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REVIEW ON THE IMPORTANCE AND ITS APPLICATION OF *AZADIRACHTA INDICA* (NEEM)

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ABSTRACT

Azadirachta indica is the botanical name of Neem. It is member of the Meliaceae Family and it is very important role in antimicrobial and antioxidant. Antimicrobial properties refers to reduce or inhibit the growth of microorganism. They have some phytochemical compound in it. They have a wide variety of medicinal values. Neem has been extensively used in Ayurveda, Unani and Homeopathic medicine and has become a focus of modern medicine. All the parts of the Neem tree – Leaves, Flowers, Seeds, Fruits, Roots and Bark have been used traditionally for the treatment of eczema, ringworm, acne, inflammation, hyperglycaemia, chronic wound infections, diabetic foot, and gas gangrene, Fever, Skin Diseases and Dental disorders. Neem helps boost your immune system. It also has blood-cleansing properties, which allow it to clear toxins and impurities from the blood leaving you with a build-up immune system. I conclude the role of *Azadirachta Indica* in the prevention and treatment of disease whereas the regulation of various biological and physiological pathways.

Keywords: *Azadirachta*, Antioxidant, Phytochemical, Eczema, Hyperglycaemia, Diabetic Foot.

I. INTRODUCTION

Azardirachta indica (Neem) also called **nim** or **margosa**. It is the fast-growing tree of the Meliaceae family, valued as a medicinal plant, as a source of organic pesticides**.** The plant product or the natural product shows a very important role in diseases prevention. They also have a good treatment through the improvement of Antioxidant (kiranmai *et al*., 2011) activity, inhibition of bacterial growth and modulation of genetic pathway (Mohammad *et al*., 2016). It is used in traditional medicine as a source of many therapeutic agents (Rafique *et al*., 2010) in the Indian culture. They are well growing well in the tropical and sub -tropical countries. Its graps provide a chewing stick and are widely used in the Indian sub-continent. In earlier studies based on neem have showed that it contains active substances with multiple medicinal properties (Rafique *et al*., 2014). Other compounds that have a biological activity are salannin (Atmakuru *et al*., 1999) volatile oils, meliantriol and nimbin (Atmakuru *et al*., 1999) Importance properties of the neem tree have been remember by the US National Academy of Sciences, which disclose a report in 1992 entitled 'Neem - a tree for solving global problems. The advancement of neem research has earlier been documented (Hussain *et al*., 2012)**.** It is one of the few known anti-viral agents. Neem leaves interacts on the surface of cells to prevent infection by suppress the multiplication of the virus. Mild neem leaf teas have been demonstrated to combat the chickenpox varicella-zoster virus (Gupta et al., 2012) and boost the immune system. It was found that neem can keep fold, which is caused by the same virus, as chickenpox, at the surface level if took internally during times of stress. It can inactivate the viruses, and preventing the virus from multiplying sufficiently to cause an outbreak (krishnan *et al*., 2015)**.**

Botanical Description of Neem

Neem tree belong to the Meliaceae family which is found in large amount in tropical and sub – tropical regions like India, Bangladesh, Pakistan and Nepal. It is the fast-growing tree with, 20 –23 m tall and trunk is straight and has a diameter around 4-5 ft. The neem leaves consist are the compound, imparipinnate, with each comprising 5–15 leaflets. The colour of leaves is in green in colour. Its fruits have seed which turn golden yellow on ripening in the months of June– August. Taxonomic position of *Azadirachta indica* (neem) is classified in Table 1 (Mohammad *et al*., 2016).

- **Classification of *Azadirachta indica* (neem).**

  Order Rutales

Suborder	Rutinae
Family	Meliaceae
Subfamily	Melioideae
Tribe	Melieae
Genus	*Azadirachta*
Species	*indica*

- **Neem Leaves**

Neem leaves are used most prominently in Ayurvedic medicine as a cure all herb and are used to help reduce symptoms of inflammatory, viral, and fungal infections. It is useful for chickenpox (Bhowmik *et al*., 2010), increase immunity of the body, reduce fever caused by malaria, treating various foot fungi, useful against termites (Shiberu *et al*., 2013) used in curing neuromuscular (kuusik *et al*.,2014). They have a wider use in the field of medical.

