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A REVIEW ON MULTIPURPOSE PROPERTIES OF ACACIA NILOTICA

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ABSTRACT

The natural medicinal plants can boost self-cure, perfect health, andlongevity. Acacia nilotica Lam (Acacia) is an imperative and oldest one from Plant that possesses many medicinal uses. Acacia Arabica commonly known as babul belongs to the family Fabaceae is widely distributed throughout the tropical and subtropical plains all over India, Sri Lanka, and Sudan, this plant is native to Egypt. Almost all its parts such as root, bark, leaves, flower, gum, Young pods are utilized as nutrients and therapeutic remedies to hinder, Alleviate, or manage many illnesses. In traditional medicine, it is used for bleeding diseases, prolapse, leucorrhoea etc and experimental studies of A. arabica showed antimicrobial, antibacterial, antifungal, antiviral, antioxidant, anti plasmodial activity, anti cancer and anti mutagenic, antibiotic, antidiabetic, anti hyperlipidemic activity of Acacia nilotica. From these review I concluded Acacia may become a natural, inexpensive alternative to pharmaceuticals and prescription drugs.

INTRODUCTION

Acacia niloticaLamarack belongs to the Mimosaceae family, and is widely distributed in tropical and subtropical countries. Ayurvedic medicine practices use of natural medicinal plants to promote self healing, good health and longevity, and have declared that A. nilotica can provide the nutrients and therapeutic ingredients to prevent, mitigate or treat many diseases or conditions.[1] Plants and plants extract used for medicinal purposes and play an important role in developing countries since; they are inexpensive, effective and have a natural origin. In traditional medicine, Acacia Nilotica is widely used.[2] Acacianilotica know as babul is the most important tree of the dried parts of India. Almost all its Vparts are used in medication including root, bark, leaves, flower, gum, pods etc.[3] This plant has anti-microbial, antiplasmodial, anticancer, antimutagenic and antioxidant activity and used for the treatment of against cold, cough, sore throat diarrhea, dysentery, tuberculosis, piles, hepatitis C virus, burns, and scalds. Some common pharmacological uses of different parts of A. nilotica.[2]

Acacia nilotica (L.) commonly known as babul, kikar or Indian gum Arabic tree, has been recognized worldwide as a multipurpose tree, In Australia it is regarded as one of the worst weeds because of its invasiveness, potential for spread, and economic and environmental impacts. It is widely distributed throughout arid and semi-arid zones of the world.[4] Acacia nilotica is a tree widely distributed all over India, Sri Lanka, Sudan, Saudi Arabia and Egypt. Arabia, Acacia nilotica has different English names: like Indian gum arabic, TomentoseBabool, Black piquant, Black babul, Gum arabic, Egyptian mimosa, Egyptian thorn, Prickly Acacia, Nile acacia, Scented thorn and Scented-pod acacia; and different Arabic names: as Ummughilan, Usarequrz and kaarad.[2] Presently about 20% of the total geographical area of India is wasteland. Growing demand for fuel, fodder, wood and food has extensively depleted or eliminated protective plant cover and exposed soils to processes of degradation resulting in partial to complete loss of soil productivity.[4]

SYNONYMS

Gum acacia, Gum Arabica, Indian gum[5], babul, kikar or Arabic tree.[4]

BIOLOGICAL SOURCE

According to the USP, acacia is the dried gummy exudation from the stems and branches of Acacia senegal (L.) Willd; family; Leguminoseae, or other African species of Acacia. It is also found in the stems and branches of Acacia arabica, Willd.[6]

GEOGRAPHIAL SOURCE

The plant is extensively found in India, Arabia, Sudan and Kordofan (North- East Africa), Sri Lanka, Morocco, and Senegal (West Africa).[6] In India, it occurs in Punjab, Rajasthan and Western Ghats.[5] Sudan is the major producer of this gum and caters for about 85% of the world supply.[6]

CHEMICAL CONSTITUENTS

Acacia consists mainly of arabin, the calcium (with traces of magnesium and potassium) salt of arabic acid. Arabic acid may be pre- pared by acidifying a mucilage with hydrochloric acid and dialysing.

