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Review Article

Therapeutic Potential Of *Azadirachta Indica* (Neem) And Phytoconstituent Against Disease

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ABSTRACT

Azadirachta indica, also referred to as neem, has attracted a lot of attention for its potential as a medicine for a variety of illnesses. The medical evidence for neem's therapeutic benefits and those of its bioactive constituents is reviewed in this article. Numerous experimental and clinical investigations have proven the antibacterial, anti-inflammatory, antioxidant, and immunomodulatory properties of neem weed. Azadirachtin, nimbin, and other important phytoconstituents help neem's broad-spectrum medicinal properties. Even with the encouraging results, there are still unanswered questions about the safety profile and entire range of neem's mechanisms of action. The present analysis highlights the necessity of more investigation to enhance neem-based remedies, assess their potential for synergy with traditional treatments, and carry out extensive clinical studies. Neem's incorporation into contemporary therapeutic procedures may offer a beneficial and long-lasting addition to current therapy alternatives, improving patient outcomes and broadening the therapeutic toolbox for infectious and chronic illnesses.

INTRODUCTION

Azadirachta indica is a tree in the mahogany family Meliaceae, also referred to as neem, margosa, Nim tree, or Indian lilac(1). It belongs to the genus *Azadirachta* and is one of the two species. Although it is native to the Indian subcontinent and some regions of Southeast Asia, it has been naturalized and is grown in tropical and subtropical regions all over the world(2). Neem oil is extracted from the plant's fruits and seeds.

Sanskrit nimba is the root of the Hindustani term Nim. Neem is a precious gift from nature and an all-powerful tree. Most neem trees are grown in the Indian subcontinent. Neem belongs to the Meliaceae family of mahogany. *Azadirachta indica* (A. indica) A. Juss is the botanical name by which it is currently known. Neem was widely utilized by humans to treat a wide range of illnesses even before written records that traced

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the beginning of history became available. Humanity has employed neem from the prehistoric era(3).



Fig 1 (Neem Leaves)

Azadirachta indica, the Latin name for neem, is taken from Persian. “Free” is the meaning of azad; “tree” is Dirakht; and “of Indian origin” is i-Hind. It thus properly translates to “the free tree of India. Neem trees belong to the Meliaceae family of mahogany. It is indigenous to Malaysia, Bangladesh, Sri Lanka, India, and Myanmar. Tropical and semi-tropical climates are where it flourishes. It was also Hyderabad Deccan's state tree(4). In India, neem is a fast-growing tree that can grow as high as 15-20 meters (50–65 feet) and occasionally as high as 35–40 meters (115–131 ft). It never goes out of style. It may be found in several important regions in Tamil Nadu, such as Tirunelveli and Tuticorin (5). For generations, India's traditional medicine has utilized products derived from margosa trees to treat rheumatism and skin conditions, but there isn't enough clinical data to support the benefits of margosa use in medicine (6). Adults: There are no known dosages, and while short-term use of margosa seems safe, prolonged usage may damage the kidneys or liver; margosa oil is poisonous and can be fatal in tiny children. Margosa may also result in low blood sugar, infertility, and miscarriages. Neem twigs are frequently used as teeth-cleaning twigs in Southern India and the Middle East.

HISTORY

The fabled Indian medicinal tree has developed with human settlement throughout the nation and

