



## **Neem (*Azadirachta indica*): A Review on Chemical constituents and Pharmacological activities.**

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### **ABSTRACT:**

The goal of global health and medical practice is to better understand the metabolic process and its consequences on the human body by combining evidence-based treatment with alternative medicine. The big tree *Azadirachta indica*, sometimes known as neem, is indigenous to India and has long been utilized for its many uses, mostly to heal skin conditions and for its "herbicide" characteristics. The two main types of chemicals that have been extracted from various portions of neem are isoprenoids and non-isoprenoids, which include proteins and carbohydrates. Additionally, it contains aliphatic compounds, dihydrochalcone, coumarin, tannins, sulfurous compounds, and polyphenolic compounds such as flavonoids and their glycosides. Neem is also known globally as a broad-spectrum fertilizer and insecticide with uses in agriculture and

**Keywords:** *Azadirachta*, anti-cancer, neem extracts, anti-inflammatory, anti-diabetic, chemistry.

### **INTRODUCTION:**

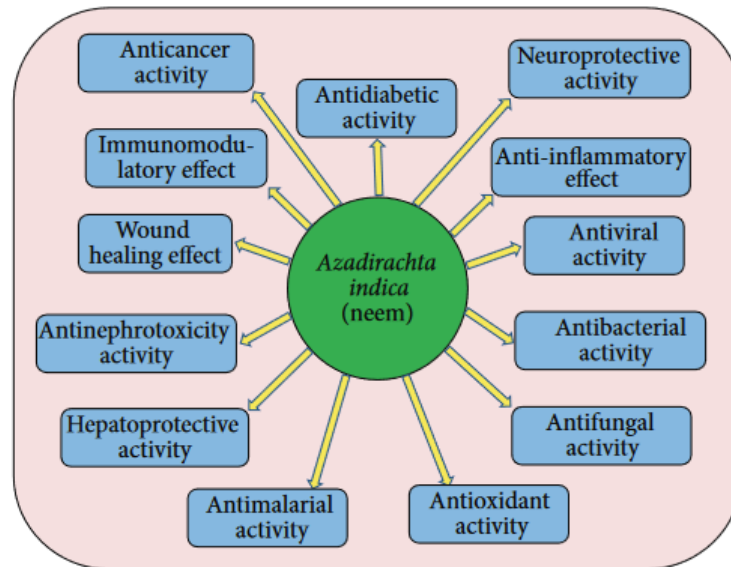
In recent years, neem has gained international attention because of its many therapeutic uses. Neem refers to the *Azadirachta indica* (neem) tree, which is historically believed to provide "good health" to individuals who consume it. The margosa tree or Indian neem are common names for *Azadirachta indica*. The Meliaceae family includes neem (*Azadirachta indica*). Neem is referred to as "Arishtha" in Ayurveda, which means "reliever of sickness." Because of its therapeutic qualities, the tree is known in India as a "divine tree" or "village pharmacy." Their anti-inflammatory, anti-arthritis, antipyretic, hypoglycemic, antigastric ulcer, antifungal, antibacterial, and anticancer properties have been verified by previous researchers. One of India's native medicinal plants, neem has therapeutic benefits in every part of the body, including

### **Botanical Description of Neem:**

Neem trees are abundant in tropical and semitropical areas such as India, Bangladesh, Pakistan, and Nepal. They are members of the Meliaceae family. The tree grows quickly, reaching a height of 20–23 meters. Its trunk is straight and around 4-5 feet in diameter. Each of the compound, imparipinnate leaves has five to fifteen leaflets. During the months of June through August, its green drupes mature into golden yellow.

