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A Phytopharmacological Profile of *Melia azedarach* L: An Overview

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ABSTRACT

This review should provide an overview of the use of natural medicines from India as diuretics. In daily practice, diuretics can be used as first-line treatment for a long time. Natural medicines are created and viral in non-industrialized countries because of their inclusive natural and restorative exercises, higher welfare limits and lower costs. The review considered the plant characteristics of the plant that help identify the plant. Such evidence is expected to provide logical certainty to the use of conventional recipes in the fairy tale and, surprisingly, will help improve future drugs and medicines and treatment regimens. Based on this review, it tends to be argued that countless plants have a decisive diuretic effect in the midst of nature. Natural medicines are free from side effects and harms, not at all like allopathic medicines. This review describes a combination of herbal medicines used as diuretics.

KEYWORDS ; *Melia azedarach Linn*, Diuretics, phytoconstituents, pharmacology.

INTRODUCTION [1-7]

Overpopulation is one of the extreme problems in growing international locations like India, which may increase to nearly 9.2 billion by the year 2050 [1]. Today, people depend on natural and Ayurvedic treatments on a daily basis [2]. Naturopathic medicine has evolved in the global scenario in recent decades. Since the beginning of time, people from almost all civilizations have tried to increase the benefits of various plants by using their medicinal properties. The widespread use of herbal medicine sand health preparations made from traditionally used herbs and medicinal plants can be traced back to the birth of natural products with medicinal properties [3]. *Melia azedarach Linn* is found in almost all countries and is very similar in appearance to the neem tree. The inner shell consists mainly of alkaloids, which are the components responsible for the thermal effect. This plant also has properties such Asanti cancer activity, antimalarial activity, antibacterial activity and antifertility activity [4,5,6]. The World Health Organization (WHO) established a Fertility Control Research Working Group to find new oral nonsteroidal oral contraceptives. Phytopharmaceuticals have a very long history in India, though proper scientific rationalization recent development. Different herbs have been used as a fertility treatment. Although only a few contraceptives made from plant extracts have been discovered, their potential no longer exists. There are many problems associated with plant extracts, one of which may be the loss of the exact active component used to improve natural contraceptive [7]. This article contains a comprehensive analysis of its systematic botanical location, phytochemical analysis, pharmacological activity study and medicinal applications.

BOTANICAL DESCRIPTION [8-12]

Native to tropical Asia, Melia azedarach (Meliaceae family) is widespread in Australia, Southeast Asia, Pakistan, India and Indonesia. It is less available in the Philippines, the United States, Brazil, Argentina and many other African and Arab countries [8].Vardi recognizes plants by local names throughout India and abroad, including Sanskrit (Himadruma, Vraksha, Mahanimba, Paratanimba), Bengali (ghoraneem), Hindi (Bakayan, Bakain, Mahanimb), Kannadan (Bevu), Telugu (Taraka Vepa), Tamil (Malai Veppam), Gujrati (Bakan, Limbo), Malayalam (mullay vaempu), Punjabi (Drek), English (Persian lila), Chinese pride and Asian people the pride of the common pearl [9,10,11].

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DESCRIPTION OF THE PLANT

Melia azedarach is a medium-sized deciduous tree which can grow up to 45 meters in height, with a spreading crown and moderately branching limbs. Under normal conditions, this plant reproduces from seeds limitably during the rains. Direct planting, cuttings and root vacuum are other methods of artificial propagation. Smooth greenish-brown rinds mature to a split gray color. The leaves are compound or bilateral, alternate and 20–40 cm long. Leaves 3-11, serrate, unseasoned, black on sides, paler beneath. When are crushed, they give off an unpleasant smell. The inflorescence is a 20 cm long axillary plant. The flowers range from white lavender to purple and are fragrant. The sepals are divided into five lobes, each about 1 cm long. The petal is 9 cm long, five-lobed and hairy. The cover tube is deep purple, blue and brown. The fruits or berries are small, almost globose, yellow drupes that are smooth, hard as stone, and contain four to five black seeds. Their diameter is 15 meters linear units. The surface of the seed is smooth, brown and surrounded by pulp. It measures 3.5 mm x 1.6mm [9,12].