has long been an essential component of Indian culture. The history of Indian civilization is closely intertwined with that of the neem tree (7). The Indian peasants have long countenanced the neem tree as a companion and defender. Indians have long believed that this tree may strengthen their health and treat a wide range of illnesses(8). It has also been used as a natural insecticide and fertilizer for fields, as well as for preserving food and grains that have been stored. More applications have been made of it than any other tree(9). The best-kept secret in India, perhaps, was the neem tree (*Azadirachta indica* A. Juss). Black pepper, cardamom, saffron, turmeric, sandalwood, silk, and other precious substances were highly sought after in ancient India and transported across the ocean to Europe for ages (10). Another thing that the British Raj was unable to appreciate was how widespread this tree is throughout India, with the exception of the Himalayas and the coastal areas. Maybe if they had been aware of the amazing range of applications for the neem tree, it would have gone global long ago. The neem tree was fascinating to Indians for numerous reasons (11). This particular tree was picked because of its reputation for having the coolest shade of any tree and for acting as a repellent to keep pests and insects away. Neem was the cornerstone of the natural beauty culture for ladies. It was also a source of medication for over a hundred medical conditions, ranging from skin rashes and scratches to diabetes and malaria (12). The women utilized it as a year-round safeguard for their grains and pulses that they had stored. The tree offered the men material for pest management and fertilizer in the form of seeds, leaves, and bark. Additionally, it offered therapeutic concoctions for their animals and cattle. In addition, their dwellings were cool all summer long and clear of germs and viruses thanks to the breeze that passed through the tree's boughs (13). Indians have been planting this tree near their homes for ages, and they have had

regular, gentle interactions with this amazing plant. Neem proved to be a freely available, priceless source of health, hygiene, and beauty, especially for women. Bathing in a neem leaf infusion kept their skin smooth and healthy. Their face treatments using crushed or powdered neem leaves offered emollient and anti-aging properties. Neem have the antibacterial properties that help reduce acne and pimples. Applying coryllium, sometimes known as lamp black, to the outer corner of the eye was a common technique in certain parts of India, especially among young women who wanted to draw attention to their eyes (14). A cotton wick and neem oil were typically placed inside an earthen lamp to create lamp black. When the wick was lit, it released a lot of smoke, which could be used to gather lamp black by setting a bronze cup with water inside for cooling some distance away from the flame(15). After that, the lamp black deposit was scraped out from under the cup and combined with a tiny amount of mustard oil to create adense paste known as Kaajal. Neem oil was used as an anti-lice and anti-dandruff remedy and was thought to stop baldness and hair graying (16). It has been reported that controlling skin allergies can be achieved by combining one teaspoon of powdered dry neem leaf with the same amount of ghee (clarified butter) and honey. To keep teeth and gums healthy, alum, rock salt, and neem seed powder were combined in equal amounts and thoroughly mixed (17). Nimba, the powerful remedy for Priyanighantu Harotakyadivarga, pitta aggravations, and blood purification Modern science has validated each of these methods.

IMPACT ON CULTURE AND SOCIETY:

"The European Patent Office (EPO) awarded the US Department of Agriculture and W. R. Grace and Company a patent in 1995 for an anti-fungal medicine that was produced from margosa. When the patent was obtained, the Indian government contested it, arguing that the method covered by the patent had been used in India for more than 2,000 years (18). India won the 2000 EPO ruling, but W. R. Grace appealed, The United Nations has named the neem tree the "Tree of the 21st century". It is an amazing plant. "Neem: A tree for solving global problems" is the title of a 1992 report released by the US National Academy of Science (19).

TAXONOMICS CLASSIFICATION:

Azadirachta indica A. Juss's taxonomic classification: Kingdom Plantae
Sub-Republic of Tracheobionta
Group Magnoliophyta
Eudicot Class
Rosidae subclass
Place an order for Sapindales
Meliaceae Family
Azadirachta Genus

IDENTICAL NAMES

Nimgachh, Nim, Nimbhatri
Danjihada, Limbado, Limbra, Limdo,
Hindi: Nim, Nimb,
Sanskrit: Picumarda, Arista, Nimba, Nimbah
English: Margosa tree, Neem tree, Indian lily,
Kannada: Kaybevu, Bivu, Bemu, Bevinamara,
Bakam, Drekh, and Nim in Punjabi (20).