When hydrolysed with dilute sulphuric acid, it yields 1-rham- nopyranose, D-galactopyranose, L-arabinofuranose and the aldo- bionic acid 6-B-D-glucuronosido-D-galactose. The complete composition of the gum is extremely complex and has not been fully elucidated. In addition to the major branched polysaccharide fraction of branched B-(1,3)-linked galactose units with side-chains of arabi- nose, rhamnose and uronic acids linked through the 1,6-positions the gum also contains small amounts of protein, including arabinogalac- tan-proteins. Recent research has concentrated on the fractionation of the gum by techniques such as hydrophobic affinity chromatography and anion-exchange chromatography and the characterization of the amino acids present in the various protein fractions.[7]

Gum acacia also contains 12-15% water and several occluded enzymes (oxidase, peroxidases and pectinases), which get destroyed on heating at 100°C.Gum acacia is water-soluble gum; one part of the gum can dissolve in two parts of water, forming a weakly acidic solution with pH 4.5-5.5.[8]

PHARMACOLOGICAL USES

1) Antimicrobial &Antibacterial Activity

Banso A (2009) has studied the antimicrobial activity of ethanolic extracts of the stem bark against Streptococcus viridans, Staphylococcus aureus, Escherichia coli, Bacillus subtilis and Shigellasonnei using the agar diffusion method and found the minimum inhibitory concentration of the stem bark extract of the plant ranged between 35 and 50 mg/ml while the minimum bactericidal concentration ranged between 35 and 60 mg/ml." One 34 study was done by Rahiman et al (2012) to screen the antimicrobial activity of Acacia nilotica and was found to give the most potent antimicrobial extract Noticeably no antimicrobial activity was found in methonolic bark extract of Acacia nilotica against the tested bacteria except Bacilluciurlans. Mahesh and Satish (2008) 37 studied methanol leaf and bark extracts of Acacia nilotica showed significant antibacterial activity against Bacillus subtilis, Escherichia coli, Pseudomonas fluorescens, Staphylococcus aureus and Xanthomonasaxonopodispv. Malvacearum and antifungal activity against Aspergillusflavus, Dreschleraturcica and Fusariumverticillioides. Hassan et al (2009) has tested antimicrobial activity of Ethanolic extract of Acacia arabica in vitro against seven bacterial species and two fungal species by well- diffusion method and microdilution methods. The result of this study showed ethanolic extracts of these plants were effective on bacterial strains." Shazia et al (2011) has studied the antimicrobial activity against medicinally important bacterial strains, such as Pseudomonas aurogenosa, Proteus vulgaris, Staphylococcus aureus and Streptococcus cereviceae. The anti-microbial activity was determined in methanolic extracts using agar well diffusion method. Result showed anti-bacterial activity against Staphylococcus aureus, Pseudomonas vulgaris, Escherichia coli and anti-fungal activity against Streptococcus cereviceae." Antimicrobial activity of the extracts against clinical isolates was performed by agar diffusion method. It exhibited potent activity against all clinical isolates. The minimum inhibitory concentration for ethanol extract was 5 mg/ml while 10 mg/ml for petroleum ether tract. These results may be helpful for rationale use of this plant the modem system of health care.[9]

Moreover, high antibacterial activity against Staphylococcus aureus, Escherichia coli, Proteus vulgaris, Proteus mirabilis, Salmonella paratyphi B, Klebsiella pneumonia detected by Deshpande SN.[2]

Chandel B.S et al. (1992) screened an air dried and powdered alcoholic and water extract of the bark in vitro study. This exhibited significant antibacterial activity against Streptococcus pyogenes, Staphylococcus aureus, Escherichia coli, Salmonella typhimurium, Pseudomonas aeruginosa and Klebsiella sp. By using the disc method but Pseudomonas aeruginosa as found to be resistant to both the extracts, further, both the extracts were highly inhibitory to gram positive organism in comparison with gram negative organism tested. The entire micro-organism showed resistance against the pet. Ether extract.[3]

Banso A (2009) showed the antibacterial activity of the extracts of Acacia nilotica assay against Streptococcus viridians, Staphylococcus aureus, Escherichia coli, Bacillus subtilis and Shigellasonnei using the agar diffusion method. This study shows antibacterial activity against all the above said organisms, but Bacillus subtilis most susceptible to the plant extract.[3]

