WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 16, 165-171. Review Article ISSN 2277–7105

A REVIEW ON NEEM (AZADIRACHTA INDICA): THE MEDICINAL MIRACLE

Muskan Nagpal[1]*, Karshi Sharma[2] and Dr. Aditi Chauhan and M. D. (AY)[3]

[1,2]Resident Intern, Babe Ke Ayurvedic Medical College and Hospital, Daudhar, Moga, Punjab, India.

[3]Assistant Professor, Babe Ke Ayurvedic Medical College and Hospital, Daudhar, Moga, Punjab, India.

Article Received on
24 June 2025,

Revised on 14 July 2025,
Accepted on 03 August 2025

DOI: 10.20959/wjpr202516-37898

***Corresponding Author**
Muskan Nagpal
Resident Intern, Babe Ke Ayurvedic Medical College and Hospital, Daudhar, Moga, Punjab, India.

ABSTRACT

Azadirachta indica, commonly known as *Neem*, is a highly valued medicinal plant in traditional systems such as *Ayurveda*, *Unani*, and Naturopathy, earning titles like "The Village Pharmacy" for its broad therapeutic potential. It possesses a rich phytochemical profile, with over 150 bioactive compounds including isoprenoids, flavonoids, limonoids (e.g., azadirachtin, nimbin, salanin), polyphenols, and sulfur-containing molecules, isolated from various parts like leaves, bark, seeds, and roots.[1] *Neem* has demonstrated wide-ranging pharmacological actions such as antioxidant, anti-inflammatory, antimicrobial, antifungal, antiviral, antihyperglycemic, anticarcinogenic, hepatoprotective, and immune-modulatory effects. Recent studies have also explored *Neem*'s potential in dermatology, particularly in inhibiting melanin production by reducing tyrosinase activity, suggesting its role in treating hyperpigmentation disorders and its incorporation into cosmetic formulations. Despite its wide applications, researchers emphasize the need for standardization in *Neem* extract preparation, as certain unregulated formulations may pose risks to liver or kidney health. Advances in genomics also show phylogenetic links between *Neem* and Citrus species, opening new doors for further pharmacogenetic studies.

KEYWORDS: Azadirachta indica, Neem, Limonoids, Ayurveda.

INTRODUCTION

Azadirachta indica A. Juss, commonly known as *Neem*, is a highly esteemed tree of the Meliaceae family, native to the Indian subcontinent and widely cultivated throughout tropical and subtropical regions, particularly in South Asia and Africa. Traditionally referred to as *"Nimba"* in ancient *Sanskrit, Neem* is considered a sacred plant in Indian culture and has been historically utilized for promoting health and well-being. Referred to as the "Village Pharmacy" due to its extensive therapeutic applications, *Neem* holds a prominent place in various traditional systems of medicine including *Ayurveda, Unani, Siddha*, and *Homeopathy. Neem* is renowned for its multipurpose medicinal properties and has been used for centuries in the treatment of numerous ailments such as skin disorders, infections, diabetes, hypertension, gastrointestinal disturbances, leprosy, and inflammatory conditions These attributes make *Neem* a potential candidate for managing chronic diseases such as cancer, diabetes, and autoimmune disorders. In recent years, *Neem* has also attracted attention in the fields of cosmetology and dermatology, particularly for its potential in treating skin conditions like eczema, acne, hyperpigmentation, and microbial infections. Studies have shown that *Neem* leaf extracts can inhibit melanogenesis by reducing tyrosinase activity, making it a promising ingredient in whitening and anti-pigmentation cosmetic formulations. Furthermore, *Neem* oil has demonstrated significant sun protection factor (SPF) properties in in vitro evaluations. Besides human health, *Neem* plays a critical role in agriculture as a biopesticide and natural insect repellent. Its insecticidal and antifungal properties are attributed to azadirachtin and other active compounds, which are effective against a wide range of pests, without causing harm to humans, animals, beneficial insects, or the environment. Despite its extensive use and long-standing reputation for safety, there remains a need for standardization in the extraction and preparation of *Neem*-derived products. Variability in the concentration of active constituents due to differences in harvesting methods, storage conditions, and extraction techniques can influence both efficacy and toxicity. Although *Neem* has been safely used by generations, toxicological studies are essential to ensure its safe integration into modern healthcare and pharmaceutical systems. As global interest in plant-based and integrative medicine grows, *Neem* stands out as a potent, affordable, and culturally accepted therapeutic resource. This review aims to provide a comprehensive overview of the bioactive constituents, pharmacological actions, therapeutic applications, and modern advancements in *Neem* research, highlighting its potential as a holistic agent for disease prevention and health promotion.

METHODS AND MATERIALS

Ayurvedic and modern publications, authentic websites (PubMed, Medicinal Plants, etc.), genuine magazines, literature, manuscripts, Sanskrit Dictionary, Shabdakosha, and other sources are used to compile information about Neem (Azadirachta indica).