Fig. 1. *Azadirachta indica* (Neem tree)

Effect of Neem as Anti-Inflammatory

Plants or their isolated derivatives are in the practice to act as anti-inflammatory agents. A study result has confirmed that extract of *Azadirachta indica* leaves at a dose of 200 mg/kg, showed very significant anti-inflammatory activity in cotton pellet granuloma assay in rats (Chattopadhyay *et al*., 1998)**.** Other study results told that neem leaf extract showed significant anti-inflammatory effect but it is less efficacious than that of dexamethasone (kind of drug) (Mosaddek *et al*., 2008) and study results suggest that nimbidin suppresses the functions of macrophages and neutrophils relevant to inflammation (Kaur *et al*., 2008)**.** In Earlier time finding showed immunomodulator and antiinflammatory effect of bark and leave extracts and antipyretic and anti-inflammatory activities of oil seeds (Arora *et al*., 2011) (Biswas *et al*., 2002). All the experiment was made to assess the soother activity of neem seed oil on albino rats and results of the study showed that neem seed oil showed significant soother effect in the dose of 1 and 2 ml /kg and oil has dose dependent analgesic activity (Kumar *et al*., 2012)**.**

- **Wound healing Effect**

The Neem is used in wound healing effect since early times. The effect of neem oil in the treatment of long-lasting**.** (Husain *et al*., 2018) It shows best wound healer property. Neem also plays role in treating skin burns. The antiseptic and healing properties of neem make it an excellent first aid for minor cuts and injury. Some results show that leave extract of neem worked on wound healing effect or through increased inflammatory response and neovascularization. (Mohammad *et al*., 2016).

- **Health and Personal Care product**

Neem personal care products derived from seed, oil and leaf include; Skin care - including eczema cream (Tomar *et al*., 2019), antiseptic cream, and nail care; hair care - shampoo, and hair oils; oral hygiene -

toothpaste and neem twigs; therapeutic (Shareef *et al*., 2018) - loose Neem leaves – tea, vegetarian capsules (Stanley *et al*., 2014), powders; household products - soaps, spray, lotion, and candles. Therapeutic (Shareef *et al*., 2018) uses: Hot water extract of the bark is taken oain.

Table 1: Organic activities of Neem and its constituents.

Plant parts	**Activities**	**Findings of study**	**Reference**
Leaf, flower and stem bark	Antioxidant	Extracts from leaf, flower, and stem bark have higher antioxidant activity	Sithisarn *et al*., 2005
Flower and seed	Free radical hunting	Ethanolic extracts of flowers and seed oil were found to possess greater free radical-hunting	Nahak *et al*., 2011
Leaves	Wound healing	Aqueous extract of leaves presented significant reduction in extended diameter wounds	Chundran *et al*., 2015
Leaves	Wound healing	Aqueous extracts of neem leaves are theoretical to act biochemically though inflammatory response and neovascularization	Osunwoke *et al*., 2013
Fruits skin and its specific ingredient, azadiradione	Anti-inflammatory	Animals treated with 100 mg/kg dose of fruit skin extract and azadiradione showed important anti-inflammatory activities	Ilango *et al*., 2013
Seed oil	Anti-inflammatory	Oil showed increased inhibition of edema with the progressive increase in dose from 0.25-2 ml/kg body weight	Naik *et al*., 2014
Leaf	Hepatoprotective	In addition to this, paracetamol -induced liver gangrene was also found to be reduced as observed macroscopically and histologically	Bhanwra *et al*., 2000
Leaf	Hepatoprotective	Leaf extract prevents and opposites the hepatotoxic damage caused by antitubercular drugs	Kale *et al*., 2003
Leaf	Neuroprotective	Leaf extract has also been checked to study its neuroprotective effects and its has shown fairly well-organized adaptable effects of cisplatin	Abdel *et al*., 2014
Leaf	Nephrotoxicity	Leaf extract has shown significant protective effects against cisplatin-induced nephrotoxicity as this extract exhibits antioxidant, anti-inflammatory, and other free radical-hunting activities	Abdel *et al*., 2014
Leaf	Immunomodulatory	Neem infusion has been found to successfully improve the antibody titer growth performance when used at the level of 50 ml/l of fresh drinking water	Durrani *et al*., 2008