DIFFERENT PARTS OF NEEM:



Fig No.2 (Different Parts of Neem)

- Flower
- Fruit
- Leaf
- Seed
- Bark
- Roots
- Neem oil
- Gum

CHEMICAL CONSTITUENTS OF NEEM: IN LEAVES

Quercetin (flavonoid) and sitosterol or nimbosterol derived from the leaves as well number of limonoids viz. nimbin and its derivatives were present in minor amounts in non-aqueous extract of neem seed kernel. Quercetin (a flavonoid polyphenolic molecule) possesses antibacterial and antifungal effect (21). This may explain the therapeutic uses of leaves against sores and scabies. At the More... max. dose (100-500 ppm), 7 out of 8 limonoids, including nimocinolide and isonimocinolide decrease fecundity in house flies (*Musca domestica*). They

also appear to be mutagenic in mosquitoes (*Aedes aegypti*) giving rise to intermediates (22). The essential oil obtained from matured fresh leaves of clove was found to be odorous, viscous and pungent in nature, having high antifungal activity against fungi (*Trichophyton mentagrophytes*) when tested in vitro (23). The white crystalline flakes isolated from petroleum ether extract of leaves containing a mixture of C 14, C 24, C 31 alkanes had exhibited superiority or equipotency to pyrethrum extracts and some commercial laticidal formulations (24). Neem leaves are mostly composed of minerals, calcium, phosphorus, vitamin C, carotene, protein (7.1%), and carbs (22.9%). However, they also include other fatty acids (dodecanoic, tetradecanoic, elcosanic, etc.), glutamic acid, tyrosine, aspartic acid, alanine, praline, glutamine, and cysteine-like amino acids (25).

IN FLOWERS

In addition, the essential oil of sesqui-terpene derivatives from flowers contain nimbosterol and flavonoids as kaempferol and melicitrin while a

waxy material composed several fatty acids consisting behenic (0.7%), arachidic (0.7%) stearic, palmitic acid; oleic — 6.5% linoleic (8) %. Neem pollen comprises of numerous amino acids like glutamic acid, tyrosine arginine methionine phenylalanine histidine aminocaproic corrosive and isoleucine (26).

IN BARK

The contents of the trunk bark include 6-desacetyl nimbinene, a bitter ingredient called margosine, nimbin 0.04%, nimbinin (0.001%), nimbidin (0.4%), nimbosterol (0.03%), essential oil 0.02%, and tannins 6.0%. There are 12–16% tannins and 8–11% non-tannins in the stem bark (27). An anti-inflammatory polysaccharide with a molecular weight of 8400 that is composed of glucose, arabinose, and fructose in a molar ratio of 1:1:1 is found in the bark (28). There is also an anticancer polysaccharide found in the bark. In addition to polysaccharides, stem bark and root bark have been shown to contain a number of diterpenoids, including nimbinone, nimbolicin, margocin,

nimbidiol, and nimbione. Together with β -sitosterol, 24-methylenelophenol, and nimatone, the heartwood also carries the salts such as calcium, potassium, and iron. 38.4% of the heartwood yields pyroligneous acid upon destructive distillation. Wood-oil contains β -sitosterol, cycloeucalenol, and 24-methylenecycloartenol, while neem wood has cellulose, hemicellulose (14.0%), and lignin (14.63%) (29).

IN GUM

L-arabinose, L-fructose, D-galactose, and D-glucose are produced by hydrolyzing the gum that the tree yields. Drainage of glucose The older tree produces a sap that contains free sugars (glucose, fructose, mannose, and xylose), organic acids (citric malonic succinic fumaric acid, arginine, aspartic acid, asparagines, glycine, nor valine, etc.), and amino acids (alanine, γ -aminobutyric acid, arginine, asparagines, etc.). Glycerol phosphate mo-NADA_N-arachidonoyl ethanolamine (30).

