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A REVIEW ON PHARMACOLOGICAL IMPORTANCE OF AZADIRACHTA INDICA

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ABSTRACT

Azadirachta indica, commonly known as neem, has attracted worldwide prominence in recent years, owing to its wide range of medicinal properties.[1] Neem has been extensively used in Ayurveda, Unani and Homoeopathic medicine and has become a cynosure of modern medicine. Neem elaborates a vast array of biologically active compounds that are chemically diverse and structurally complex. More than 140 compounds have been isolated from different parts of neem.[2] Neem possesses anti-diabetic, anti-oxidant, anti-viral, anti-inflammatory properties. Various effects like antibacterial, anti-fungal, anthelmintic, anti- parasitic, anticancer, anti HIV, antibone resorption, antispasmodic, antipyretic, antidiarrheal, immunomodulation, hypolipidemic, anti-microbial, hepatoprotective, gastro protective have also been studied.[3]

KEYWORDS: Azadirachta indica, Medicinal Use, Pharmacology.

1. INTRODUCTION

Neem is a natural herb that comes from the neem tree, other names for which include Azadirachta indica and Indian lilac. The extract comes from the seeds of the tree and has many different traditional uses.[4] Neem is known for its pesticidal and insecticidal properties, but people also use it in hair and dental products. All parts of the neem tree- leaves, flowers, seeds, fruits, roots and bark have been used traditionally for the treatment of inflammation, infections, fever, skin diseases and dental disorders.[5] The medicinal utilities have been described especially for neem leaf. Neem leaf and its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, antihyperglycaemic, antiulcer, antimalarial,

antifungal, antibacterial, antiviral, antioxidant, antimutagenic and anticarcinogenic properties.[6] This review summarises the wide range of pharmacological activities of neem leaf.

Fig.: Neem Leaves.

2. Synonyms

Azadirachta indica var. minor Valeton Azadirachta indica var. siamensis Valeton Azadirachta indica subsp. vartakii Kothari, Melia azadirachta L. Melia indica, Brandis

3. Taxonomical Classification

Kingdom: Plantae Subkingdom: Tracheobionta Division: Magnoliophyta Class: Eudicot Subclass: Rosidae Order: Sapindales Family: Meliaceae Genus: Azadirachta Species: A. indica.

4. Plant description

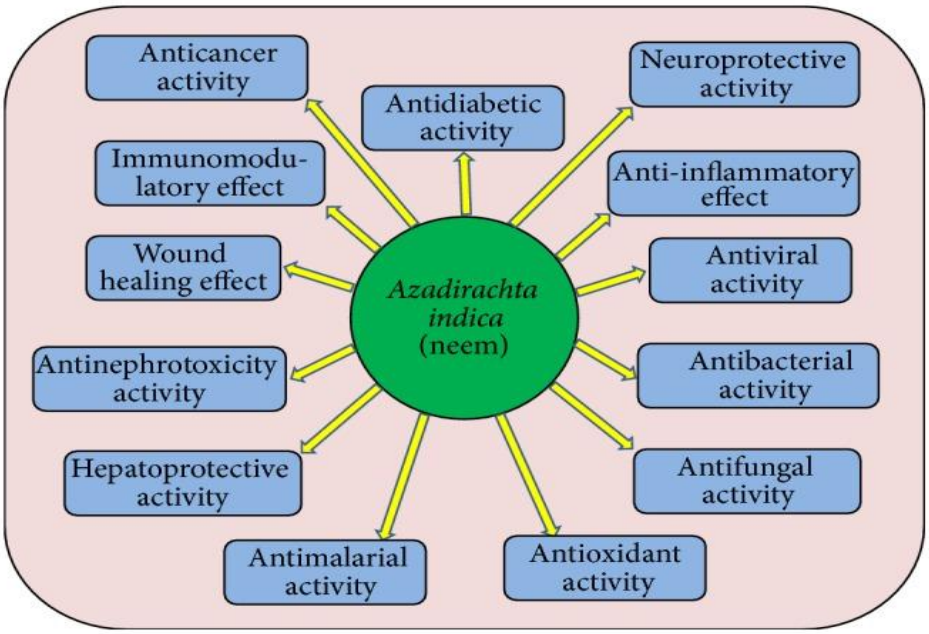
Neem is a fast-growing tree that can reach a height of 15–20 metres (49–66 ft), and rarely 35–40 metres (115–131 ft). It is evergreen, but in severe drought it may shed most or nearly all of its leaves.[7] The branches are wide and spreading. The fairly dense crown is roundish and may reach a diameter of 20–25 metres (66–82 ft). The neem tree is very similar in appearance to its relative, the Chinaberry (Melia azedarach).