Flower	Antifertility	Extract caused a statistically important reduction in the number of ova sheds in the morning of estrus	Gbotolorun *et al.*, 2008
Oil	Antifertility	oil resulted in a block of spermatogenesis without affecting testosterone production	Upadhyay *et al.*, 1993
Stick	Reduction in plaque and with gums. Treatment of dental caries	Significantly reduce the plaque and with gums scores as compared to baseline. Extracts of neem have a strong antimicrobial properties and told that it can be useful in the treatment of dental caries.	Bhambal *et al.*, 2011 Lekshmi *et al.*, 2012
Root bark	Antidiabetic	Neem root bark extract (NRE) was given in the dose of 800 mg/kg showed important reduction in blood sugar level. They have reduced the blood sugar level very fastly.	Patil *et al.*, 2013
Leaf	Cardioprotective	Neem extract shows equipotent cardioprotective activities as compared to Vitamin E	Peer *et al.*, 2008
Leaf	Antimicrobial	Neem leaf extracts have showed that wider zones of inhibition and further confirming that they contain antimicrobial properties and the extract showed significantly greater zones of inhibition that 3% sodium hypochlorite	Ghonmode *et al.*, 2013
Seed	Antimicrobial	Minimum inhibitory concentration of seed extracts was 31 µg/mL concentration was noticed to be sufficient for twisting the growth pattern of the organisms tested	Natarajan *et al.*, 2003
Bark	Antimicrobial	Bark extract confirmed that neem bark extract significantly blocked HSV-1 entry into cells	Tiwari *et al.*, 2010
Leaf	Antitumor	Leaf extract much reduced the incidence of DMBA- induced hamster buccal pouch carcinomas and tumor burden	Elumalai *et al.*, 2012
Leaf	Antitumor	Treatment with leaf extract inhibited MNU- induced mammary tumor progression and treatment was also highly effective in reducing mammary tumor burden and in suppressing mammary tumor progression even after the cessation of treatment	Sharma *et al.*, 2014
Leaf	Antitumor	Leaf extract gives 50% inhibition at a dose of 100 µg/ml in both PC-3 (bone	Metwally *et al.*, 2014

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		metastasis) and LNCaP cells (lymph node carcinoma of the prostate) (human cell)	

Antimicrobial Activity

Neem extracts are rich in antimicrobial properties as some surveys have clearly express that neem extracts can may be useful to control many foodborne pathogens and some other spoilage organisms. (Hoque *et al*., 2007) NLEs (Neem Leaf Extract) have been found in practically to show zones of inhibition confirmed told that they have contain antimicrobial properties, and the extract showed significantly larger zones of inhibition. (Ghonmode *et al*., 2013).

- **Antibacterial Activity**

The petroleum ether, methanol and aqueous extracts of the leaves of *Azadirachta indica* (Meliaceae), knob of Allium cepa (Liliaceae) and methanol extract of gel of Aloe vera (Liliaceae) were isolate for their anti-microbial activity using agar diffusion method. They were tested against six bacteria; two Gram positive bacteria (***Bacillus subtilis*** and ***Staphylococcus aureus***) and four Gram-negative bacteria (***Escherichia coli***, ***Proteus vulgaris*** (Gupta *et al*., 2020)**,** ***Pseudomonas aeruginosa*** (Mehrotra *et al*., 2010) and ***Salmonella typhi***). The susceptibility of the microorganisms to the extracts of these plants was compared with each other and with preferred antibiotics. The methanol extract of Azadirachta indica (Neem) exhibited marked activity against ***Bacillus subtilis*** (28 mm)16. (Azad *et al*., 2012).