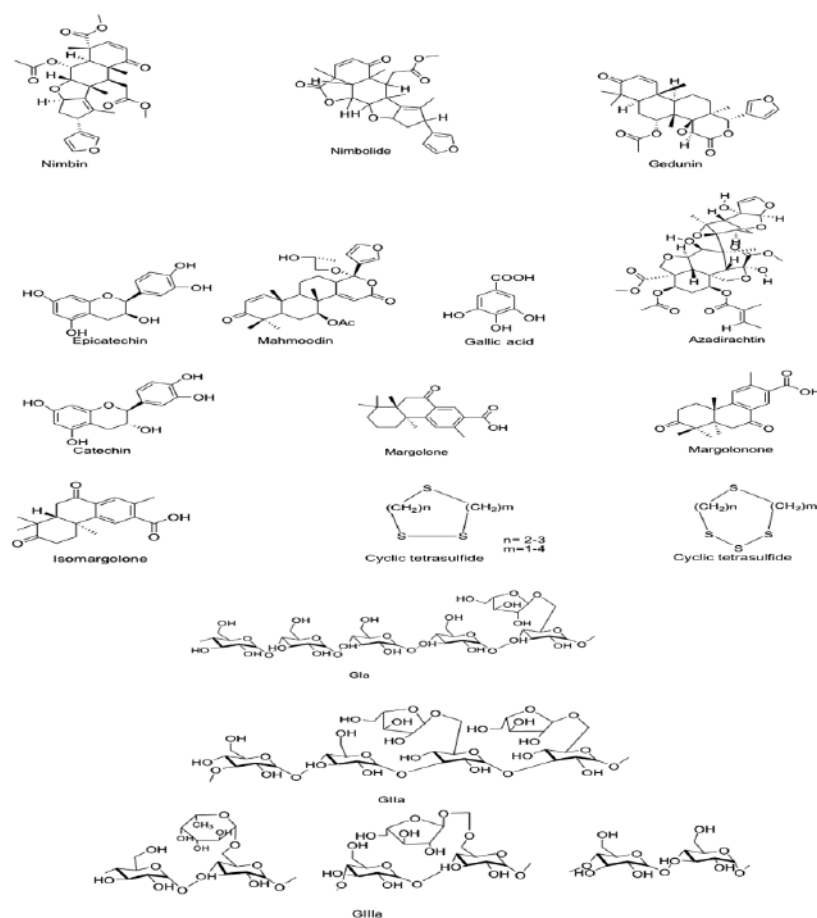
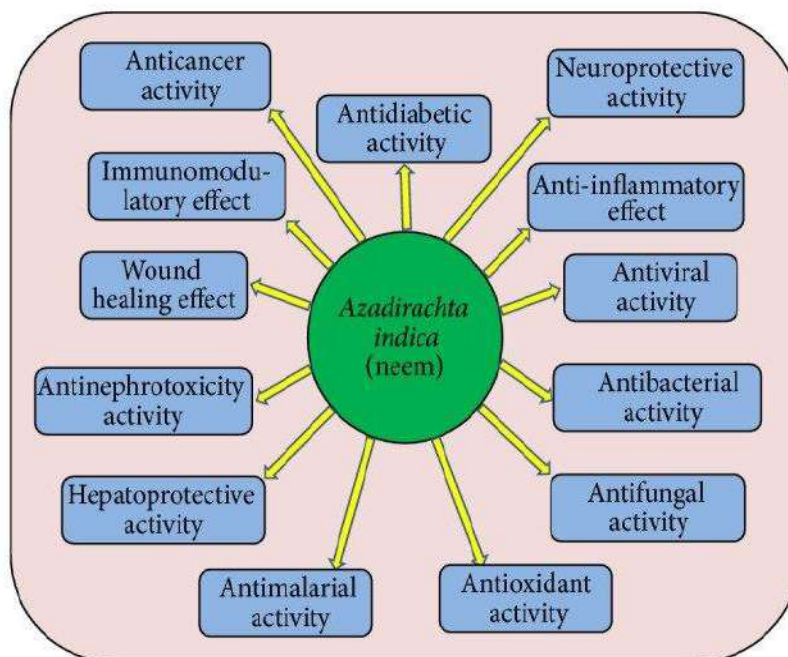


Fig No. 3 (Structure of Nimbin, Nimbolide, Gendunin, Gallic Acid, Azadirachtin, Catechin, Mahmoodin, Margolone, Margolonone, Isomargolone, Cyclic Tetrasulfide, Gla, Glla, Gllla.....)

