal properties are among the biological and pharmacological actions ascribed to various plant parts and extracts. Additional effects include immunomodulating, molluscicidal, nematocidal, immunocontraceptiv, insecticidal, anti-feedant, anti-ulcer, spermicidal, anthelmintic, antidiabetic, anti-implantation, and insect repellent properties.

Different parts of Ocimum sanctum Linn, a small herb found all over India, including the leaves, stem, flower, root, seeds, and even the entire plant, have been suggested in traditional medical systems as treatments for bronchitis, bronchial asthma, malaria, diarrhea, dysentery, skin conditions, arthritis, painful eye diseases, chronic fever, insect bites, and more. It has also been proposed that Ocimum sanctum L. contains anti-emetic, anti-spasmodic, analgesic, adaptogenic, diaphoretic, anti-cancer, antidiabetic, antifungal, antibacterial, hepatoprotective, and cardioprotective properties.

Humans have been using plants as medicine for thousands of years. One of these medications is tulsi. The scent of a plant comes from within. It can be found throughout India. Around Hindu temples or other places of worship, it is harvested. Its roots, leaves, and seeds are used in Ayurvedic medicine. Numerous nutrients and bioactive substances can be found in tulsi. Linalool, caryophyllene, oleanolic acid, and rosmalinic acid are the main chemical constituents of tulsi.

Modern science has made use of tulsi standardization. Ursolic acid (an acid) and eugenol (an essential oil) are two of its active components. An anti-bronchitis, anti-periodic, and diaphoretic leaf. Colds, coughing, and malaise can all be cured with a leaf decoction. It does more than just moisturize. Ringworm can be cured by the oils of flowers. Ocimum sanctum has been employed in many clinical trials due to its antibacterial and

antifungal properties. The chemistry and pharmacology of Ocimum species are covered on this page.

**Index Terms**—Azadirachta indica, Ocimum sanctum, pharmacological,

## I. INTRODUCTION

By increasing antioxidant activity, preventing bacterial development, and altering genetic pathways, plant or natural products play a significant role in the prevention and treatment of disease. Since many plants have less side effects and are more reasonably priced, their therapeutic potential in the treatment of various ailments is still being actively investigated. Allopathy-based medications are known to be costly and to have harmful effects on healthy tissues and a range of biological processes.

Many pharmacologically active medications are widely acknowledged to have this property (1, 2). The neem tree, scientifically known as Azadirachta indica (A. Juss), is a hardy, evergreen, tropical and sub-tropical plant that grows quickly. It is a member of the Meliaceae family, which also includes mahogany. Even with poor soils, they flourish in regions with 400–800 mm of annual rainfall and a long dry season (3,4).

A condition of physical and mental well-being that is unaffected by illness or affliction is referred to as "Good-Health" by the World Health Organization (5). The Neem tree is mostly grown in southern Asia and Africa, and its medicinal uses have been documented for a very long time. It should be noted that the aforementioned medical folklore links the leaves, bark, fruit, flowers, oil, and gum of the Neem tree to the treatment of certain illnesses like diabetes,

cancer, high blood pressure, and heart disease. Cellular and molecular mechanisms, such as free radical scavenging, detoxification, DNA recombination, cell cycle alteration, immune surveillance, anti-inflammatory, anti-angiogenic, and anti-metastatic activities, and the capacity to modulate different signaling pathways, are undoubtedly responsible for the potential effects observed when using these extracts (5, 6, 7). The adoption of alternative medicine as primary care is estimated to be about 80% in poor nations (8), while it is still becoming more and more popular as a supplemental form of treatment in developed (or industrialized) nations.

Migration is largely to blame for this effect; as more people migrate to industrialized nations, they bring with them not just their skills but also their customs and way of life (9). Traditional medical practitioners have made extensive use of medicinal plants in their daily practices due to these benefits. About 80% of patients in India, 85% in Burma, and 90% in Bangladesh are treated by practitioners of traditional medicine, according to a 1993 World Health Organization (WHO) survey (10,11). Tulsi (*Ocimum sanctum* L.) has a long history of medicinal use in Ayurveda, where it is referred to as an anti-asthmatic medication called Dashemani Shwasaharni and an anti-kaphic treatment called Kaphaghna (12).