- **Antifungal activity**

Antifungal activity mainly worked in these five strains are: (***Aspergillus flavus***, ***Fusarium solani***, ***Aspergillus fumigatus***, ***Mucor spp***. and ***Aspergillus niger***). They have great value of Antifungal Properties. The fungi (P. ovale) were cultured in the various laboratory. Neem are extracted in various concentration (25 %, 50 % , 75 %, 100 %) was prepared. There are various type of Fungal infection in human body are: - Dandruff, skin infection, foot infection. The separation of neem leaves produced the large zone of inhibition then the other concentrate on**. (**Akhtar *et al*., 2015).

- **Antiviral activity**

In the previous Results showed that Neem Bark Extract (NBE) significantly blocked HSV-1 entry into cells at concentrations ranging from 50 to 100 μg/mL (Yerima *et al*., 2012). Furthermore, blocking activity of NBE (Neem Bark Extract) 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 (Tiwari *et al*., 2010). Leaves extract of neem (***Azadirachta indica***) 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 (Badam *et al*., 1999).

Table 2:- Antimicrobial activity of *Azadirachta indica* (neem)**.**

S.no	Parts	Extract	Bacteria		Virus	Fungi	Reference
			Gram Positive	Gram Negative			
1	Leaves ,Seeds ,Barks ,Fruits	Ethanol and Methanol	*Staphylococcus aureus*		*HSV-1*	*Aspergillus, Rhizopus ,Alternaria solani Aspergillus flavus and Cladosporium*	Shareef *et al*., 2018
2	Leaves , Barks	Leaf and Bark extract	*Bacillus subtilis*	*Escherichia coli , Salmonella typhi* and , *Vibrio cholerae*			Raut *et al* ., 2014
3	Leaves	Leaf extract	*Enterococcus Faecalis*			*Candida albicans*	Dubey *et al* ., 2012

		and Ethanol					
4	Leaves	Benzene, Acetone, Toluene, Ethyl Acetate ,Ethanol and Butyl Alcohol		*Escherichia coli*			Sahrawat *et al* ., 2018
5	Leaves	Petroleum Ether , Chloroform and Methanol	*Staphylococcus aureus*	*Salmonella typhi*			Biwas *et al* ., 2015
6	Leaves , Barks ,Seeds, Fruits	Leaf extract and Ethyl extract	*Staphylococcus aureus* and , *Clostridium botulinum*	*Escherichia coli* and *Campylobacter*	*HSV-1* and *Coxsackievirus*	*Aspergillus* and *Rhizopus*	Alzohairy *et al* ., 2016
7	Leaves , Barks ,Seeds, Fruits	Methanolic extract and Ethyl extract	*Streptococcus mitis* , *Streptococcus mutans* and *Staphylococcus aureus*	*Corynebacterium* , *Lactobacilli* and *Prevotella*	*Coxsackievirus*	*Aspergillus flavus* , *A. fumigatus* , *A. niger* , *A terreus* , *Candida albicans* and *Microsporum gypseum*	Trivedi *et al* ., 2019
8	Leaves	Ethanol	*Staphylococcus aureus*	*Escherichia coli,* and *Proteus Vulgaris*			Chauhan *et al* ., 2018
9	Leaves	Petroleum Ether and Methanol	*Bacillus subtilis and Staphylococcus aureus*	*Escherichia coli, Proteus Vulgaris, Pseudomonas aeruginosa and Salmonella typhi*			Hashmat *et al* ., 2012
10	Leaves	Ethanolic	*Staphylococcus aureus*	*Vibrio Cholerae* and *Pseudomonas aeruginosa*			Mehrotra *et al* ., 2010
11	Leaves	Acetone extract and Chloroform	*Bacillus subtilis, Bacillus cereus* and *Staphylococcus aureus*	*Escherichia coli, Salmonella pneumonia* and *Pseudomonas aeruginosa*			Krishnan *et al* ., 2015
12	Leaves	Methanol and	*Bacillus subtilis* and	*Salmonella typhimurium* ,		*Aspergillus flavus* ,	Akhtar *et al*., 2015

