

PHARMACOLOGICAL POTENTIAL, MEDICINAL USES, AND BIOACTIVE PROPERTIES OF AZADIRACHTA INDICA (NEEM): A SYSTEMATIC REVIEW

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ABSTRACT:

Scientific name of neem is AZADIRACHTA INDICA. ARISHTHA is the sanskrit name of neem tree that means helper for sickness. Neem also has various medicinal property and has been used in worldwide in recent years. It is also used in ayurveda medicine, homoeopathic and Unani medicine and also become the centre of attention of in modern medicine. It also elaborates a wide variety of biologically active compound that are chemically different and structurally elaborated. In neem tree all parts like leaves, flower, fruits, seeds, root and bark are used for the treatment of skin diseases, infection, dental disorder, inflammation, etc.

Neem leaf extract is also known as IRAB has been used against malaria, HIV- AIDS and cancer. Its element has been indicated to exhibit anti-inflammatory, anti-hyperglycaemic, antioxidant, antidiabetic immune modulatory, antiviral, antimutagenic and anticarcinogenic properties. Neem also consists of compounds like flavonoids, glycosides, tannins and aliphatic compounds. It also useful for heart illnesses, hepatitis, psoriasis, ulcers, etc.

Neem are used in various research fields of food safety, virology, mycology, bacteriology, etc. The biological, pharmacological and toxicological properties of neem can be analyses by modern techniques like NMR spectroscopy, infra-red spectroscopy, HPLC-MS, etc.

Keywords: AZADIRACHTA INDICA, medicinal properties, biological activity, neem, pharmacological properties

INTRODUCTION:

Neem is also known as AZADIRACHTA INDICA (AZADI in Persian means free and DIRACHTA means tree) which means "the free tree of India". It is also referred as "WONDER TREE" or "NATURE'S PHARMACY" and in Indian subcontinent it is used as a medicinal plant. It is used in ayurveda, homoeopathic and Unani medicine due to its therapeutic properties

For curing various disorder or diseases more than 80% of population believed in development of medicinal plants. India has been ranked second in worldwide for export medicinal plants.

Neem is one of medicinal plants in India and has medicinal properties in every part of the plant like roots, leaves, seeds, flowers, bark, fruit, etc. Each part of the plant has been used for the medicine and which become the centre of attention in modern medicine. Neem is well-known for its antibacterial, antiviral, anti-inflammatory, antifungal, antioxidant, etc properties and make it effective natural remedy for several disorders. It is used for treatment of dental health, immune system, cough, fever, worm infection, skin allergy, vomiting, diabetes, eye disorder, etc. Neem also plays an important role in pest control, agriculture, cosmetic industries due to its non-toxic nature and eco-friendly nature. Neem trees are used for the medicinal uses, biological activities and pharmacological activity.

Its scientific classification are as follows:

Order :	Sapindales
Kingdom :	Plantae
Family :	Meliaceae
Subfamily :	Meliodeae
Species :	A.indica
Genus :	Azadirachta
Clade :	Angiosperms
Tribe :	Melieae

From different part of the neem plant more than 140-150 compound has been isolated. This compound has divided into two major classes:

Isoprenoid like triterpenoids and diterpenoids contains azadirone, protomeliacins, limonoids and its derivatives, vilasinin type of compound, etc. Non-isoprenoids like carbohydrates, proteins, dihydrochalcone, aliphatic compounds, etc.



CHEMISTRY OF COMPOUNDS IN NEEM:

Azadirachta indica (neem) contains a bioactive compound that contribute its medicinal properties. Natural compounds that are present in neem are limonodis, flavonoids, tannins, steroids and glycosides. The most known neem compounds are nimbin, nimbidin, azadirachtin, gedunin and nimbolide.

Limonodis:(Tetranortriterpenoids)

This are the most active component of neem, which are useful for its antifungal, insecticidal and antibacterial properties.

This limonoids include:

- Azadirachtin – In neem it is most powerful bioactive compound which is known for its insect-repellent and growth-inhibitory effect on pest.
- Nimbin – It shows antifungal, antibacterial and anti-inflammatory properties.
- Nimbidin – It also known for its hypolipidemic, antifungal and anti-ulcer effects.
- Nimbolide – It also carries antimalarial, antioxidant and anticancer properties.

Flavonoids:

In neem both leaves and bark contain flavonoid such as kaempferol and quercetin, which also provide strong antimicrobial, antioxidant and anti-inflammatory.

Tannins:

Tannins are present in both bark and leaves in neem, which provide its antimicrobial and astringent effects, which make it useful for skin care and oral applications.