Despite the fact that Tulsi has been used extensively by Indian traditional healers to treat a wide range of illnesses since ancient times, little is known about how it works and there isn't a logical way to combine this age-old practice with contemporary medicine. Indian scientists and researchers have conducted a number of studies in the past few decades to propose the potential medicinal benefits of *Ocimum sanctum* L., including the role of essential oils and eugenol (13,14).

## II. AZADIRACHTA INDICA (NEEM)

Neem belongs to the Meliaceae family of mahogany trees. Native to India and Burma, it is one of two species in the genus *Azadirachta* and grows in tropical and semi-tropical climates. This tree grows quickly and can occasionally reach a height of 35–40 meters. Although it is evergreen, it may lose most or

almost all of its leaves during periods of extreme dryness. The branches are widely spaced. Indian culture has acknowledged the health benefits of neem (*Azadirachta indica* A. Juss) for thousands of years. Every portion of the neem tree has certain therapeutic benefits.

Rutales (Order), Rutinae (Suborder), Meliaceae (Family), Melioideae (Subfamily), Melieae (Tribe), *Azadirachta* (Genus), and *indica* (Species) are the taxonomical classifications for neem (15). From the various plant sections, several phytochemicals, including azadirachtin and quercetin, as well as liminoids, including nimbin and nimbinin, have been isolated. Additionally, a variety of chemicals, including nimbanene, 6 desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid, n hexacosanol, nimbiol, different amino acids, and other substances, are present in the leaves (16, 17, 18).

### PLANT DESCRIPTION AND CLASSIFICATION

The neem tree, which grows quickly and can reach a height of 15 to 20 meters with tiny, bright green leaves, is widely distributed in tropical and semi-tropical areas. It blooms in the spring and has a lot of white flowers. It belongs to the family Meliaceae, and Table 1 describes its botanical classification. Figure 1 depicts the neem tree and its various components (19).

### TAXONOMY OF NEEM: -

Taxonomic positions of neem	
Kingdom	Plantae
Division	Magnoliophyta
Class	Dipsacales
Order	Rutales
Sub-order	Rutinae
Genus	<i>Azadirachta</i>
Species	<i>indica</i> Latin
Subfamily	Melioideae

Table 1. Taxonomical classification of *Azadirachta Indica*

### HISTORY OF NEEM: -

Neem trees are recognized as "Panacea of all Diseases" by the majority of the world's other

reputable medical systems, including Unani, Chinese, and European "Materia Medica," in addition to Ayurveda. Nonetheless, it is well-known in India by a variety of other titles, including "Divine Tree," "Heal All," "Nature's Drugstore," and "Village Dispensary." Neem has long been used in Ayurvedic medicine to treat TB, leprosy, fever, malaria, and ophthalmia. Neem is used as an anthelmintic, antifedant, antiseptic, diuretic, emmenagogue, contraceptive, febrifuge, parasiticide, pediculicide, and pesticide in a variety of traditional medicine applications.

Neem extracts were traditionally administered orally, vaginally, and topically. In these circles, it is referred to as "The Village Pharmacy." Millions of people who are exposed to the tree use its twigs to brush their teeth, apply its juice to skin conditions, and scatter its leaves throughout their homes to ward against insects. The following lists some of the most significant traditional use for the various plant parts:

- In Pakistan and India, people wash their teeth with neem twigs. One of the oldest and most successful dental procedures is probably this one.
- The tree's seeds, leaves, blossoms, and bark are all used to make a variety of medicinal remedies.
- Neem oil helps with acne and maintains the suppleness of the skin.
- In India, people with chicken pox have historically slept on the leaves because of their therapeutic properties.
- Various portions of neem were used to cure a variety of ailments in Ayurvedic, Unani, and folkloric traditional medicine.

### III. DESCRIPTION

#### MACROSCOPIC DESCRIPTION: -

**Tree** - Neem trees (*Azadirachta indica*) are tropical evergreens that grow quickly—up to twenty feet in three years—and are linked to mahogany. It can grow in places with as little as 18 inches of annual rainfall and flourishes in regions that get extremely hot temperatures of up to 120 degrees Fahrenheit. According to reports, they can live up to 200 years.