### **THE IMPORTANCE OF AZADIRACHTA INDICA (NEEM) AS A MEDICINAL PLANT:**

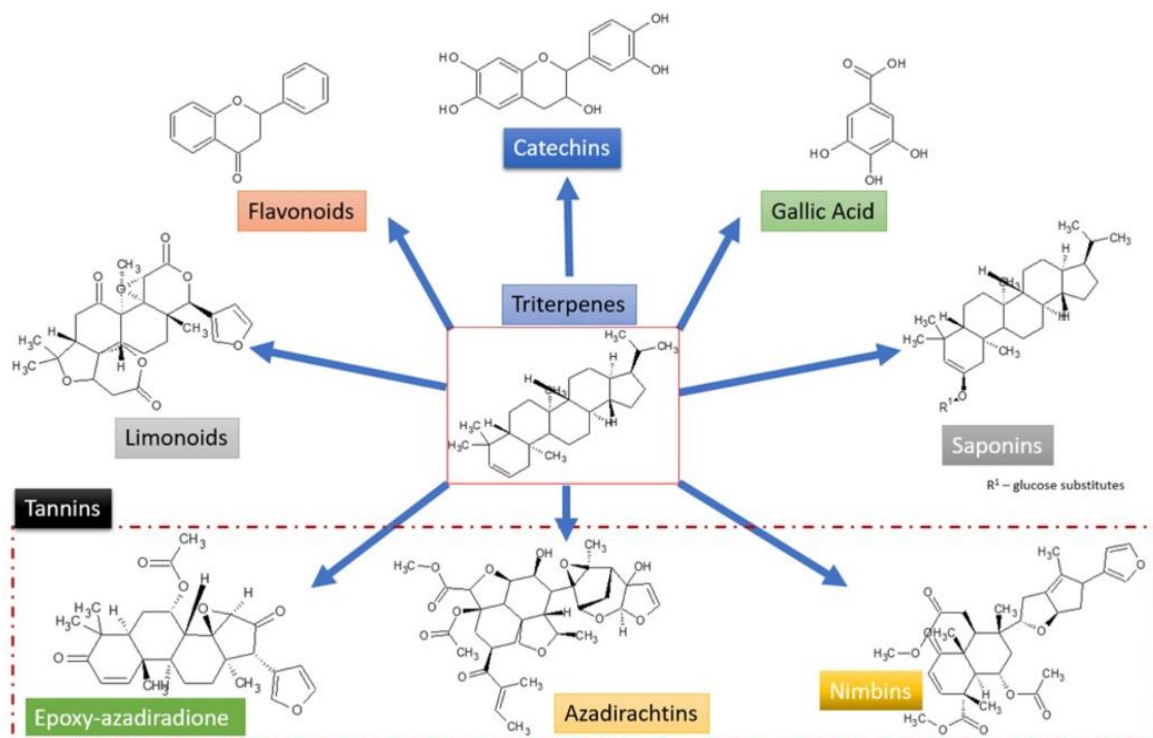
The tropical evergreen neem tree, *Azadirachta indica* (A. Juss), is indigenous to the Indian subcontinent (Noorul Aneesa, 2016). Neem has been known for its many health benefits for thousands of years. These include its use in traditional medicine to treat a variety of common human ailments and in agriculture to control pests. However, because of their purported antipyretic, antacid, antiparasitic, antibacterial, antiviral, anti-diabetic, contraceptive, antidermatitic, anticancer, anti-inflammatory, antioxidant, antifungal, dental, and other healing and protective qualities, different parts of the neem tree have been used for millennia in traditional Indian medicine. The stem, bark, roots, leaves, gum, seeds, fruits, flowers, and almost every other part of *A. indica* have all been utilized as home cures for human ailments.

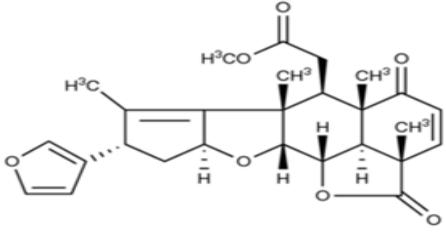
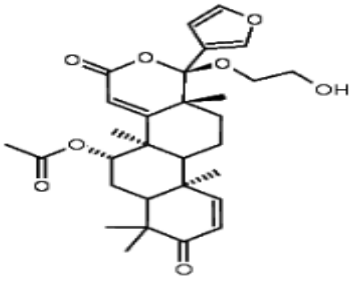
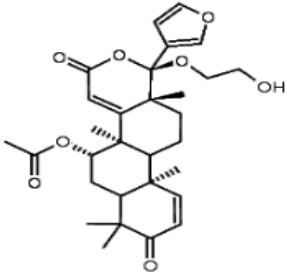
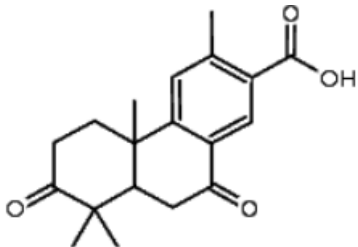
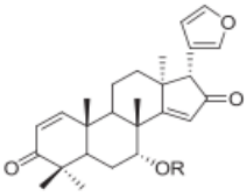