Steroids and Glycosides:

Steroid and glycosides both are present in seeds and barks in neem, which plays an important role in neem immune-boosting and inflammatory properties.

All parts in neem (*AZADIRACHTA INDICA*) like bark, flowers, seeds, toddy and neem oil in contains some natural compounds.

Bark:

Bark discharge yellowish-brown coloured gum that is collected in very small fragments. It is sour alkaloid name “margosine”. Leaves are also sour but in very small quantity that is more soluble in water. Seeds also contains 10%-30% of yellow sour oil with a strong unpleasant acrid taste. Fatty acid that are present in the bark contain stearic and oleic acids in small amount of lauric acid.

Flowers:

Flowers contain flavonoid and nimbicetin that is similar to kaempferol. Dried bark has been same sour components as present in the seed oil and a sour principle bakayanin was found.

Toddy:

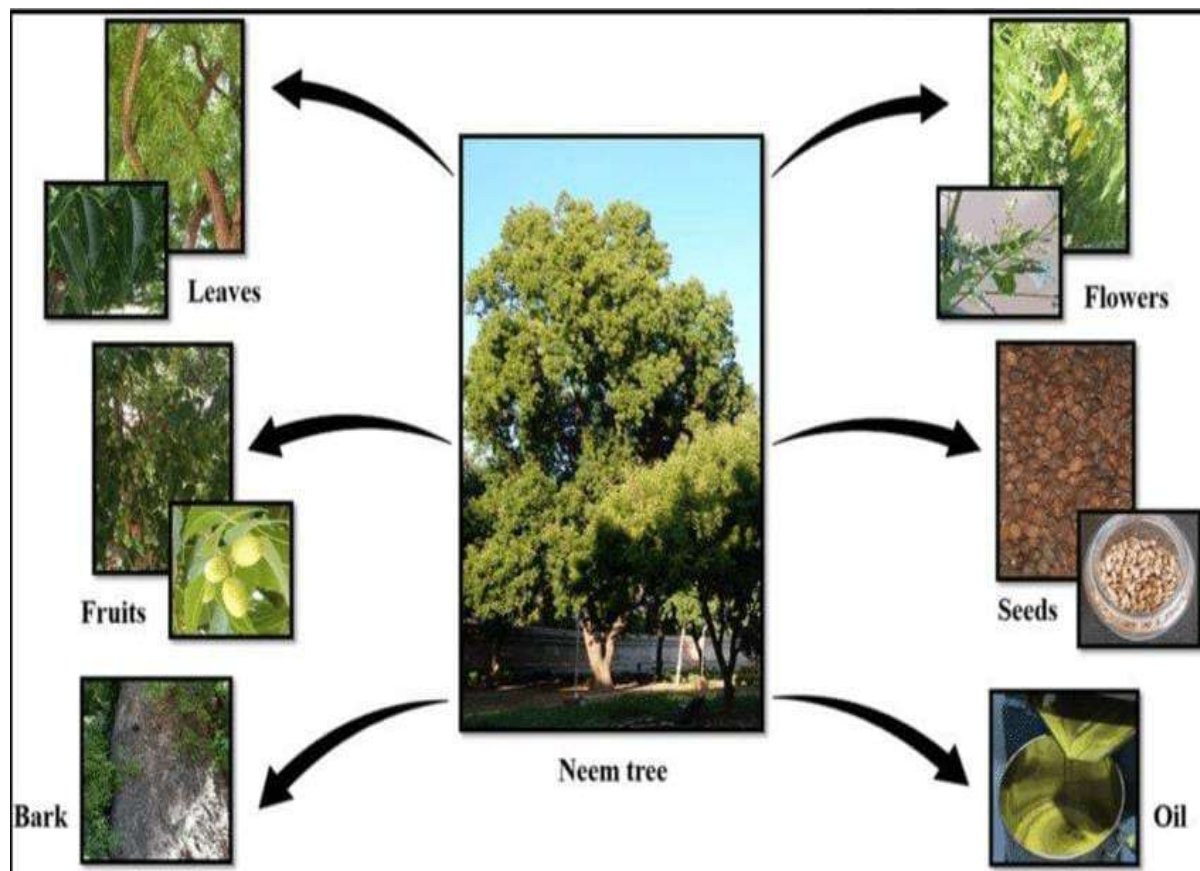
Toddy or sap mainly consist of sucrose, gums, glucose and colouring matter.

Seed:

Seeds consist of meliacins which include 7-desacetylgedunin, azedarachtin, gedunin and desacetylnimbin. Seed oils mainly consist of nimbin, nimbinin and nimbibin which also present in stembark.