THERAPEUTIC USES

In Ayurvedic medicine, preparations of Melia azedarach are used to treat various diseases, including flu, inflammation, headache, stomach disease, diabetes, several types of poisoning and malaria. In an enlarged spleen, the gum secreted by Melia azedarach is believed to be beneficial, and the extract of the tree is used to treat bronchial allergies. A bark necklace is given to patients suffering from paroxysmal fever to relieve symptoms such as thirst, vomiting, loss of appetite, nausea and skin diseases. A decoction of the leaves of the plant is used to treat hysteria, scrofula and leprosy. The juice of the leaves of the plant acts as a medicine, emmenagogue, diuretic, cough medicine and narcotic. The juice of the leaves of the plant also acts as an emmenagogue. The flowers have astringent, cooling, emmenagogue, anodic and diuretic properties. Eating the fruits is thought to have anthelmintic, emollient, diuretic and cleansing effects. The seeds have several medicinal uses, such as an aphrodisiac, medicine, cough medicine and aid in the treatment of typhus. The seed oil is often used to treat a variety of skin conditions. The root is used as an expectorant, astringent and antipyretic in the treatment of constipation. In addition, these plants can be used in various contexts, including but not limited to the treatment of conditions such as sciatica, lumbago, piles, cough, bronchial allergy, ulcers, wounds, diabetes, intermittent fever, etc. [8].

PHYTOCHEMICAL CONSTITUENTS

Preliminary phytochemical analysis of Melia azedarach revealed various naturally occurring compounds including flavonoids, steroids, terpenoids, acids, alkaloids, saponins, anthraquinones and tannins, among others [12].

Leaves

The leaves contain terpenoids and limonoids such as 1-cinnamoyl- 3-acetyl-11-hydroxy meliacarpin, l-cinnamoyl-3-methacrylate-11-hydroxymeliacarpine, deacetylsalannin,1,3-dicinamoyl-11-hydroxy-meliacarpine, β-pinene, α-terpinene, Kaempferol-3-O-β-Rutinoside, Rutin. They also contain acids such as palmitic acid and Hexa decanoic acid, e.g.

Fruits

The fruits contain terpenoids and limonoids such as 15-epoxy-3, 6-acetoxy-14, 5-dien-7-one, amoorastatin, amorastatone, 11-dihydroxymeliaca-1, azadirachtin-A, cinnamoylmelianolone, l-Cinnamoylmelianone , l-Cinnamoyl-3,11-dihydroxy-meliacarpinin, compositeid,1-O-deacetyl-ohchinolide-B, 1-deacetylnimbolinin-A, 3-deoxymelian, 25-diepoxy-tirucall-7-ene-21-ol, 29-deacetylsendanin, 3-epimelianol, 3-epimeliantriol, Gedunin,12-α-hydroxyamoorastatin, meliandiol, Melianol, Melianolone, Melianone, Meliantriol, -Nimboline- B, Meliatoxin-A1, Melianoninol, Meliatoxin-A2, Nimbolidin-A, Meliatoxin-B1, Nimbolinin-A, Ohchinal, Meliatoxin-B2, Ohchinin, Ohchinin Acetate. They also contain acids such as octadecanoic acid and stearic acid.

Stem bark

It consists of terpenoids and limonoids such as acetoxy-14β, 15β- epoxygedunanl-ene-tri-O-β-DG-glucopyranoside, 12-acetoxyamoorastatin, Amoorastatin, Fraxinellone, 12-Hydr oxyamoorastatone, Hydroxy alpha-7, 24 -diene-21, 16-olide, kula-tone, kulinone, kulolactone, Methylmalonate, α-pinene, β-pinene, α-terpinene, α-A-terpineol. They also contain flavonoids such as 4',5-dihydroxyflavone-7-O-u-L-Rhamnopyranosyl-(1-4)-β-Dglucopyranoside, Anthraquinone, such as 5,8-tetrahydroxy-2-methyl anthraquinone, 8 -Me ether, 3-O-α-Lrhamnopyranoside. In addition, they consist of steroids such as campesterol, cholesterol and stigmasterol and linoleic acid, linolenic acid and oleic acid (9-octadecenoic acid).