**Leaves** - The leaves are opposite, exstipulate, lanceolate, acute, serrate, 7-8.5 cm long and 1.0-1.7 cm wide, with a somewhat yellowish-green color; the

rachis is compound, alternate, and 15-25 cm long, with a thickness of 0.1 cm. The smell is vague, and the flavor is bitter.

**Stem Bark**- The thickness of the bark varies greatly depending on the age and portions of the tree from which it is taken; the outside surface is rough, cracked, and rusty-grey, while the inner surface is laminated, yellowish, foliaceous, fractured, and fibrous; the smell is distinctive; and the taste is bitter.

**Flower, Fruits And Fruits** - In the early summer, the tree is frequently covered in exquisite blossoms. The fragrant, white blooms are grouped in axillary panicles, which can grow up to 25 cm long and typically droop. Its fruit is olive-sized and semi-sweet. The oil-rich seed within has amazing botanical and therapeutic qualities. The kernels can be simply pressed in a juicer to extract the oil. It usually starts to bear fruit between the ages of three and five, and when fully grown, it can yield up to 110 pounds of fruit every year.

#### MICROSCOPIC DESCRIPTION:

**Leaf** -

**MIDRIB** - The leaflet through the midrib has a biconvex shape; the epidermis is covered with thick cuticle on both sides; there are four to five layers of collenchyma beneath the epidermis; the stele is made up of one crescent-shaped vascular bundle at the lower end and two to three smaller bundles at the upper end; the remaining tissues are made up of thin-walled, parenchymatous cells with secretory cells and calcium oxalate rosette crystals; the phloem is encircled by a non-lignified fiber strand; crystals are also present in the phloem region.

**LAMINA** - has dorsiventral structure; both surfaces have epidermis made up of tangentially elongated, thin-walled cells with thick cuticle covering them; Only the lower surface has anomocytic stomata; the palisade is single-layered; the spongy parenchyma is made up of five to six layered, thin-walled cells that are crossed by several veins; a few cells have calcium oxalate rosette crystals; the palisade ratio is 3.0-4.5; the stomatal index is 13.0-14.5 on the lower surface and 8.0-11.5 on the upper surface.

**STEM BARK** - outer exfoliating pieces that are hard, woody, and noticeably thicker in older barks; nearly all of the secondary phloem's dead elements alternate with irregular tangential bands of compressed cork

tissue; the former is made up of multiple layers of stone cells that occur in regularly arranged groups along with collapsed phloem elements that are filled with brown contents; there are three to five layers of fiber groups between the successive zones of cork tissue, with thin-walled and frequently collapsed phloem elements present; each zone of cork tissue is made up of multiple layers of regular, thin-walled cells, sometimes with a few compressed rows of thick-walled cells.

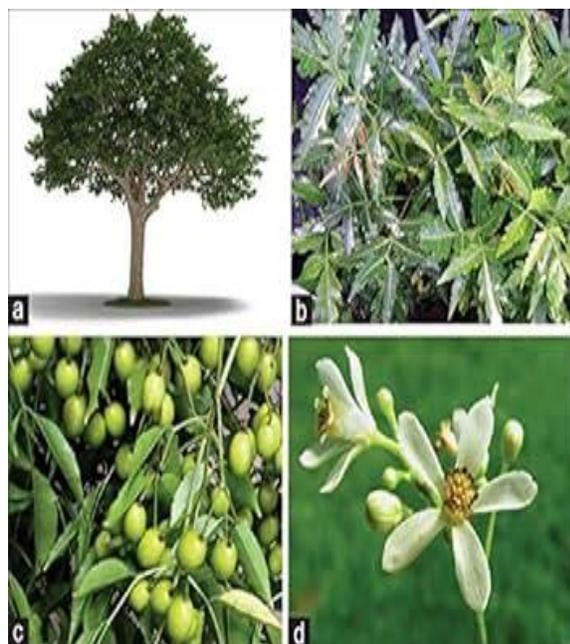


Figure 1. The different parts of neem tree

#### CHEMISTRY OF NEEM: -

Azadirachtin, the active component, was extracted from *A. seeds. indica* by David Morgan (Butterworth and Morgan 1968), and its comprehensive structural analysis was finished in the labs of Steven Ley, W Kraus, and K Nakanishi around 17 years later.