2) Antifungal activity

Mahesh B et al. (2008) have concluded that antifungal activity of methanolic extracts and aqueous extract of Acacia nilotica with percentage inhibition ranging from 34.27±1.45 to 93.35±1.99.[3] In the same way, Khan R. exposed antifungal activity of ethanolic extracts against multidrug-resistant (MDR) strains of Candida.[2]

3) Antiviral activity

Singh R et al. (1972) evaluated the crude thoug extract of the leaves of the plant showed in vitro antiviral activity against the Turnip mosaic virus. There was a decrease in lesions dose numbers on the hosts Chenopodiumamaranticolor (93.77%) and high C. album (80.2%) 1431.[3]

Parmar et al (2010) has investigated Acacia arabica for preliminary phytochemical analysis and characterization

by various instrumental techniques. Methanolic extracts of Acacia arabica seeds was very good antibacterial activity and also minimum inhibitory concentrating of different virus using HEL cell cultures HeLa cell cultures Vero cell cultures but Minimum inhibitory concentration (MIC) of Herpes simplex – 1 and 2, vaccinia virus, vesicular stomatitis and Herpes simplecx-1 (TK ACVI) were observed very good antiviral activity of Acacia arabica seeds DMSO extracts.[9]

4) Antioxidant activity

Agrawal S (2010) explored methanolic extract of plant have anti-oxidant activity which was found to be 9.88 µg/ml (48), Sultana B (2007) explained that different extracts of bark of Acacia niloticalinn exhibited inhibition of oxidation.of linoleic acid 44-90% while DPPH radical scavenging activity ranged from 49% to 87%.[3]

Singh R (2010) studied the fractionation of methanol extract, a fraction, AN-2, was isolated, which was identified by spectroscopic techniques, namely NMR and mass spectroscopy to be a coumarin derivative, i.e. umbelliferone. The antioxidative activities, including the DPPH, deoxyribose (site and non-site specific), chelating power, reducing power and lipid peroxidation assays, were studied in vitro and performed. It was found that the antioxidative effect of umbelliferone was dose dependent up to 100 µg/ml and then levelled off with no further increase in activity. This is the first report of the isolation and antioxidant potential of umbelliferone from A. Nilotica.[3]

The ethanolic extract of Acacia leaves showed a powerful antioxidant efficacy In 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay (IC50 = 75.2 µg/ml) plus a significant hydroxyl radical scavenging effect (IC50 = 159.6 µg/ml). The total antioxidant capacity of the extract equal to 152.8 µg/ml ascorbic acid. Acacia leaves extract markedly counteract the oxidative stress produced in the Saccharomyces cerevisiae system. These antioxidant effects could be attributed to the acacia active ingredients phytol and a-tocopherol.[10]

The ethanolic extract of Acacia leaves, pods, and bark showed significant antioxidant action in favored the leaves extract using the reducing power capacity assay, the percent inhibition of lipid peroxidation, and ferric reducing assay[36] It was also found that the methanolic extract of Acacia leaves exerted a powerful antioxidant capacity (94.3 %) in DPPH, hydrogen peroxide scavenging, metal chelating, and B- carotene-linoleic acid assays. A positive linkage was noticed among the total phenolic constituents, total flavonoid constituents, and the antioxidant efficacy.[10]

5) Antiplasmodial activity

Aqueous root extract of A. nilotica was analyzed for antiplasmodial activity in mice. Acute toxicity of the extract was studied using Organization for Economic Cooperation and Development (OECD) guideline 423. Suppressive activity, curative and prophylactic effect was studied in chloroquine-sensitive Plasmodium berghei NK 65 infected mice. Five groups, of five mice in each group were used. Group I or control, was administered with 10ml distilled water/kg body weight; groups 2, 3 and 4 were administered with 100, 200, and 400 mg extract/kg body weight, respectively, while group 5 was administered with 5 mg chloroquine/kg body weight. The doses were administered orally. All doses of the extract produced significant, dose dependent, chemo suppressive activity against the parasite in the suppressive, curative and prophylactic tests. This is comparable to the group treated with chloroquine. The extract also prolonged the mean survival time of treated mice compared to the untreated group. The oral median lethal dose (LD50) of the extract in mice was 5000 mg/kg body weight. The results of this study showed that the aqueous root extract of Acacia nilotica is safe and has anti plasmodialactivity.[3]

Eman A. Abduljawad, The ethyl acetate extract of Acacia possessed a powerful inVitro antimalarial impact versus both chloroquine-sensitive And resistant Plasmodium falciparum. Besides, Jigam et Al. showed that, in mice, Acacia root extract showed Antimalarial activity versus Plasmodium falciparum andPlasmodium berghei.