Neem oil:

It consists of sulphur 0.427% and a yellowish substance which is very bitter that obtain from alcoholic extraction of oil, that should be alkaloid, glucosides, fatty acid and resins.



MEDICINAL USES OF NEEM:

Azadirachta indica (neem) have been used form ages due to its medicinal and therapeutic properties. Each and every part of neem (leaves, bark, seeds, oil and flowers) have bioactive compounds that have important health benefits. Neem has important place in medicine like ayurveda, homeopathy and Unani and it is used for healing, detoxifying and antimicrobial properties.

MEDICINAL USES IN AYURVEDA:

In ayurveda neem is consider to be holy pant and it is referred as “Sarva Roga Nivarini”, which means “the curer of all diseases”. It is classified as light (*laghu*) and dry (*ruksha*) in quality, cooling (*sheeta*) in nature and astringent (*Kashaya*) and bitter (*tikta*) in taste. It also helps to balance kapha and pitta dosha and it is used to purify the blood and detoxify the body.

USES:

- Skin disorders like eczema, boils, acne, psoriasis and other skin conditions according to its anti-inflammatory and antimicrobial effects.
- Fever and infections like it used to treat viral infections, malaria and general fever by fighting pathogens and reducing inflammations.

- Digestive health like to treat worm infections, constipation and ulcers. Also stimulate digestion and to improve metabolism.
- Neem is also used for oral care like to prevent from dental issues and used for brushing teeth (datum)
- Neem is also helpful in maintaining diabetes which help to keep low blood sugar levels and also to maintain type 2 diabetes.

MEDICINAL USES IN HOMEOPATHY:

Neem is used in form of tablets, tinctures and dilutions. Here the principle applied is “like cures like”, where the neem is used as a dose to stimulate body nature and healing mechanism

USES:

- Liver and metabolic disorder like neem is used for inactive liver function, metabolic imbalances and jaundice.
- Detoxification like neem is used for detoxifier of lymphatic system and blood and also help to remove toxins form body.
- Neem is also used for skin disorders like treating for ulcers, eczema, boils and rashes.
- Neem is also used to increase immunity and to improve body resistance to infections.
- Neem is also used for joint and muscular pains like general body pain, arthritis and joint inflammation.

MEDICINAL USES IN UNANI:

According to Unani system neem is known as “Shajar-e-Mubarak” which means blessed tree. It is accepted for dry and cold temperament. It is used for humors balance, dam (blood) and safra (yellow bile).

USES:

- Neem is used for blood purification which help to clean the blood and to treat for conditions like acne, boils and skin eruptions.
- Used in treatment of fevers like malaria and typhoid due to its detoxifying and cooling properties.
- Neem is also used for treatment of skin diseases and hair treatment like fungal infections, eczema and dandruff due to its antiseptic and antifungal properties.
- Neem is also helpful for treating digestive disorders like gastrointestinal inflammation, worms and ulcers.
- Neem oil is also used for antifertility effects in Unani for reproductive health practices.
- It is also used for treatment of ulcers, inflammatory conditions and wounds.

BIOLOGICAL ACTIVITY OF NEEM:

Neem (*Azadirachta indica*) shows the wide range of biological activities due to its composition of bioactive elements like nimbin, nimbidin, azadirachtin, gedunin and nimbolide. This element shows therapeutic effects on multiple systems in body.

Immunostimulant Activity:

Neem helps to increase body immune response by increasing macrophage, balancing cytokine production and restoring lymphocyte proliferation. It also boosts both hormonal immunity and cell-mediated by making it effective against immune-related disorders and infections.

Hypoglycaemic activity:

Neem leaf extraction shows result in reducing blood sugar level. Ethanolic extraction from neem bark and leaves shows fast reduction of blood glucose level by increasing impaired insulin sensitivity and enhancing glucose uptake in tissues.

Anti-ulcer effect:

Neem leaf and bark extraction shows gastroprotective properties and also produce antacid secretory and antiulcer activity. They help to increase mucus production, reduce gastric acid secretion and help to heal ulcers by protecting gastric lining from inflammatory and gastric damage. Anti-ulcer effect is notice in nimbidin by preventing indomethacin, acetylsalicylic acid, etc by induced gastric lesions as well as histamine or cysteamine induced duodenal ulcers.

Anti-fertility effect:

Neem leaf and seed extraction shows chemical components which act as an anti-fertility sources. Neem oil shows spermicidal activity and for its contraceptive effects. It mediates with gamete functions and implantation and making it potential for natural contraceptive for both females and males. The liquid extraction from leaves and seed contains sodium nimbinate (triterpene) which shows anti-fertility activity. The intra-vaginal application of neem oil, can prevent pregnancy and this treatment is safe.