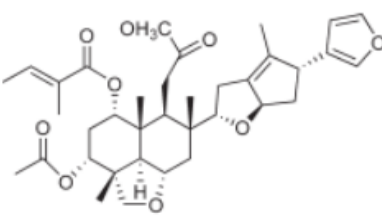
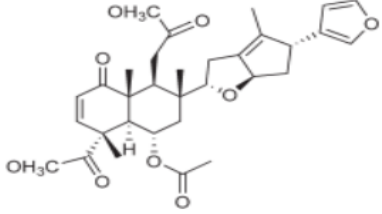
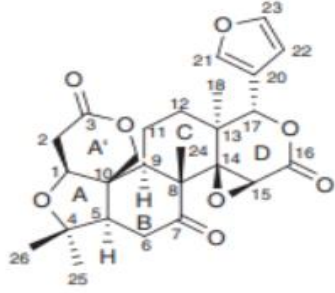
### Chemistry of Neem compounds:

Triterpenes or limonoids are natural substances found in neem. In neem, new limonoids continue to be found. Nimbin, meliantriol, salannin, and azadirachtin are well-known. An acetoxy, lactone, ester, methoxy, and aldehyde group are all present in the bitter component, nimbin. Sulfur is present in Nimbidin. Oxidized tetranortriterpenoids, including azadirachtin A (azadirachtin) B (3-tigloylazadirachtol), azadirachtin D (1-tigoyl-3-acetyl-11-hydroxy-meliacarpin), azadirachtin H (11-demethylcarbonyl azadirachtin), azadirachtin I (1-tigoyl-3acetyl-11-hydroxy-11-demethylcarbonyl meliacarpin), azadirachtin anin, azadiriaadione, azadirachtolide, deacetylnimbin, epoxyazadiradione, isoazadirolide, margosinolide, nimbandioli, nimocinol, nimbinene, nimboconone, nimboconolide, nimocin, nimbolide, salannin, and related derivatives are the main representative phytochemical compounds.

The following substances are responsible for additional biological activity discovered in neem oil studies: nimbin, salannin, meliantriol, meliacin, tignic acid, gedunin (also found in leaves), nimbidin, nimbidic acid, nimbidinin, and nimbolide.



Phytochemical Constituents	Part of the Plant	Structural Formula	Biological Activity
Nimbolide	Oil from leaves and seeds, fruit		Psoriasis, antibacterial
Gedunin	Oil from leaves and seeds		Antifungal
Mahmoodin	Oil from seeds		Antibacterial
Margolone	Oil from seeds and stem bark		Antibacterial
Cyclic trisulphide	Oil from seeds and leaves	$  \begin{array}{c}  \text{S} \\  \diagup \quad \diagdown \\  (\text{CH}_2)_m \quad (\text{CH}_2)_n \\  \diagdown \quad \diagup \\  \text{S} \quad \text{S}  \end{array}  $ <p><math>m = 1 - 4</math> <math>n = 2 - 3</math></p>	Antifungal
4 azadiradione-type limonoids	Leaf extract		Melanogenesis inhibition

2 salannin-type limonoids	Leaf extract		Melanogenesis inhibition
5 nimbin-type limonoids	Root extract		Melanogenesis inhibition
Limonoid	Leaves extract		Anti-inflammatory

### Pharmacological activities:

Neem has numerous therapeutic applications and is a key component in the treatment of the majority of common illnesses. Neem has several uses, including:

#### 1.Ayurveda:

In India, the neem tree has a significant role in traditional Ayurvedic treatment. In traditional medicine, neem bark, leaf extracts, and neem oil have been used to treat a variety of ailments, including intestinal helminthiasis, constipation, and leprosy. Additionally, it is essential for the treatment of indolent ulcers, persistent syphilitic sores, and rheumatism. It is commonly known that neem oil can help with a variety of skin issues. The bark, gum, leaf, and seed are used to treat scorpion stings and snake bites.

#### 2.Homeopathy:

Neem is used to treat rheumatism. Hand and toe aches, rib and sternum pain, and extremity pain. Additionally, it is used to treat scabies, pemphigus, and eczema.

#### 3.Unani:

Neem is used as a blood purifier and resolvent. Leaves clear the air and treat urinary tract ulcers. used to treat skin conditions and as anemmenagogue. Fruit is used to treat bronchitis, leprosy, and as an anastringent.

#### 4.Hypoglycaemic activity:

Diabetes, or the inability to regulate blood glucose levels, is one of the main chronic degenerative diseases that is progressively becoming more prevalent.

In a nutshell, diabetes comes in two varieties. Studies on the impact of neem extracts on both forms of diabetes have shown conflicting findings. As neem extracts are still being studied for their effects and toxicity, we advise against using them directly.