In a study aimed to investigate the therapeutic effect of raw Methanolic extract (70% v/v methanol/water) and the Partially purified extract of Acacia stem bark against Laboratory-induced trypanosomiasis (Trypanosomabrucei) in Mice. The raw extract (400 mg/kg) completely eliminated the Disease in eight days. Interestingly, the researchers confirmed That the effect of the partially purified extract (50 mg/kg) Completely abolished the parasite in just two days. The study Also showed that injecting healthy mice with the blood of the Treated mice did not cause trypanosomiasis infection during The observation period (28 days).

The aqueous extract of Acacia root exerted a dose-dependent (100, 200, and 400 mg/kg) antimalarial effects against Plasmodium berghei in mice and the result was comparable To chloroquine (5 mg/kg).

The results of a recent study that investigated the antimalarial Effect of Acacia root extract (eluted fractions, 50 and 100 g/kg) showed a marked decrease in the Plasmodium bergheicount in the diseased mice. The extract also prolonged the survival age of the infected mice and improved the haemoglobin deficiency in the cured mice.[10]

6) Anticancer and Antimutagenic Activity of Acacia

Meena et al. 146) reported the anticancer effect of the aqueous extract of gum, flowers, and leaves of Acacia against 7,12- Dimethylbenz[a]anthracene produced skin papillomagenesis in mice. Medication with the aqueous

extract (800 mg/kg orally) for 15 days was the most effective. Treatment with various extracts resulted in decreased tumor load, tumor incidence, and a cumulative number of skins papilloma. The latency of the tumor in the groups treated with leaf and flower extracts was prolonged.

In another study, it was found that the ethanolic extract of Acacia leaves had cytotoxic activity against two cell lines, Hela (IC50 = 53.6 µg/ml) and Vero (IC50 = 28.9 µg/ml). In contrast, the extract did not show any toxicity towards the erythrocytes in humans or rats.

A subsequent study also concluded that the Acacia extract could be used to treat cancers in humans. As the methanolic extract of the aerial parts of the Acacia (10 mg/kg) showed a significant reducing effect on the development of the solid tumor induced in BALB/c mice by Dalton's ascitic lymphoma (DAL). Besides, the extract increased the number of white blood cells (WBCs) and hemoglobin compared to the ascitic tumor group.

In addition, the crude (chloroform, n-hexane, and ethyl acetate) extracts of Acacia root showed cytotoxic effect against the brine shrimp lethality bioassay, and it was dose- dependent.[10]

MTT assay for cytotoxicity

The cytotoxicity of Ag/TiO2 NPs was verified amongst MCF-7 Cell-lines by exposing 10–100 mM concentrations of NPs for 1 dayusing the MTT-assay. Concentration dependent cytotoxicity wasrecorded after exposing the cell lines to 10, 25, 50 and 100 mM con-centrations of synthesized NPs (Fig. 01).

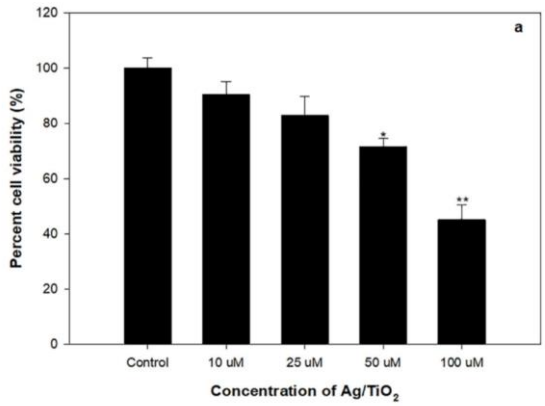

Fig. 01.