Taxonomy of Neem Plant[2]

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Super Division: Spermatophyta
- Division: MagnoliophyaClass: Dicotyledons
- Subclass: Rosidae
- Order: Sapindales
- Family: Meliaceae
- Genus: Azadirachta
- Species:indica

Classification of *Nimba* in Classical Texts[3]

In *Ayurveda*, *Nimba* has been classified based on *Doshkarma*, properties, morphological characters, therapeutic values, etc. *Nimba* is classified in various *Gana* in *Brihattrayi* and *Nighantus*. *Panchnimba* has been mentioned in *Paryaya Ratnamala*, *Dhanvantri Nighantu, Abhidhan Ratanmala, Madanpal Nighantu,* and *Kaidev Nighantu.*

Morphological features[3]

The neem tree (Azadirachta indica) is a medium-sized, evergreen tree known for its deep roots and attractive, rounded crown. It typically reaches heights of 15-30 meters and can have a crown diameter of 10-20 meters. The bark is grey, becoming fissured and flaky with age, and the tree exudes a sticky, foetid sap. Neem trees have alternate, pinnate leaves with toothed leaflets, and small, white, fragrant, bisexual flowers borne in clusters. The fruit is a smooth, yellow-green drupe containing a sweet-flavored pulp.

Chemical composition of *Nimba*[7]

Part	Chemical composition
Leaves	Vitamin C and Carotene,Quercetin and Isoprenylated flavanone, Nimbaflavone ,Limonoid Azadirachtin A.,Amino acids like Glutamic acid, Tyrosine, Aspartic acid, Alanine, Proline, Glutamine, Cysteine,Saponins, Mucilage, Essential oils, Steroids, Saponins, Flavonoid
Flowers	Nimbosterol, Glycoside- Nimbosterin, Flavon-Nimbecitin,Hydrocarbonate nonacosane, Pungent essential oil,Myricetin glycoside –Melicitrin, Tetranortriterpenoid Neeflon, Essential oil from flowers contained Thio-amyl alcohol (7.6%), Benzyl alcohol (9.67%), Benzyl acetate (8.2%), Sesquiterpenes viz azadirachtin, Margosene
Fruits/ seeds	HPLC yielded Azadirachtins i.e., Azadirachtin A, Azadirachtin B, Azadirachtin D, Azadirachtin H and 11β-H epimer ,Azadirachtin I rabinogalactan isolated from fruit pulp contained D-galactose, L-arabinose, L-rhamnose, D-glucuronic acid, Amino acids obtained are Aspartic acid, Isoleucine, Lysine,Seed oil contained Azadirone, Azadiradione, Epoxyazadiradione, Gedunin.

Pharmacological Properties[6,7,8]

1. Hepatoprotective effect[10]

Aqueous *neem* leaf extract (ANLE) showed hepatoprotection against anti-tubercular drug-induced damage in rats as indicated by minimized alteration of bilirubin, Alanine aminotransferase, Aspartate aminotransferase, and Alkaline phosphatase in serum. Azadirachtin-A, and, Nimbolide the major components of *neem*, showed a hepatoprotective effect against carbon tetrachloride (CCl4)-induced liver injury in rat models with efficacy similar to that of Silymarine standards.

2. Anti diabetic effect[9]

Neem leaf extracts showed promising results in decreasing blood sugar level and prevents adrenaline as well as glucose induced hyperglycaemia. Recently, hypoglycaemic effect was observed with leaf extract and seed oil in normal as well as alloxan-induced diabetic rabbits.

3. Immunostimulant effect[8]

The aqueous extract of leaf also possesses potent immune-stimulant activity as evidenced by both humoral and cell-mediated responses. Leaf extract at 100 mg/kg after three weeks of oral administration causes higher IgM and IgG levels along with increased titter of ant ovalbumin antibody.

4. Anti-cancerous activity

Dietary *neem* flowers, at level of 10% in diet, reduced both incidence and multiplicity (number of tumours per rat) of mammary gland tumours in female Sprague Dawley rats induced by DMBA (Dimethylbenz[a]Anthracene) when given 1 week prior to carcinogen administration. Dietary *neem* flowers, at the level of 12.5% in the diet, could also suppress the development of liver tumour in male Wistar rats induced by AFB1 (Aflatoxin B1).

5. Antioxidant activity

Ethanolic extracts of flowers and seed oil were also found to have better free radical-scavenging action.

6. Anti-ulcer activity

Some active ingredients (Phytosterols) were isolated from lipophilic fraction of *neem* fruit, exhibit antiulcer activity in stress induced gastric lesion.

7. Anti-inflammatory activity

The anti-inflammatory activities of *neem* fruit skin and its specific ingredient, azadiradione, have also been evaluated. The results have concluded that the animals treated with 100 mg/kg dose of this fruit skin extract and azadiradione exhibited significant anti-inflammatory activities.