*A. indica* produces a plethora of triterpenoids, the biosynthesis of which culminates in azadirachtin. Starting with a steroid precursor (such as tirucallol, azadirone, and azadiradione) and C-ring opening (such as nimbin and salannin), the biosynthesis of azadirachtin proceeds via two additional stages of structural complexity: furan ring formation (such as modifications give azadirachtin (20)).

When azadirachtin's antifeedant and toxic properties were compared to those of several less structurally complex putative biosynthetic precursors, it was found that only azadirachtin was toxic to insects, causing severe growth and moult disruption in larvae of the milkweed bug, *S. gregaria*, and *Spodoptera littoralis* (Boisd.). In this way, the less complicated, less oxygenated molecules were demonstrated to be useless (21).

Nevertheless, compounds with lower degrees of structural complexity exhibit antifeedancy, especially against lepidoptera like *S. littoralis*, which are very susceptible to the presence of secondary plant chemicals in their diet. Therefore, it would seem that there is no clear connection between the toxicity of specific neem triterpenoids throughout the biosynthesis paths to azadirachtin and their antifeedant function. Furthermore, azadirachtin's antifeedancy differs significantly between insect orders and species within orders, even if its harmful insect growth regulatory (IGR) effects are observed in all species (22).

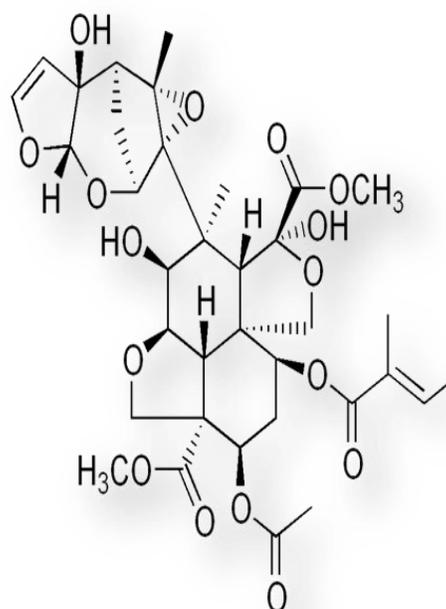


Figure 2- The Structure of Azadirachtin Molecule

PHYTOCHEMICALS AND PHARMACOLOGICAL ACTIVITY INVOLVE: -

For over 2,000 years, neem has been recognized as one of the most adaptable medicinal plants with a broad range of biological activity in India and its neighboring nations. Since ancient times, every part of the tree has been utilized as a home cure and traditional medicine to treat a variety of human illnesses (23, 24, 25). Genetic and environmental variables can produce differences in the chemical composition of individual neem trees. Studies conducted by many experts over varying periods of time have demonstrated the inherent diversity in the phytochemicals' percentage content (26, 27, 28, 29).

**PHARMACOLOGICAL ACTIVITIES OF NEEM: -**

**Antioxidant activity-**

Neem plant elements, including leaves, bark, roots, seeds, and flowers, all have a contribution in managing illness by regulating different biological processes (Table 2). The antioxidant activity of many extracts made from different neem tree sections was assessed in a study. According to the findings, extracts from the bark of leaves, flowers, and stems have strong antioxidant properties (30). Additionally, ethanolic floral and seed oil extracts were revealed to have superior free radical scavenging activity in another investigation (31).