Anti-malarial activity:

Neem leaf and seeds extraction are helpful in both chloroquin-resistant and strain malarial parasites. Compounds like gedunin (limonoid) and nimbolide shows antimalarial properties by prohibit the growth of Plasmodium falciparum. Neem is used for the treatment of malaria fever and related symptoms. Neem oil also treated for mosquito nets and mosquito-repellent tablets are becoming popular.

Anti-fungal activity:

Neem extracts which show antifungal activity opposed to pathogenic fungi such as Aspergillus species and candida albicans. There are some fungi where neem is being effective like athlete's foot, hair, skin, and nails. Neem is also effective in a ringworm that occupy in both nails and skin of the feet and also effective in fungus development in bronchi, intestinal tract, lungs, vagina, etc. Gedunin and nimbidin disrupt fungal cells membranes and inhibit spore germination.

Anti-bacterial activity:

Neem reveals strong antibacterial properties due to presence in bioactive compounds like nimbolide, azadirachtin, quercetin, nimbidin and nimbin. This are effective in wide range of gram-negative and gram-positive bacteria.

Anti-viral activity:

Neem leaf extraction gives antiviral activity against chikungunya, vaccinia virus and measles virus. Neem prevents the replication of viruses like hepatitis B virus, HIV and herpes simplex virus. Antiviral activity is assigned by its ability to prevent replication, viral entry and protein synthesis in host cells. Both nimbin and nimbidin has found in antiviral activity, they also affect potato virus X, vaccinia virus and fowl pox virus.

Anti-cancer activity:

Neem compounds such as nimbin, quercetin and nimbolide shows cytotoxic effects on cancer cells. Neem leaf extract repressed oral squamous cell carcinoma induced by DMBA. They also induced apoptosis (programmed cell death), slow down tumor growth and stop metastasis in various cancers like prostate, breast and colon. It is discovered that alkaloid-derived limonoid, azadiramide-A, is found in neem leaf which stop the cell growth and induced apoptosis in estrogen independent and estrogen dependent cells in breast cancer in human beings.

Antioxidant activity:

Neem is rich in flavonoids and polyphenols, which reduce oxidative stress and neutralize free radicals. The seed extraction in neem have been display in vivo during horse grain germination with low level of lipoxygenase activity and lipid peroxides. The antioxidant property plays role in protecting against chronic diseases like cardiovascular disorders and cancers.

Anti-diabetic effect:

In recent studies diabetes has become a major chronic progressive disease. The neem extract has equable grown interest in various methods and pharmaco therapies. It is a hypoglycemic activity, where help to improve pancreatic beta-cell function, insulin secretion and also reduces oxidative damage to pancreatic tissue by supporting it for long-term diabetes management.

Effect on central nervous system (CNS):

Neem leaf extraction shows fractions of acetone which is significant to CNS depressant activity and dose up to 200 mg/kg of the body weight produce anxiolytic activity in rats. The extraction form root bark and stem bark show spasmolytic, diuretic and hypotensive activities. Neem also has neuroprotective effects and have potential in reducing seizure activity, anxiety and depression. It also regulates neurotransmitter levels and by protecting neurons from oxidative damage.

Other biological activity:

In neem the gum from bark is demulcent and stimulant tonic. It influences immenagogue, antispasmodic and anti-leprosy. There are many biological activities like cardioprotective (which helps in lowering blood pressure and cholesterol), wound healing (which speed up healing due to tissue-repair and antimicrobial properties), hepat-protective (which supports liver functions and protects liver from toxins), anti-bacterial and anti-inflammatory

CONCLUSION:

Neem is one of the greatest harmless biological sources for creating modern medications. As result a wide range of neem extracts have advantages that go beyond traditional medicinal folklore. We can now use neem extract as modern medical adjuvants on humans, animals and plants by knowing there of scientific and technical advancements. The significance of “kalpavirksha” is potential for both therapeutic and economic use in support of sustainable development can be investigated.

The therapeutic uses make it an essential part of ayurvedic, Unani and homeopathic medicine. Each system employs neem in a different way, they all acknowledge and its benefits as natural immune-stimulating, detoxifying, anti-inflammatory and antiseptic. In traditional healing systems, it is highly valued for its capacity to treat a wide range of illnesses. Neem continues to be a vital component of holistic and natural medicine and contemporary studies support this ancient use. With wide range of biological activities, neem is powerful medicinal plant that are used to prevent and treat a wide range of illnesses. It is promising optional for both conventional and contemporary therapeutic applications due to its multi-targeted actions and natural nature.

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