Histogram (Fig. 01) very clearly demonstrates that with theIncrease in concentration of Ag/TiO2-NPs, there is progressive Decrease in percentage cell viability. Upon increasing the Concentration the adsorption of NPs on cell membranes increases, Leading to enhanced penetration, facilitating binding to the bases Of DNA and causing cell death. Ag/TiO2 NPs demonstrated concentration-dependent cytotoxic profile in MCF-7 cell lines. Themicroscopic analysis to observe morphological changes showedthat the cell proliferation was significantly reduced. Cell shrinkageand cell detachment was also observed, as depicted in Fig. 6b–d.Similar concentration dependent cytotoxicity against MCF-7 cellswas demonstrated by hydrothermally synthesized TiO2 NPs.[11]

7) Antihypertensive activity

Gilani et al. (1999) determined that a methanol extract of Acacia nilotica pods possess decrease in arterial blood pressure at dose (3-30 mg/kg). It also produces an inhibitory effect on force rate concentration through calcium channel blockage in guinea-pig and rabbit. Amos S et al (1999) reported that aqueous extract of seeds of Acacia nilotica shows spasmogenic activity on the isolated guinea-pig ileum. The mechanism behind it may be increase in calcium influx that results in muscle spasm.[3]

A methanol extract of Acacia nilotica pods (AN) caused a dose-dependent (3-30 mg/kg) fall in arterial blood pressure. Treatment of animals with atropine abolished the vasodilator response of acetylcholine (Ach), whereas the antihypertensive effect of the plant extract remained unaltered. Phentolamine (an alpha-adrenergic blocker) abolished the vasoconstrictor effect of norepinephrine (NE), whereas pretreatment of the animal with AN, did not modify the NE response. These results indicate that the antihypertensive effect of plant extract is independent of muscarinic receptor stimulation or adrenoceptor blockade. Pn the in vitro studies, AN produced a dose-dependent (0.3-3.0 mg/mL) inhibitory effect on force and rate of spontaneous contractions in guinea-pig paired atria. Similarly, it inhibited the spontaneous contraction of rabbit jejunum in a concentration-dependent (0.1-3.0 mg/mL) manner, AN also inhibited K+-induced contractions in rabbit jejunum at a similar concentration range, which suggests that the antispasmodic action of AN is mediated through calcium channel blockade, and this may also be responsible for the blood pressure lowering effect of AN, observed in the in vivo studies.[12][13]

8) AntidiabeticAnd Antihyperlipidemic Activity ofAcacia

In an early study, the researchers found that administering an oral dose (400 mg/kg) of the aqueous methanolic extract of Acacia pods reduced the level of glucose, cholesterol, triglycerides, and low-density lipoprotein (LDL) in serum compared to the group of alloxan-induced diabetic rabbits. The extract also reduced liver function (alanine aminotransferase (ALT) and aspartate aminotransferase (AST)) while not affecting kidney function (creatinineclearance) in diabetic rabbits. The level of high-density lipoprotein (HDL) increased significantly in the treated rabbits compared to untreated diabetic rabbits.[10]

The various aspects of hypoglycemic effects A. nilotica and its application in the treatments of type II diabetes. Systematic reviews will provide the highest level of evidence for informed decisions. A systematic review can provide convincing evidence relevant to many aspects of small set of studies. To the best of our knowledge, no systematic review has been conducted on this topic. Efforts will be made to publish the results in valuable peer-reviewed journals. Although, the lack of studies on the hypoglycemic effects of A. nilotica in type II diabetes has been given a study limitation.[14][15]

We believe that our findings will provide details about difficulties researchers face during the design of protocols or implementation of scientific studies. The results will also help future studies by clarifying the characteristics of patients with type II DM who were recruited in previous research. Ultimately, the publication of our findings will facilitate the development of effective treatment strategies to promote the health of people with type II DM. One limitation of this study is the lack of studies about hypoglycemic effects of A. nilotica in type II diabetes.[14][15]

CONCLUSION

In conclusion this review the Acacia nilotica is the early and recent published research article through many medicinal activities acacianilotica was been in use since as ancient times to treat wide range of diseases in traditional system of medicine. The experimental studies and research article data proven its pharmacological uses such as antimicrobial, antibacterial, antifungal, antiviral, antioxidant, anti plasmodialactivity, anti cancer and anti mutagenic, antibiotic, antidiabetic, anti hyperlipidemic activity of Acacia nilotica.

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