USES OF NEEM:

Neem trees are good for nearly everything, and many of their medicinal and cosmetic uses stem from their antibacterial and antifungal properties. Neem is commonly found in soaps and lotions that treat skin conditions such as psoriasis, acne, and athlete's foot, as well as in dandruff shampoos. Young twigs are used as inexpensive toothbrushes in rural areas and are a common ingredient in mouthwashes and toothpastes, especially in the subcontinent like India (31). Neem leaves have long been used in conventional diabetic treatment, and some clinical studies suggest that neem may help control blood sugar levels. The oil extracted from the seeds serves as the foundation for a number of commercial pesticide products, such as

granules, concentrates, and dusts. It can also be applied directly as an insecticide, fungicide, and mite and insect repellent. The primary active component of pesticides, azadirachtin, inhibits eating and tampers with hormones associated with insect molting, preventing larvae from developing into adults as planned (32). By preventing mating and reproductive actions, neem oil lowers pest fecundity and can instantly kill soft-bodied insects. Applying neem oil as a fungicide helps control black spot, rust, anthracnose, scab, mildew, and blight. When if it is exposed to UV light, neem oil deteriorates quickly, necessitating repeated applications. Because neem-based insecticides are not harmful to animals, they are frequently utilized in organic farming applications (33).

BIOLOGICAL ACTIVITIES ON NEEM:**Fig.No. 4 (Biological Activity of Neem)****ANTI OXIDATIVE PROPERTY OF NEEM**

Neem has the power to regulate the compounds that are often produced by the body's hyperactivity and free radical activities. Free radicals are actually produced by the body on a regular basis(34). In hyperactive conditions, they can lead to cancer in addition to causing aging. These free radicals' hyperactivity is the cause of a number of illnesses, such as cardiovascular disease, eye health issues, cataract and macular degenerations, age-related neuronal degeneration, etc. Products containing neem improve antioxidant levels, protecting against chemically caused carcinogens and liver damage (35).

ANTI CANCER PROPERTY OF NEEM

Multifaceted diseases like cancer are a big global health concern. A molecular or genetic pathway modification may be crucial to the development of cancer (36). The allopathic approach, which is the foundation of the therapy module, is efficient yet has negative effects on normal cells. According to earlier research, plants and their constituents have the ability to modify apoptosis, cellular proliferation, tumor suppressor genes, and a

number of other biochemical pathways in order to restrict the growth of malignant cells (37). Carcinogenesis is a multifaceted, intricate process that starts with precancerous lesions and progresses through several stages to transform normal cells into cancer cells with enhanced invasive capability. Angiogenesis, or the cancer cells' resistance to apoptosis, is uncontrollable. Tumor cells exhibit unique behavior to adjust to their surroundings (38). Neem's ability to alter the tumor environment, including reducing angiogenesis and raising cell toxicity, plays a significant role in preventing cancer. Most research on the effectiveness of neem extracts against cancer employed various combinations of neem components (39).

ANTI INFLAMMATORY PROPERTY OF NEEM

Utilizing plants or their individual constituents as anti-inflammatory medications is a frequent practice. In the rats' cotton pellet granuloma assay, the results of this study have confirmed that the extract extracted from *Azadirachta indica* leaves at a dose had a significant anti-inflammatory effect at

200 mg/kg (40). Further research revealed that while The of neem leaves has a significant anti-inflammatory effect, it is not as effective as dexamethasone. Empirical results demonstrate that nimbidin suppresses neutrophil and macrophage functions related to inflammatory responses. Previous studies have shown that bark has an effect on the immune system and reduces inflammation. Leaf extracts have also been shown to have anti-inflammatory and antipyretic qualities in seeds for oil. An investigation was carried out on albino rats to evaluate the analgesic properties of neem seed oil and the results of The study found that at doses of 1 or 2 mL/kg, neem seed oil exhibited a significant analgesic impact and had dose-dependent analgesic action. An extra study was done to look at the anti-inflammatory effects of neem seed oil on albino rats' hind paw edema caused by carrageenan. The Neem seed oil demonstrated enhanced suppression of paw edema after the dosage amount is increase of 0.25 mL to 2 mL/kg of body weight, according to the results. 2 mL/ kg of body weight is the dosage (41). The greatest amount of edema inhibition (53.14%) occurred four hours after carrageenan injection. Azadirachta carbon tetrachloride extract at a dosage of 100 mg kg⁻¹ was administered to the treated rats, according to the study's findings. Accompanying the sole component azadiradione, the epidermis of an indica fruit demonstrated notable the anti-inflammatory and anti-nociceptive characteristics.