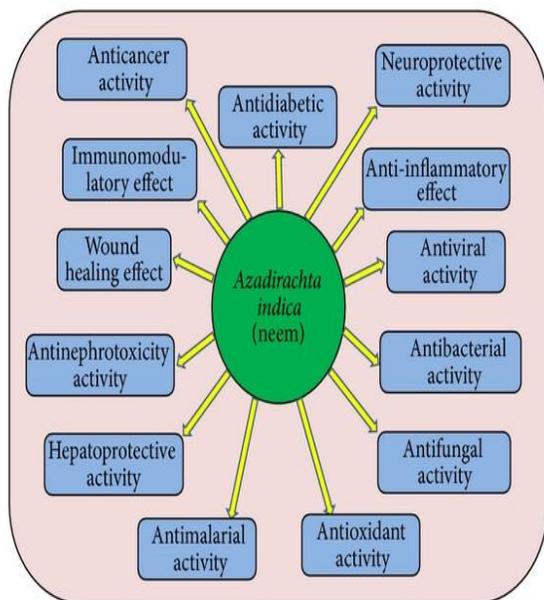


Figure 3- Pharmacological activities of neem and its ingredients

**Anti-inflammatory effect-**

Numerous research have documented neem plants' anti-inflammatory properties. Nimbidin from neem trees was taken orally to assess its anti-inflammatory effect in a rat model-based experimental investigation. Both the inhibition of phagocytosis and the considerable inhibition of macrophage migration to their peritoneal cavities in response to inflammatory stimuli were confirmed. Furthermore, nimbidin also prevented phagocytosis in rat peritoneal macrophages when exposed to it in vitro, and phorbol myristate acetate triggered a respiratory burst in these cells. Following in vitro exposure, lipopolysaccharide activated macrophages, which in turn reduced the synthesis of prostaglandin E2 and nitric oxide (32).

**Wound-healing effect-**

Neem leaves' ability to heal wounds has long been recognized as a traditional remedy. One study examined the benefits of neem oil on chronic, nonhealing wounds and found that nearly 44% of patients experienced 50% wound healing after 8 weeks of treatment (33).

**Hepatoprotective effect-**

Azadirachtin A, which is generated from neem, and its other components are known to have hepatoprotective properties. One study found that when carbon tetrachloride (CCl4) was used to cause hepatotoxicity in animal models, the disease control groups had significantly higher levels of alkaline phosphatase and aminotransferases (aspartate aminotransferase [AST] and alanine aminotransferase [ALT]) and a lower level of total protein. The reference range of these proteins and enzymes was considerably enhanced by azadirachtin A treatment.

Furthermore, histological and ultrastructural studies revealed that azadirachtin A therapy reduced hepatocellular necrosis (34).

**Neuroprotective effect-**

Animal models have also shown neuroprotective effects from a standardized neem extract. The results of peripheral neuropathy (induced by partial sciatic nerve ligation) animal models revealed a significant decrease in allodynia, hyperalgesia, motor coordination, and motor nerve conduction velocity,

whereas chronic treatment with this extract significantly reduced such behavioral changes (34).

**Antimicrobial activity-**

Neem extracts are high in antibacterial chemicals, and some studies have suggested that they can be used to combat some foodborne diseases and spoilage organisms. NLEs have been reported to exhibit zones of inhibition, demonstrating their antibacterial capabilities, and the extract demonstrated much higher zones of inhibition than 3% sodium hypochlorite(35).

**Antidiabetic effect-**

The neem tree extract has also been tested for anti-diabetic properties. An earlier discovery revealed that diabetic rats treated with neem extract (250 mg/kg body weight) had considerably lower glucose levels than the control group(34).

**Anticancerous activity-**

Natural products, or plant products, play an important role in inhibiting tumor growth by modulating cell signaling pathways. The remarkable therapeutic benefits of the neem tree were further proven when it was discovered to have anti-cancer capabilities. The study aimed to investigate the cellular and molecular mechanisms of azadirachtin and nimbolide's cytotoxic effects in the human cervical cancer (HeLa) cell line. The findings demonstrated that azadirachtin and nimbolide significantly reduced the survival of HeLa cells in a dose-dependent manner by inducing cell cycle arrest at G0/G1 phase, followed by p53-dependent p21 accumulation and downregulation of cell cycle regulatory proteins (35).

**Ocimum sanctum (Tulsi):-**

Many plants are utilized to produce medicines. Medicinal plant secondary metabolites and therapeutic oils are well-known. Medicinal plants have numerous advantages over pharmaceuticals, including lower costs, higher efficacy, and global availability. Plants have long been utilized for therapeutic purposes. From 4000-5000 B.C., the Chinese employed plants for medicine. From 3500 to 1600 B.C., the Rigveda first documented the use of herbs as medicine. Plant therapeutic characteristics were thoroughly investigated in accordance with Ayurvedic principles(36).

Tulsi is considered sacred in India. Tulsi (*Ocimum sanctum*) is an aromatic plant in Ayurveda. It's part of the Labiateae family. Several tropical and subtropical countries cultivate it. It is present in nearly every field in India. It's a tall, slender, fragrant plant. Tulsi means "incomparable" in Sanskrit. The entire plant is a remedy. In India, there are two types of tulsi: dark or Shyama (Krishna), and bright or Rama. *Deo gratia* is most commonly used in *O. canum*, *O. basilicum*, *O. kilimandscharicum*, *O. ammericanum*, *O. camphora*, and *O. micranthum*, which are all found in India. Toxicological research showed that this plant has analgesic and bactericidal characteristics. Tulsi is the most beneficial vitamin for animals(37).