Root bark

The root bark contains terpenoids and limuloids such as 12-O'acetylazadirachtin-A, 12-O-acetylazedaraquine-B, l-acetyl-3-tigloyl-1,1-methoxymeliacarpine, 12-O-acetyltrichilin-B, n E, Nimbolidin-B, Salannal, Salannin. They also contain steroids such as 6-β-hydroxy-4-canpesten-3-one, 6-β-hydroxy-4-stigmasten-3-one and aceclaracol.

Roots

The root bark contains terpenoids and limuloids such as 12-O'acetylazadirachtin-A, 12-O-acetylazedaraquine-B, l-acetyl-3-tigloyl-1,1-methoxymeliacarpine, 12-O-acetyltrichylin- B . n E, Nimbolidin-B, Salannal, Salannin. They also contain steroids such as 6-β-hydroxy-4-canpesten-3-one, 6-β-hydroxy-4-stigmasten-3-one and aceclaracol [12,13,14,15].

PHARMACOLOGICAL ACTIVITY

MALE CONTRACEPTIVE POTENTIALITY

Azam and colleagues (2013) found that sperm motility in male rats treated (50 mg/kg *M. azedarach* seeds and 150 mg/kg doses) was significantly lower than. The results also showed a significant decrease in fertility at doses of 50 and 150 mg/kg ($p<0.01$) compared to the control group, suggesting that *M. azedarach* can lower fertility rates [11].

ANTI-FERTILITY ACTIVITY IN FEMALES

The estrogenic/antiestrogenic and progestational/ antiprogestational effects of implantation of a hydroalcoholic extract of the roots of *M. azedarach* were demonstrated in a study. The extract was found to have no estrogenic or antiestrogenic activity, although it had significant anti-implantation and progestational activity. It has been hypothesized that the extract contains a specific substance that inhibits the biosynthesis, secretion and properties of ovarian steroids. It also interferes with the implantation process by preventing the development of oocytes and Graafian follicles. These effects are thought to be due to the substance [9].

FOLLICULOGENESIS INHIBITION

Roop et al. (2005) conducted a study using *M. azedarach* seed extract fractions at a dose of 24 mg/kg body weightday-1 for 18 days to investigate quantitative aspects of follicular growth in cyclic female albino rats. The number of typical single layer follicles was greatly reduced. [16]

ANTI-CANCER ACTIVITY

Jafari et al. (2013) conducted a study to evaluate the anticancer effects of *M.azedarach* on cancer cell lines and evaluate their protection in humans by testing them on normal cell lines. The cytotoxic activity of the three main fractions of *M. azedarach* in their leaf extracts was evaluated in this work against MCF-7, HT-29, A-549, HepG-2 and MDBK cell lines. Various chemically active elements found in *M. azedarach* may be responsible for its anticancer therapeutic effect [17].

ANTI-BACTERIAL ACTIVITY

The diffusion method was used by Rhaymah et al.(2006) to demonstrate the antibacterial activity of *M. azedarach* crude leaf extract against Gram (+)and Gram (-) bacterial strains. The extract was prepared using various solvents including methanol, ethanol, dichloromethane, ethyl acetate and water. Ethyl acetate extract and aqueous solution of *Melia azedarach* showed significant inhibitory activity against the microorganism (Rhaymah et al., 2006). Khan et al. (2011) conducted an additional experiment to test the antibacterial efficacy of polar and non-polar extracts of *M. azedarach* seeds against harmful bacterial strains. The diffusion method was used to evaluate extracts from several solvents, including petrified, benzene, ethyl acetate, methanol, and water at five

different concentrations (1, 2, 5, 10, and 15 mg/ml). All solvent extracts of seeds showed antibacterial agation against infections. Of all the extracts, the ethyl acetate extract had the highest inhibitory effect. *M.azedarach* was selected as the best conventional antibacterial agent [18]. Another study in 2002 by Saleem and colleagues (2002) used *M. azedarach* flower extract to treat bacterial skin disease in children. The methanolic flower extract of the plant mentioned above was used to make the power. Neomycin was a commonly prescribed medication. The result showed that the cream is an effective treatment in many conditions [19]. Another study by Saleem and colleagues (2008) found that M. azedarach flower extract could treat rabbits suffering from skin disease caused by Staphlococcus aureus. The study used neomycin, considered the gold standard for antibacterial testing [20].