ANTI BACTERIAL PROPERTY OF NEEM

A comparative study was done to evaluate the antibacterial efficacy of herbal alternatives as endodontic irrigants. Zones of inhibition were seen in leaf extracts, suggesting that they had antibacterial properties, according to data obtained with sodium hypochlorite, a common irrigant. Moreover, the greater zones of inhibition for sodium hypochlorite exceeding 3% were clearly visible in leaf extracts. The antimicrobial

efficiency of neem extracts is against many strains of foodborne pathogens was investigated. The results of the study indicated that neem extracts contain certain compounds that give them antibacterial properties, which may help prevent foodborne infections and reduce the growth of spoiling organisms (42). A second study looked at the antibacterial effects of extracts from the leaves, bark, seeds, and fruit of *Azadirachta indica* (neem) on bacterial isolation from the adult mouth. The results showed that the antibacterial agent was effective against all test microorganisms used in the study when it came to extracts from leaves and bark. Additionally, fruit and seed extracts had antibacterial properties, with the exception of larger quantities of *Cladosporium*. Scientists have previously reported the antifungal qualities of water-based extracts from various neem components, including the primary constituents of neem oil. A study was conducted to investigate the antifungal characteristics. of *Azadirachta indica* vs *Alternaria solani* Sorauer The results confirmed that, with a minimum inhibitory concentration (MIC) of 0.19 mg, the portion containing ethyl acetate was the most effective at inhibiting the development of fungi. Furthermore, this part outperformed fungicide. Metalaxyl + Mancozeb together constitute the fungicide, and their MIC is 0.78 mg (43).

ANTI VIRAL PROPERTY OF NEEM

The study detected the antiviral and virucidal efficacy of neem leaf methanolic extract fraction, as well as its potential mechanism of action against the Coxsackie B group of viruses. NCL-11 repressed plaque development in six Coxasakei virus B antigenic types at a concentration of 1000 µg/mL in vitro for 96 hours (44). Furthermore, yield and viral inactivation decrease and the impact of the assay's addition time revealed that NCL-11 was most effective virucidal agent against Coxasakei Virus B in addition to interfering early on in its replication cycle. The data indicated that



the presence of many compounds other than triterpenoids, flavonoids, and their NCL-11 glycosides exhibit antiviral properties against the Coxsakei B group of virus with in vitro (45).

HEPATOPROTECTIVE EFFECT OF NEEM

Neem trees and their active ingredients are essential for their hepatoprotective properties without causing any negative side effects. A significant investigation was carried out to look at the Azadirachtin's hepatoprotective properties. A carbon The rate of hepatotoxicity was produced by tetrachloride. Histopathology The ultrastructure investigation included the pretreatment using azadirachtin: A hepatocellular damage that was dosage dependent necrosis, protecting the liver from toxicity as a result. brought on by CCl₄. Additionally, the findings of this investigation demonstrate that using azadirachtin-A at a greater dose as a pretreatment levels returns the rat liver to normal in a modest way. Neem trees and their active ingredients are essential for their hepatoprotective properties without causing any negative side effects. A significant investigation was carried out to look at the Azadirachtin's hepatoprotective properties. A carbon The rate of hepatotoxicity was produced by tetrachloride. Histopathology The ultrastructure investigation included the pretreatment using Azadirachtin (46). A hepatocellular damage that was dosage dependent necrosis, protecting the liver from toxicity as a result. brought on by CCl₄. Additionally, the findings of this investigation demonstrate that using azadirachtin-A at a greater dose as a pretreatment levels returns the rat liver to normal in a modest way. Another significant investigation into the potential acute toxicity of neem's active ingredients, such as nimbolide, and its potential protective benefits against Rats exposed to carbon tetrachloride (CCl₄) developed liver damage. Their study's findings indicate that nimbolide has Hepatoprotective action against liver damage caused by CCl₄ in rats that perform