**PLANT DESCRIPTION AND CLASSIFICATION:**

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From the Andaman and Nicobar Islands to the Himalayas, the plant can grow up to 1800 feet above sea level. It can be found in Malaysia, Australia, West Africa, and a few Arab countries. It is a multi-branched, herbaceous annual plant valued by Hindus for its medicinal properties in India. Plants like this one are popular among both gardeners and temple visitors. It spreads with the usage of seeds (38).

**TAXONOMY OF TULSI: -**

Kindom	Plantae
Sub kingdom	Tracheobionta
Superdivision	Spermatopta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Lamiales
Family	Lamiaceae
Genus	Ocimum
Species	O.Sanctum

Table 2 - Taxonomical classification of Tulsi

**MORPHOLOGY OF TULSI:-**

It is everything about the appearance of a plant's root, stem, leaves, branches, flower, fruit, and seeds. Morphology is the study of the plant's exterior

appearance. According to Tulsi plant morphology, this is how it appears.



Figure 4 – The Tulsi Plant

The root system of the *Ocimum sanctum* plant is particularly important. It's dark brown on the outside, yet a delicate hue of violet inside. This herbaceous, woody stem features hairy, sub-Quadrangular leaves that are dark purple to black on the outside and cream on the inside, as well as fibrous bark and short xylem. Its perfume is subtle, and its stem is upright. It is elliptical, oblong, oblique, or acute, entire or serrated, pubescent on both sides; the petiole is thin, 1.5-3 cm long, and hairy, with an aromatic perfume and a distinct flavor.

The flower's pedicels are longer than the calyx, which is ovoid or campanulate and 3-4 mm bilipped; upper lips are broadly oblong or suborbicular, shortly apiculate, while lower lips that are 170 longer than upper have four mucronate teeth, the central two largest; corollas are about 4 mm long, pubescent, aromatic, with an aromatic odour and pungent flavor, and a nectar-like nectar. The four nuts in this fruit are subglobose or broad-elliptic, somewhat compressed,

pale brown or reddish with minute black lines at the thalamus, aromatic, and have a strong flavor. It's brown, mucilaginous, 0.1 cm long, somewhat notched at the base, and has a pungent, mucus-like flavor when soaked in water (39, 40, 41).



Figure 5- The Flower of Tulsi Plant

#### CHEMICAL CONSTITUENTS OF TULSI:-

*O. sanctum* contains 1,8-cineole, 1,8-bisabolene from India, eugenol from India, methyl eugenol from Nigeria, isocaryophyllene from Nigeria, eugenol,  $\beta$ -elemene, and linalool from India, methyl eugeneo,  $\beta$ -eugenol from Nigeria, and eugenol,  $\beta$ -caryophyllene, and  $\beta$  caryophyllene oxide from Northeastern Brazil. *O. gratissimum*, a well-known plant in Indian herbal medicine, comes in several variations, including the one listed below.

Teas and infusions can be made from this plant's flowers and leaves, which are abundant in essential oils. *O. gratissimum*'s antibacterial powers may be due to its volatile oil, which has a high concentration of thymol and eugenol. *O. kilimandscharicum* is often known as kapur tulsi in India(42).