ANTIVIRAL ACTIVITY

This was shown by Wachsman et al. (1998) that a peptide called "meliacin" derived from the leaves of *M. azedarach* can inhibit viruses that cause foot and mouth disease [21]. Further research by Alche and his colleagues \ n showed that \ n the experiment showed that the isolated compound "meliacarpin", \ n which is a purified extract of M. azedarach leaves \ n, inhibited both vascular stomatitis \ nand \ nproliferation. herpes simplex virus [22].

ANTI-MALARIAL ACTIVITY

In a mouse study, Chaturvedi et al. (2006) studied the antimalarial activity of *M. azedarach* fruit, bark and leaf methanol extract against the malaria parasite Plasmodium berghei. Fruit and bark extract has been found to significantly reduce parasites. The results showed that *M. Azedarach* has strong antimalarial activity, but less significant than chloroquine as a conventional drug [23].

ANTIPROTOZOAL ACTIVITY

Lee et al. (2007), *M. Azedarach* extract has antiprotozoal activity against Trichomonas vaginalis by inhibiting cell division and interfering with protein synthesis [24].

ANTI-NEPHROLITHIASIS

Aqueous extract of *M. Azedarach* was studied by Christina et al. (2006) in a rat model of ethylene glycol-induced nephrolithiasis. The overall results of the study \ n supported the hypothesis that *M. azedarach* extract \ n lowered urinary oxalate, calcium and phosphate \ n levels. Therefore, *M. azedarach* shows inhibitory \ n efficiency against induced nephrolithiasis based on serum \ n and urinary creatinine levels [25].

ANTHELMINTIC ACTIVITY

The ethanol extract of M. azedarach was shown to have an anthelmintic effect on the tapeworm Taenia solium and the earthworm *Pheretima Posthuma* using piperazine as the reference drug in the experiment. As a result of the study it was found that the extract showed both tapeworm and earthworm activity. In addition, the results showed better efficacy against tapeworm compared to piperazine phosphate [26].

ANTI-COMPLEMENTARY ACTIVITY

Kayastha BP et al. (1985) conducted a study in which they investigated the effects of aqueous fruit extracts of *M. azedarach* on rat complement. The extract had a significant anticomplementary effect on rat serum; However, complete inhibition was achieved only at higher concentrations of *M. azedarach* extract [27].

HEPATOPROTECTIVE ACTIVITY

Ahmed et al. (2012) investigated the possibility that the chemical compound CCl4 could be harmful to the liver. ALP, SGPT, SGOT, and serum bilirubin were among the biochemical indicators that were assessed in addition to the histological examination. Biochemical measurements have improved and histological abnormalities including fibrosis and steatosis—fatty modifications in hepatocytes—have returned to normal in the group that had been exposed to CCl4. The phytoconstituents in plants that are in charge of the hepatoprotective action are currently the subject of more investigation [28].

ANTIULCER ACTIVITY

Using a Gipsing - restricted stress injury paradigm, Moursi and colleagues (1984) studied the effects of *M. azedarach's* lipid fraction on rats in their research. The results showed that *M. azedarachi's* lipid component, particularly the phytosterol fraction, was able to

dramatically lower the levels of free and total HCl. This was followed by a significant amount of antiulcer activity and a decrease in overall acidity [29].

SUPPRESSION OF INDUCIBLE NITRIC OXIDE SYNTHASE (iNOS)

The alkaloids B-carboline, 4, 8-dimethoxy-1-vinyl-B-carboline, and 4-methoxy-1-vinyl-B-carboline block inducible nitric oxide synthase in lipopolysaccharide/interferon-activated RAW 264.7 cells, according to research done by Lee et al. (2000). This is achieved by inhibiting the expression of the (iNOS) protein, which takes place [30].

ANTIOXIDANT ACTIVITY

Munir et al. (2012) investigated the effect of the antioxidant activity of *M. azedarach*. The total phenolic content (TPC) and total flavonoid content (TFC) of *M. azedarach* dried extracts were found to be within the respective ranges of 74.43-112.10 mg GAE/g DW and 13.32-28.11 mg CE/g DW. However, the dried extracts of M. azedarach exhibited a higher level of antioxidant activity in ambient dried TPC (Total Phenolic Contents) and TFC (Total Flavonoid Contents) observed to correspond with the findings, excluding the stem bark, which was demonstrated to have a higher level of antioxidant activity than the other plant parts [31].