as well as the Silymarin standard. Another investigation into neem trees shows that It was discovered that A. indica leaf extract in water offered protection. against rats' liver necrosis brought on by paracetamol (47). Neem trees and their active ingredients are essential for their hepatoprotective properties without causing any negative side effects. A significant investigation was carried out to look at the Azadirachtin's hepatoprotective properties. A carbon The rate of hepatotoxicity was produced by tetrachloride. Histopathology The ultrastructure investigation included the pretreatment using azadirachtin. A hepatocellular damage that was dosage dependent necrosis, protecting the liver from toxicity as a result. brought on by CCl₄. Additionally, the findings of this investigation demonstrate that using azadirachtin-A at a greater dose as a pretreatment levels returns the rat liver to normal in a modest way. Another significant investigation into the potential acute toxicity of neem's active ingredients, such as nimbolide, and its potential protective benefits against Rats exposed to carbon tetrachloride (CCl₄) developed liver damage. The hepatoprotective effect of A. indica leaf extract on antitubercular drug-induced hepatotoxicity in albino rats was evaluated in a study. The study's findings verified that Aqueous leaf extract greatly inhibited alterations in the serum concentrations of protein, alanine aminotransferase, bilirubin, and Alkaline phosphatase and aspartate aminotransferase. In a similar vein, strongly inhibited the histological alterations as in contrast to the group on antitubercular medication. It greatly reverted the histological and biochemical alterations. Neem trees and their active ingredients are essential for their hepatoprotective properties without causing any negative side effects. A significant investigation was carried out to look at the Azadirachtin's hepatoprotective properties. A carbon The rate of hepatotoxicity was produced by tetrachloride. Histopathology The ultrastructure



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ANTI DIABETIC PROPERTY OF NEEM

Neem trees and their active ingredients are essential for their hepatoprotective properties without causing any negative side effects. A significant investigation was carried out to look at the Azadirachtin's hepatoprotective properties (51). A carbon The rate of hepatotoxicity was produced by tetrachloride. Histopathology The ultrastructure investigation included the pretreatment using azadirachtin: A hepatocellular damage that was dosage dependent necrosis, protecting the liver from toxicity as a result. brought on by CCl₄. Additionally, the findings of this investigation demonstrate that using azadirachtin-A at a greater dose as a pretreatment

levels returns the rat liver to normal in a modest way. Another significant investigation into the potential acute toxicity of neem's active ingredients, such as nimbolide, and its potential protective benefits against Rats exposed to carbon tetrachloride (CCl₄) developed liver damage (53). The 70% alcoholic neem root bark extract (NRE) in diabetes was the subject of a study, and the findings indicated that the statistically significant noteworthy outcomes at a dosage of 800 mg/kg. One more trial was carried out to analyze the hypoglycemic medication. effects of *Azadirachta indica* in rats with diabetes. The outcomes have demonstrated that in a test of glucose tolerance with neem extract 250 mg/kg showed that glucose levels were considerably decreased in comparison to *Azadirachta* and the control group On the fifteenth day, *indica* dramatically lowered glucose levels in rats with diabetes.

ANTI MALARIAL PROPERTY OF NEEM

Neem has demonstrated strong anti-malarial properties. The chemical components found in the plant are principally responsible for this activity; multiple studies have shown these compounds to be efficient against malaria parasites (54). Several bioactive substances can be found in neem, including:

Azadirachtin:

Found to possess potent anti-malarial effects, azadirachtin is one of the most researched substances. It functions by obstructing the malaria parasites' ability to grow inside the mosquito vector and may possibly directly impact the parasites.