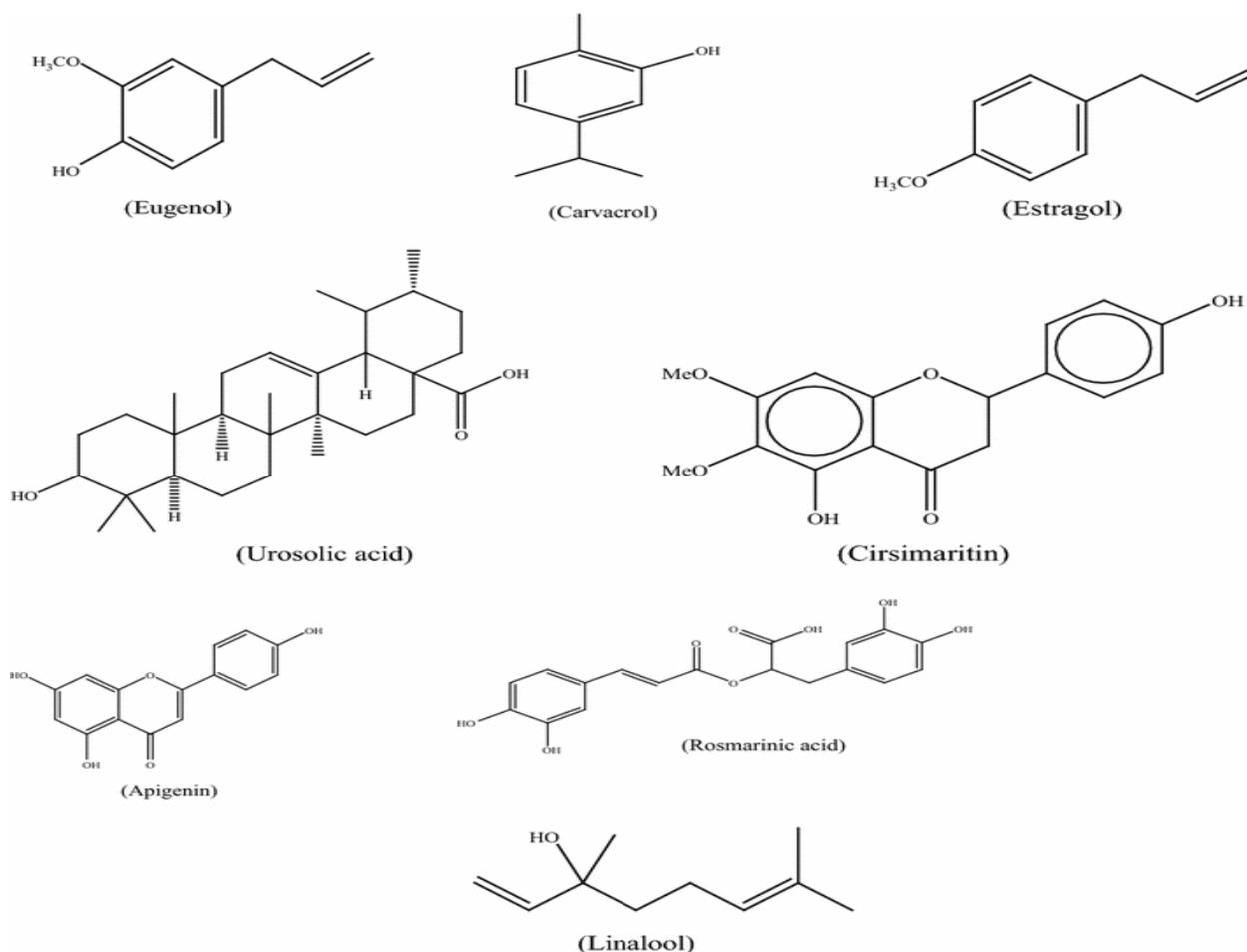


Figure 6 – The Chemical Constituents of *Ocimum sanctum*

**PHYTOCHEMICALS AND PHARMACOLOGICAL ACTIVITY INVOLVE:-**

The chemical makeup of *Ocimum sanctum* (Tulsi) is a mixture of several nutrients and some well-known physiologically active chemicals that are involved in pharmacological activities against many illness conditions(43). The well-established nutritional and pharmacological benefits of the whole plant in its natural form are the consequence of synergistic interactions between many different active phytochemicals (44).

**PHARMACOLOGICAL ACTIVITIES OF TULSI:-**

Antibacterial, antiviral and antifungal activities-

Almost every *Ocimum* species produces essential oil with antifungal, antibacterial, and antiviral activities. Diseases produced by antibiotic-resistant bacteria provide a serious treatment challenge. Use medicinal plants to treat this illness. Tulsi leaves have been

shown to have high antifungal properties against the *Aspergillus* species (45).