		Chloroform	*Staphylococcus aureus*	*Escherichia coli, Bordetella bronchiseptica* and *Enterobacter aerogens*		*Fusarium solani , Aspergillus fumigatus ,Mucor spp.* and *Aspergillus niger*	
13	Leaves , Barks ,Seeds	Leaf extract and Bark extract	*Staphylococcus aureus* and *Bacillus cereus*	*Escherichia coli* and *Salmonella typhi*	*HSV - 1*	*Candida*	Rahmani *et al* ., 2018
14	Leaves	Ethanolic	*Staphylococcus aureus*	*Escherichia coli*			Pandey *et al*., 2014
15	Leaves , Barks ,Seeds, Fruits	Acetone Chloroform , Diethyl ether and Methanol	*Staphylococcus aureus*	*Escherichia coli, Salmonella typhimurium* and *Shigella*			Shinde *et al*., 2016
16	Leaves	Ethanol	*Staphylococcus aureus* and *Corynebacterium bovis*	*Escherichia coli,*			Aslam *et al*., 2009
17	Leaves	Leaf Extract	*pyogenes*	*Salmonella pneumonia* and *Moraxella Catarrhalis*	*Rhinovirus , Influenza virus* and *Parainfluenza virus*		Brook *et al*., 2011
18	Leaves	Petroleum Ether and Chloroform	*Streptococcus mutans , Streptococcus salivarius* and *Fusobacterium nucleatum*				Lekshmi *et al* ., 2012
19	Seed	Neem Leaf Extract		*Aeromonas hydrophila , Pseudomonas fluorescens , Escherichia coli,* and Myxobacteria			Bharathi *et al*., 2020
20	Leaves , Barks ,Seeds, Fruits	Leaf Extract , Bark Extract ,Seed Extract and Fruit Extract	*Staphylococcus aureus , Streptococcus mutans*	*Salmonella typhimurium ,*	*Hepatitis B virus , Herpes virus,* and *Measles virus.*	*Candida, Microsporum, Trichophyton, Geotrichum* and *Epidermophyton, Trichosporon*	Sitara *et al*., 2008 Mahmoud *et al*., 2011 Pandey *et al*.,2014 Aslam *et al*., 2012

							Galhardi *et al.*, 2012 Parid *et al.*, 2002 Tiwari *et al.*, 2010

II. CONCLUSION

Neem leaves use a wider in our daily life. *Azadirachta indica* extract is very important source of compound having anti-microbial, anti-oxidant, anti-tumor, anti-malarial, anti-fungal, anti-inflammatory and anti-viral properties. It contains a plethora of phyto active constituents with varied chemical structures. They are good in blood circulation and blood purification. There are main compound which we are isolate from neem in different parts of neem. All the parts of neem tree traditionally use to treatment of inflammation, skin disease, dental disorder, fever and infection. Clinical based studies confirmed that neem play a vital role in the prevention of various disease. Clinical proved that neem leaves and their parts do not have any side effect. On the basis of research, they proved that using plant parts of neem had beneficial effect in controlling the pathogenic microbial organism. The use of neem in Allopathic, Homeopathic, Unani, Ayurvedic medicine. Neem is widely used in safeguarding human and animals' health.

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Conflict of interests

The author declares that there is no conflict of interests regarding the publication of paper.

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