Extracts from neem leaves have demonstrated encouraging outcomes in lowering blood sugar levels and preventing hyperglycemia brought on by adrenaline and glucose.

**5. Antiulcer effect:**

Aqueous extracts of neem leaves and bark have strong antiacid secretory and antiulcer properties. Nimbidin was found to have a strong antiulcer effect in preventing duodenal ulcers caused by histamine or cysteamine, as well as stomach lesions caused by acetylsalicylic acid, indomethacin, stress, or serotonin.

**6. Antimalarial activity:**

Extracts from neem seeds and leaves work well against malarial parasites of both sensitive and chloroquin-resistant strains. The limonoid "gedunin," one of the constituents of neem, is as good at preventing malaria as quinine. One of the epidemic diseases that kills millions of people annually in India and many other nations is malaria. China has embraced neem extensively in order to benefit from its antimalarial properties. India would also have access to the Chinese-made anti-malarial compound "Quinahausa." Since malaria is getting harder to manage due to rising issues with resistance to traditional treatments, neem oil-treated mosquito nets and inexpensive medicines that repel mosquitoes are also becoming more and more popular. Clinical studies have been carried out to determine whether neem extracts can effectively regulate

**7. Antifungal activity:**

Neem is thought to be beneficial against several fungi that infect the human body and has been for ages. Several significant fungi that neem medicines have been shown to protect against. The following have been found to be effective: ringworm, which infiltrates the skin and nails of the feet; athlete's foot fungus, which infects the hair, skin, and nails; a fungus that grows in the intestinal tract, bronchi, lungs, and mucous membranes; and a fungus that is a normal component of mucous flora and can become out of control, resulting in lesions in the mouth (thrush), vagina, etc.

**8. Antibacterial activity:**

Since the need for new treatments has arisen due to the increasing rates of antibiotic resistance in bacterial infections, a large portion of recent research on neem's antibacterial potential has concentrated on the plant's antimicrobial qualities. The effective uses of neem in the food industry and the historic usage of neem products for oral hygiene lend credence to this field of study. Azadirachtin, one of the chemicals derived from neem, is well known for its antibacterial properties. The complex tetranortriterpenoid limonoid found in seeds and leaves is mostly to blame for the harmful effects on microorganisms.

**9. Antiviral activity:**

While the majority of recent research has focused on *A. indica*'s antibacterial and antifungal properties, several studies have also looked at neem's antiviral properties. As of right now, the majority of publications have focused on the influenza, Dengue, herpes, and human immunodeficiency virus (HIV); however, new reports have also mentioned SARS-CoV-2, which is the cause of the COVID-19 pandemic. Interestingly, this implies that the results could both identify a unique therapeutic candidate that can be directly altered for pharmaceutical development and define a mechanism of action.

**10. Anticancer activity:**

The incidence of oral squamous cell carcinoma caused by 7, 12-dimethylbenz[a]anthracene (DMBA) is decreased when neem leaf aqueous extract is used.

(Gogati and Marathe, 1989) neoplasm. A study by Pramanik et al. (2016) examined the effects of chemoprotective neem chemicals, specifically azadirachtin, nimbolide, and limonoid concentrate extracts, on hamster models of buccal carcinogenesis.

**11. Antioxidant activity:**

The inclusion of antioxidants in dermocosmetics can reduce the effects of ROS and free radicals, which are known to be implicated in DNA damage, cancer, and even aging [1].

Consequently, some extracts containing flavonoids with established antioxidant properties and other. Strong antioxidant potential was demonstrated by extracts made from *A. indica* flowers and young leaves [4]. Furthermore, due to a larger concentration of phenolic components, the aqueous portion of Neem bark exhibited better antioxidant activity than the leaf extract. Neem seed extract's antioxidant properties have been shown in vivo during horse grain germination, which is linked to low levels of lipid peroxides and lipoxygenase activity (Balasenthil et al., 1999).

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**Conclusion:**

To sum up, neem (*Azadirachta indica*) is a plant that has a long history of traditional use in agriculture, medicine, and other fields. It has been demonstrated that the chemical components of the plant, including as limonoids, flavonoids, and alkaloids, have a variety of pharmacological effects, such as anti-inflammatory, antibacterial, antiviral, and anticancer qualities. Neem has several potential health advantages, but further study is required to fully understand its therapeutic potential. Neem is a natural, affordable, and sustainable resource that has the potential to significantly improve health and wellness around the world. Although further research is required to verify the effectiveness and safety of Neem-based therapies, the information now available indicates that Neem is a useful plant that merits more study.

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