Oil from *O. gratissimum* L. was also found to have antifungal action against *Candida* species in vitro. *Ocimum* has potent antibacterial properties against bacteria that cause pneumonia and urinary tract infections, including *Klebsiella*, *E.coli*, *Proteus aureus*, and *Vibrio cholerae*. According to study, *O. basilicum* is efficient against both DNA and RNA viruses (herpes, adenoviruses, and hepatitis B virus). *O. tenuiflorum* also has antiviral efficacy against bovine herpesvirus-1. Essential oils from *Ocimum* sp. are supposed to have antibacterial characteristics since they include carvacrol, caryophyllene, and methyl eugenol (46).

**The anti-diabetic properties-**

*O. sanctum* leaves have been found in animal studies to exhibit hypoglycemic properties (47). Various

plant parts can be combined to create a decoction that reduces blood sugar levels. In rats, *O. sanctum* leaf extracts have been shown to improve insulin production via physiological mechanisms. The antiglycemic qualities of *Ocimum* have been extensively explored, however the underlying mechanism remains unknown. Tulsi and Neem together have been demonstrated to lower blood sugar levels in diabetics (48).

As an anticancer agent –

In many developing countries, cancer has been the leading cause of death since the 1970s. Changes in lifestyle and food choices, as well as the availability of curative medication for many infectious diseases, have led in an increase in cancer-related illness and mortality in both developed and developing countries. Surgery, radiotherapy, and chemotherapy are well-known cancer treatments that are expensive, mutilating, and have significant side effects, including recurrent relapses. Ayurveda includes a large range of herbs with anticancer and antitumor effects. In mice with Sarcoma-180 solid tumours, an ethanolic extract of *O. sanctum* reduced cancer cell proliferation and extended lifespan (49).

Stress relieving agents –

We have all experienced stress at some point in our life. Stress is defined as the "non-specific effect of any exertion on the body." Depending on the cause of the stress, you may suffer both physical and psychological symptoms. Stress can be damaging to the body if it becomes excessive (50).

Immunomodulatory agent-

Both cell and humoral immunity are boosted, resulting in a stronger immunological response. It has no negative side effects on the body, unlike aspirin. Take this supplement to relieve the pain and inflammation produced by osteoarthritis. In multiple studies, tulsi oil dramatically reduced the symptoms of arthritis and edema in rats exposed to Freund's adjuvant, formaldehyde, and turpentine oil (51).

Eye Disease-

*Ocimum sanctum* leaf juice and triphala can aid with glaucoma, chronic conjunctivitis, and other eye problems. According to legend, three drops of tulsi oil and honey can help one's vision.

#### IV. CONCLUSION

Neem (*Azadirachta indica*) and Tulsi (*Ocimum sanctum*), which are adored in ancient Ayurvedic medicine, have shown promising pharmacological properties as natural treatments. Their broad range of therapeutic actions, including antibacterial, anti-inflammatory, antioxidant, hepatoprotective, antidiabetic, and immunomodulatory properties, make them essential resources in current phytotherapy. Neem includes bioactive chemicals such as azadirachtin, nimbin, and nimbidin, which help it fight bacteria, viruses, and fungal infections. Similarly, Tulsi contains eugenol, ursolic acid, and rosmarinic acid, which are known to have adaptogenic, cardioprotective, and antistress characteristics.

Both herbs have showed promise in preclinical and clinical trials for treating chronic ailments such as diabetes, cardiovascular disease, and respiratory disorders. Their usage as complementary medicines may lessen reliance on synthetic pharmaceuticals.

Similarly, Tulsi is known for its adaptogenic, antibacterial, antioxidant, hepatoprotective, and anti-diabetic properties. Key phytochemicals such as eugenol, ursolic acid, and rosmarinic acid help it manage stress, metabolic disorders, respiratory ailments, and infections. Both herbs have minimal toxicity profiles and offer interesting alternatives or supplementary options to synthetic pharmaceuticals, particularly for designing safe, multi-targeted treatments.

Their synergistic potential is being investigated in polyherbal formulations to improve medicinal outcomes. However, despite widespread traditional use and preliminary scientific evidence, more in-depth research, including clinical trials and extract standardization, is required to ensure uniform dose, efficacy, and safety.

Finally, Neem and Tulsi are significant therapeutic plants with solid pharmacological foundations and promising future use in evidence-based integrative healthcare systems. Further research could open up more targeted applications and assist their widespread acceptance in modern medicine.

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