Nimbin:

This intriguing substance also has the ability to lessen the parasitic load in models used in experiments.

Nimbidin:

It has been suggested that this substance possesses several pharmacological properties, including anti-malarial properties (55).



Inhibition of Parasite Growth: It has been demonstrated that compounds in neem prevent *Plasmodium falciparum*, the parasite that causes the most severe type of malaria, from growing and replicating.

Mosquito Larvicidal Activity:

By impacting the larvae of malaria-carrying mosquitoes, neem extracts can also interfere with the life cycle of these insects, limiting the spread of the illness (56).

IMMUNOMODULATING EFFECT ON NEEM

Particularly in South Asia, neem (*Azadirachta indica*) is a plant that is frequently utilized in traditional medicine. Numerous chemicals in it have the potential to improve health, some of which have immunomodulatory properties. The ability of a drug to alter or control the immune system's reaction is known as immunomodulation. The numerous bioactive substances found in neem, such as the following, are responsible for its immunomodulatory effects:

Azadirachtin:

Although this molecule is mainly recognized for its insecticidal qualities, it may also have impacts on the immune system, including the ability to modify immunological responses and influence the generation of cytokines (57).

Nimbin:

Nimbin has demonstrated the ability to alter immunological responses, potentially influencing the generation of cytokines and lymphocytes.

Nimbidin:

It has been discovered that this substance possesses anti-inflammatory qualities, which may have an indirect impact on immunological responses.

ANTI FUNGAL ACTIVITY OF NEEM

Both neem leaves and seed kernels have been employed as antifungal agents. Extract from neem seed kernels significantly ($P < 0.05$) lowers post-harvest illnesses, pathogens of *Penicillium*

expansum, *Monilinia fructicola*, *Trichothecium roseum*, and *Invitro*, *alternaria alternate*.^{22, 23} neem leaves with water, concentrations of ethanol and ethyl acetate (5, 10, 15, and 20%) of these extracts prevented human infections (58). (*Fugigatus Aspergillus*, *Aspergillus flavus*, *Aspergillus niger*, *Candida albicans*, *Aspergillus terreus*, and *Microsporum gypsum*. HPLC and NMR studies revealed that the 20% ethyl acetate was the strongest extract compared to the other extracts. ethylene The active ingredients in acetate are nimonol.

ANTI FERTILITY ACTIVITY

An effective spermicidal that considerably inhibits spermatogenesis is neem seed oil. It stops fertility, motility and the counting of the sperm. Additionally, neem possesses abortifacient and anti-implantation effects. After being exposed to 1 mL of NSO intravaginally, it was found that the spermatozoa of Rhesus monkeys and humans were immortal and would expire in 30 minutes. No adverse effects were seen during the vaginal biopsy, and radioisotope investigations show that the vagina is not absorbed and is not anti-ovulatory (59). The sensual use of neem oil in India was made possible by these discoveries.

CONCLUSION:

Azadirachta indica (neem) is a plant that has great potential for use in therapeutic treatments because of its wide range of bioactive phytoconstituents. This review highlights neem's diverse potential in treating a range of illnesses, from microbial infections to long-term ailments including cancer and diabetes. Neem's diverse range of therapeutic applications is evidenced by its extensive pharmacological profile, which includes anti-inflammatory, antioxidant, antibacterial, and immunomodulatory characteristics. Many preclinical and clinical studies have shown the great efficacy of neem's active components, such as nimbin and azadirachtin, suggesting that these compounds have promise for use in both



therapeutic and preventive applications. Even so, more investigation is necessary to completely understand the processes underlying neem's therapeutic effects as well as to resolve any safety or efficacy issues. Subsequent research endeavors ought to concentrate on refining formulations derived from neem, investigating the potential for synergy with traditional treatments, and executing extensive clinical trials to authenticate its efficaciousness among heterogeneous populations. As our knowledge of the pharmacodynamics and pharmacokinetics of neem grows, there may be a chance to incorporate this age-old cure into contemporary therapeutic paradigms, maybe providing a more affordable and long-lasting option than traditional therapies.

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