5. Neem compound, Source & Biological Activity

Various parts of the neem tree have been used as traditional Ayurvedic medicine in India. Neem oil and the bark and leaf extracts have been therapeutically used as folk medicine to control leprosy, intestinal helminthiasis, respiratory disorders, constipation and also as a

general health promoter. Its use for the treatment of rheumatism, chronic syphilitic sores and indolent ulcer has also been evident.[8] Neem oil finds use to control various skin infections. Bark, leaf, root, flower and fruit together cure blood morbidity, biliary afflictions, itching, skin ulcers, burning sensations and pthysis.[9]

6. Pharmacological Effect



6.1. Antioxidant Activity

Free radical or reactive oxygen species are one of the main culprits in the genesis of various diseases. However, neutralization of free radical activity is one of the important steps in the diseases prevention.[10] Antioxidants stabilize/deactivate free radicals, often before they attack targets in biological cells and also play role in the activation of antioxidative enzyme that plays role in the control of damage caused by free radicals/reactive oxygen species. Medicinal plants have been reported to have antioxidant activity. Plants fruits, seeds, oil, leaves, bark, and roots show an important role in diseases prevention due to the rich source of antioxidant.[11]

6.2. Anticancerous Activity

Cancer is multifactorial disease and major health problem worldwide. The alteration of molecular/genetic pathways plays role in the development and progression of cancer.[12] The treatment module based on allopathic is effective on one side but also shows adverse effect on the normal cell. Earlier studies reported that plants and their constituents show inhibitory

effects on the growth of malignant cells via modulation of cellular proliferation, apoptosis, tumour suppressor gene, and various other molecular pathways. Neem contains flavanoids and various other ingredients that play an important role in inhibition of cancer development.[13] Large number of epidemiological studies proposes that high flavonoid intake may be correlated with a decreased risk of cancer.

6.3. Effect of Neem as Anti-Inflammatory

Plants or their isolated derivatives are in the practice to treat/act as anti-inflammatory agents. A study result has confirmed that extract of A.[14] indica leaves at a dose of 200 mg/kg, p.o., showed significant anti-inflammatory activity in cotton pellet granuloma assay in rats. Other study results revealed that neem leaf extract showed significant anti-inflammatory effect but it is less efficacious than that of dexamethasone] and study results suggest that nimbidin suppresses the functions of macrophages and neutrophils relevant to inflammation.

6.4. Hepatoprotective Effect

Medicinal plants and their ingredients play a pivotal role as hepatoprotective without any adverse complications.[15] A study was performed to investigate the hepatoprotective role of azadirachtin-A in carbon tetrachloride (CCl4) induced hepatotoxicity in rats and histology and ultrastructure results confirmed that pretreatment with azadirachtin-A dose-dependently reduced hepatocellular necrosis . Furthermore results of the study show that pretreatment with azadirachtin-A at the higher dose levels moderately restores the rat liver to normal.

6.5. Wound Healing Effect

Numerous plants/their constituents play an important role in the wound healing effect. A study was made to evaluate the wound healing activity of the extracts of leaves of A. indica and T. cordifolia using excision and incision wound models in Sprague Dawley rats and results revealed that extract of both plants significantly promoted the wound healing activity in both excision and incision wound models[16] Furthermore, in incision wound, tensile strength of the healing tissue of both plants treated groups was found to be significantly higher as compared to the control group.[17] Other results showed that leave extracts of Azadirachta indica promote wound healing activity through increased inflammatory response and neovascularization.[18]

6.6. Antidiabetic Activity

A study was undertaken to evaluate the 70% alcoholic neem root bark extract (NRE) in diabetes and results showed that neem root bark extract showed statistically significant results in 800 mg/kg dose.[19] Another experiment was performed to examine the pharmacological hypoglycemic action of Azadirachta indica in diabetic rats and results showed that in a glucose tolerance test with neem extract 250 mg/kg demonstrated glucose levels were significantly less as compared to the control group and Azadirachta indica significantly reduce glucose levels at 15th day in diabetic rats.