CONCLUSION

Neem (*Azadirachta indica*), an evergreen tree native to the Indian subcontinent, holds a revered status in traditional medicine systems like *Ayurveda*, *Unani*, and *folk medicine*. From ancient texts such as the *Samhitas* to contemporary pharmacological research, *neem* has consistently demonstrated its profound therapeutic potential across a wide range of diseases. Its widespread use in home remedies—from applying leaf paste for skin disorders to using bark for wound healing—underscores its accessibility, affordability, and effectiveness, making it a valuable alternative to modern synthetic medicines, especially in resource-constrained settings.

Every part of the *neem* tree—leaves, bark, fruits, seeds, flowers, and even oil—offers distinct medicinal benefits. Its broad spectrum of activity includes anti-inflammatory, antimicrobial, antioxidant, antidiabetic, anticancer, hepatoprotective, antifertility, immunomodulatory, antiulcer, and wound-healing properties. These effects are attributed to its diverse and potent

bioactive compounds such as Nimbin, Nimbinin, Nimbidine, and Azadirachtin, among others. These phytoconstituents act synergistically to modulate key biological processes, inhibit microbial growth, and enhance the body's natural defense mechanisms without causing significant adverse effects. Modern scientific research continues to validate the traditional uses of *neem* by demonstrating its efficacy in treating acute and chronic illnesses, and in the development of novel drug formulations. The role of *neem* as a bioavailability enhancer in herbal and pharmaceutical preparations adds to its commercial and therapeutic appeal. Ayurvedic pharmacodynamics provide a deeper understanding of *neem*'s multifaceted actions. Classified under *Panchnimba* in Ayurvedic literature, each part of the *neem* plant is associated with specific therapeutic properties. Its *Tikta* (bitter) and *Kashaya* (astringent) rasa, *Sheet* (cooling) and *Ushna* (heating, in the case of fruits) virya, and *Katu vipaka* all contribute to its ability to pacify *Pitta* dosha and alleviate *Krimi* (worms), *Kushtha* (skin diseases), *Arsh* (piles), and *Raktapitta* (bleeding disorders), among others. This harmonizes with modern understandings of its anti-parasitic, anti-inflammatory, and blood-purifying properties. Globally recognized for its ecological and medicinal value—aptly named the "Tree of the 21st Century" by the United Nations—neem stands out as a sustainable, environmentally friendly medicinal resource. Its role in integrative and holistic medicine is expanding, as ongoing research continues to explore its utility in enhancing drug delivery, managing lifestyle diseases, and even in cosmetic and agricultural applications. In conclusion, neem represents one of nature's most versatile and invaluable medicinal plants. Its time-tested traditional uses, backed by modern pharmacological validation, highlight its immense potential as a cornerstone in the development of future therapeutics. Harnessing neem's full potential in a scientifically rigorous and sustainable manner could open new frontiers in preventive and curative healthcare worldwide.

REFERENCES

1. Prof. P. V. Sharma (1998), "Dravyaguna- Vijanana,",vol-II, Chaukhambha Bharti Academy, Varanasi. (P-709, 513).
2. Sri Brahmasankara Misra and Sri RupalalajiVaisya (2016), "Bhavaprakasa", Part-I, 12th edn., Hindi commentary, Chaukhambha Sanskrit Bhawan, Varanasi (P-668).
3. Dr. ManasiMakrand Deshpande and Dr. A. P. Deshpande (2017), "Dravyagunavigyan", vol-2, Hind Chaukhambha Sanskrit Pratishthan, Delhi (P-308).
4. The Ayurvedic Pharmacopeia of India (2004), Part-I, vol-IV, 1stedn. (P-128,129)

5. Gautam, P. and Mittal, P. "A Review on Traditional Plant Azadirachta indica: Natural Source for Disease Curability and Health Promotion", Journal of Pharmaceutical Research International, 2021; 33(56A): 1–7. doi: 10.9734/jpri/2021/v33i56A33880.
6. El-Hawary SS, El-Tantawy ME, Rabeh MA, Badr WK. DNA fingerprinting and botanical Gautam and Mittal; JPRI, 33(56A): 1-7, 2021; Article no.JPRI.775687A. Juss. (neem), 2013; 2(1): 1–13.
7. Kaur R, Ankita, Tree of the 21st century - Neem and its 5 parts. J Ayu Int Med Sci., 2025; 10(3): 256-265.
8. Maithani A, et al. Azadirachta indica (Neem) leaf: A review. J Pharm Res., 2011; 4(6): 1824-1827. [Crossref][PubMed][Google Scholar]
9. Reddy IVS, Neelima P. Neem (Azadirachta indica): A review on medicinal Kalpavriksha. Int J Econ Plants. 2022. [Crossref][PubMed][Google Scholar]
10. Yadav D. Importance of neem leaf: An insight into its role in combating diseases. Indian J Exp Biol. 2016; 54: 708-718. [Crossref][PubMed][Google Scholar.