ANTIPYRETIC ACTIVITY

A hydro-methanolic extract of *M. azedarach* leaves showed substantial ($p<0.0001$) antipyretic effects when given at a dose of 500 mg/kg, according to research done by Sultana et al. (2013). When compared to the common medication paracetamol, the leaf extract showed a significant ($p<0.0001$) decrease in yeast-induced elevated body temperature. However, in contrast to a higher dose ($p<0.05$), the leaf extract at a dose of 250 mg/kg proved to be less efficient in preventing brewer's yeast-induced pyrexia in experimental animals. The antipyretic action of *M. azedarach* was attributed to the flavonoids and/or alkaloids present in this extract [3].

WOUND HEALING ACTIVITY

The wound healing ability of *M. azedarach* leaves was investigated by Vidya et al. (2012) using an alloxan-induced diabetic rat model. An alloxan-induced diabetic rat model showed that topical treatment of methanolic leaf extract of *M. azedarach* had wound healing ability. The results showed that it is. Povidone-iodine was the control drug in this study and the results of the study showed that the application of *M. azedarach* leaf extract promoted wound healing in diabetic rats. Antibacterial activity of *M. azedarach* leaf extract can cause faster wound healing in a diabetic rat model [32].

IMMUNOMODULATORY ACTIVITY

In a 1997 study by Benencia and colleagues, they found that an extract of *M. azedarach* leaves reduced phagocytosis and phorbol-12-myristate-13--acetate in human monocytes [33].

ANTIFEEDANT ACTIVITY

El- Lakwah et al. (1995) investigated the effect of *Melia azedarach* fruits and extracts ground in petroleum ether and acetone on the reduction of young and rejection of adults of Sitophilus oryzae F1. Findings showed that deaths recorded after the powder exposure were initially very low during the first week of treatment, then gradually increased to a moderate percentage [34].

ANTIDIABETIC ACTIVITY

Mohammed Faheem khan et al. (2014) revealed that the extract and fractions of M. azedarach leaves have the potential to inhibit PTP-1B activity and to stimulate the glucose uptake by C2C12 myotubes .Bioactivity -guided chemical analysis of Melia azedarach L. displaying antidiabetic activity [35].

ANTITUBERCULAR ACTIVITY

Antitubercular activity of Melia azedarach leaves was investigated by won hyung choi et al. (2016) using different indicator methods such as resazurin microtiter assay (REMA) and mycobacteria growth indicator tube (MGIT) 960 system assay. These results demonstrated that *M. azedarach* and L. chinensis extracts not only have unique anti- M tuberculosis activity, but also induce the selective anti M. tuberculosis effects by consistenly inhibiting or blocking the growth of M. tuberculosis through a pharmacological action [36].

ANTI- SARS-COV 2 ACTIVITY

Bahaa A. Hemdan et al. (2023) invitro assessment of both M. azedarach leaves and A. indica L. extracts revealed that they robust antiviral activity against SARS-CoV-2 as well as antibacterial effects against broader spectra of GN and GP bacteria. These data emphasize their broad- spectrum medicinal value and demand further in vitro and in vivo investigation as anti-SARS-CoV-2 candidate and antibacterial agents [37].

CONCLUSION

This article briefly discusses the ethnomedicinal description, phytochemistry, pharmacological activity and therapeutic use of the herb *Melia azedarach*. According to this article, Melia azedarach has antiulcer, antipyretic, antifertility, anticancer, antiviral, wound healing and liver protection properties, which makes it useful in treatment. of several diseases. The plant contains various types of active substances, including terpenoids, flavonoids, steroids, acids, anthraquinones, alkaloids, saponins and tannins. Therefore, it can be concluded that *M. azedarach* is a medicinal plant, traditionally and clinically proven suitability for its use. Considering its numerous health benefits, research is urgently needed to purify the components of *M. azedarach* cheaply and characterize them on a molecular basis, considering possible chemical structure and mode of action. These ingredients could almost certainly prove useful while being relatively less dangerous than currently available drugs.

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