6.7. Antimicrobial Effect

Neem and its ingredients play role in the inhibition of growth of numerous microbes such as viruses, bacteria, and pathogenic fungi. (20) The role of neem in the prevention of microbial growth is described individually as follows.

6.8. Antibacterial Activity

A study was performed to evaluate antimicrobial efficacy of herbal alternatives as endodontic irrigants and compared with the standard irrigant sodium hypochlorite and finding confirmed that leaf extracts and grape seed extracts showed zones of inhibition suggesting that they had antimicrobial properties.[21] Furthermore, leaf extracts showed significantly greater zones of inhibition than 3% sodium hypochlorite.

6.9. Antiviral Activity

Results showed that neem bark (NBE) extract significantly blocked HSV-1 entry into cells at concentrations ranging from 50 to 100 µg/mL.[22] Furthermore, blocking activity of NBE was noticed when the extract was preincubated with the virus but not with the target cells suggesting a direct anti-HSV-1 property of the neem bark.[23]

Leaves extract of neem (Azadirachta indica A. Juss.) (NCL-11) has shown virucidal activity against coxsackievirus virus B-4 as suggested via virus inactivation and yield reduction assay besides interfering at an early event of its replication cycle.[24]

6.10. Antifungal Activity

Experiment was made to evaluate the efficacy of various extracts of neem leaf on seed borne fungi Aspergillus and Rhizopus and results confirmed that growth of both the fungal species was significantly inhibited and controlled with both alcoholic and water extract. Furthermore,

alcoholic extract of neem leaf was most effective as compared to aqueous extract for retarding the growth of both fungal species.[25] Another finding showed the antimicrobial role of aqueous extracts of neem cake in the inhibition of spore germination against three sporulating fungi such as C. lunata, H. pennisetti, and C. gloeosporioides f. sp. Mangiferae[26] and results of the study revealed that methanol and ethanol extract of Azadirachta indica showed growth inhibition against Aspergillus flavus, Alternaria solani, and Cladosporium.[27]

6.11. Antiviral Activity

Results showed that neem bark (NBE) extract significantly blocked HSV-1 entry into cells at concentrations ranging from 50 to 100 μg/mL.[28] Furthermore, blocking activity of NBE was noticed when the extract was preincubated with the virus but not with the target cells suggesting a direct anti-HSV-1 property of the neem bark.[29]

6.12. Antimalarial Activity

Experiment was made to evaluate the antimalarial activity of extracts using Plasmodium berghei infected albino mice and results revealed that neem leaf and stem bark extracts reduced the level of parasitemia in infected mice by about 51–80% and 56–87%, respectively,[30] and other studies showed that azadirachtin and other limonoids available in neem extracts are active on malaria vectors.[31]

6.13. Antinephrotoxicity Effect

An experiment was made to investigate the effects of methanolic leaves extract of Azadirachta indica (MLEN) on cisplatin- (CP-) induced nephrotoxicity and oxidative stress in rats and results confirmed that extract effectively rescues the kidney from CP-mediated oxidative damage.[33] Furthermore, PCR results for caspase-3 and caspase-9 and Bax genes showed downregulation in MLEN treated groups.[34]

6.14. Neuroprotective Effects

A study was performed to investigate the neuroprotective effects of Azadirachta indica leaves against cisplatin- (CP-) induced neurotoxicity and results showed that morphological findings of neem before and after CP injection implied a well-preserved brain tissue. No changes, in biochemical parameters, were observed with neem treated groups.[35]

6.15 Immunomodulatory and Growth Promoting Effect

Experiment was performed to investigate growth promoting and immunomodulatory effects of neem leaves infusion on broiler chicks and results showed that neem infusion successfully improved antibody titre, growth performance, and gross return at the level of 50 mL/liter of fresh drinking water.[36]

7. CONCLUSION

The current review deals with the medicinal uses and Pharmacological importance of Azadirachta indica Which having potential such as antimicrobial, antioxidant, antinflammatory, analgesic, cardiac, anticancer, antidiabetic, antispasmodic, radio protective effect, Neuroprotective Effects, Antifungal Activity,. Hepatoprotective Effect,. Antimalarial Activity.

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