Review Article

Bioactives and Pharmacology of *Acacia Nilotica*- A Review

ABSTRACT:

This review article aims to give information about the main phytochemicals present in Acacia and its many pharmacological activities. This review is helpful for researchers in the development of new drug products.

1. INTRODUCTION

Acacia is a genus of shrubs and trees belonging to the subfamily Mimosoideaeof the family Fabaceae (baravker et al., 2008).

They are pod-bearing, with sap and leaves typically bearing large amounts of tannins and condensed tannins that historically in many species found used as pharmaceuticals and preservatives. This name derives from the Greek word for its characteristic thorns, (*as*, thorn). The generic name derives from ἀκακία (*akakia*), the name given by early Greek botanist-physician Pedanius Dioscorides (ca. 40-90) to the medicinal tree *A. nilotica* in his book Materia Medica (Anonymous. 2003). The genus *Acacia* previously contained roughly 1300 species, about 960 of them native to Australia, with the remainder spread around the tropical to warm temperate regions of both hemispheres, including Europe, Africa, southern Asia, and America. The extract of pods or legumes is known as *Aqaqia* in the Unani system of medicine (Antaki AD et al, 1998) when it is obtained from unripe fruit then called *Qurz.* It is Native to Egypt, and seen throughout the greater part of India, Ceylon, Baluchistan, Waziristan, Arabia, Egypt and traopical Africa (Brenan J.P, 1983).

Acacia nilotica known as babul is the most important tree in the dried parts of India. Almost all its parts are used in different aspects including root, bark, leaves, flower, gum, pods, etc.(Fosberg FR. Et al, 1980), The bark of the babul tree contains tannin made up of strong and astringent acid (gallic acid) and used in tanning and dyeing, inks and pharmaceuticals (Dymock W. et al,2005).It is an evergreen tree, growing up to 10 meters in height. It is a small tree with dark brown or black longitudinally fissured bark; branchletsare slender, terete,

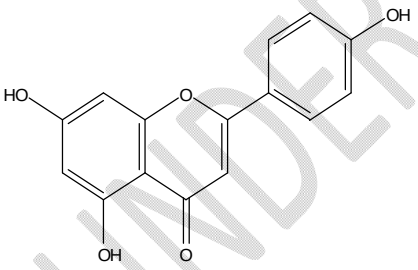
and pubescent when young. The tree generally attains a height of 15 m and girth of 1.2 m, though trees up to a height of 30 m with a girth of 3 m have also been recorded.[1]The leaves are 2-pinnate, 5-10 cm long; main rachis downy, often furnished with glands; petioles are 2.5-5 cm long; stipular spines very variable, 0.6-5cm long, and smooth.(Rushed I. Kitabul Kulliyat,1987)The leaflets are opposite in 10 to 20 pairs of crowded, sessile, linear-oblong, obtuse or acute, rigid, greyish green about 1/6 inch long.(Khan R .2009). The flowers are yellow, golden–yellow, fragrant, crowded in long-stalked, globed heads, 1.5 cm in diameter, forming axillary clusters of 2-5 heads,[1] and pubescent; bracteoles 2, calyx campanulate, 1.25 mm long; teeth very short. Corolla 3 mm long; lobes short, triangular.[10] Pod shortly stalked, 3 or 4 inches long by about ¾ wide, more or less constricted between the 2-6 seeds, flat except over the seeds, smooth, pale membranous, with a strong fibrous marginal rib and fainter transverse reticulating veins. Seeds with a long funicle slightly dilated at the hilum, roundish in outline[15], and persistently grey downy.It is very bitter to taste.The gum exudes from the cuts in the bark in form of ovoid tears. The tears are glossy and marked with minute fissures and are brittle. The color of the gum varies from pale yellow to black. It is soluble in water(Gupta, R.K, 1970)

Figure 1: Picture of *Acacia nilotica*

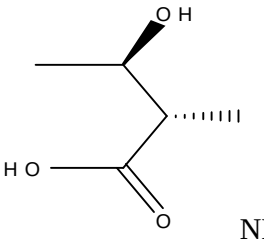
2. BIOACTIVES

Acacia species contain secondary metabolites including amines and alkaloids, cyanogenic glycosides, cyclitols, fatty acids,seed oils, fluoroacetate, gums, nonprotein amino acids, terpenes (including essential oils, diterpenes, phytosterol, and triterpene genins and saponins, hydrolyzable tannins, flavonoids, and condensed tannins. The plant is a richer source of

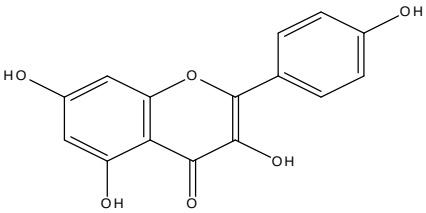
cysteine, methionine, threonine, lysine, tryptophan, potassium, phosphorus, magnesium, iron, and manganese (Dymock W, 2005). The plant chemical compounds like diester, pentacosane dioic acid dihexadecyl ester and alcohol, heptacosane 1, 2, 3-triol. Seeds: It containsa high percentage of phenolic constituents consisting of m-digallic acid, gallic acid, protocatechuic and ellagic acids, leucocyanidin, mdigallic dimer 3,4,5,7-tetrahydroxy flavan-3-ol, oligomer 3,4,7- trihydroxy flavan 3,4-diol and 3,4,5,7tetrahydroxy flavan-3-ol and (-) epicatechol. The mature seed also contains crude protein, crude fiber, crude fat, carbohydrates, potassium, phosphorus, magnesium, iron, and manganese occurring in high concentrations and it is a richer source of cysteine, methionine, threonine, lysine, and tryptophan (Eline M.B, et al 2005). Fruit also contains mucilage and saponins.Pods: It contains gallic acid & its Me-este-n-digallic acid and condensed tannins. Leaf: It contains apigenin, 6-8-bisD-glucoside, rutin, and 8% digestive protein (12.4% crude protein). Relative levels of tannin in different parts of the plantare deseeded pods (50%), pods (5.4%), leaves (7.6%), bark (13.5%), and twigs (15.8%).Bark: It contains tannin (12-20%), terpenoids, saponins and glycosides, Phlobetannin, gallic acid, protocatechuic acid pyrocatechol, (+) – catechin, (-) epigallocatechindigallate (Bachayaa H.A, Et al 2009).Its extract contains total phenolic content ranging from 9.2 to 16.5 g/100 g. Root: It contains octaconsanol, betulin, B-amyrin and Bsitosterol. Gum: It is composed of galactoaraban which gives on hydrolysis L-arabinose, D-galactose, Lrhamnose, D-glucuronic acid, and 4-O-methyl- Dglucuronic acid (Ali A.J, Et al 2010).



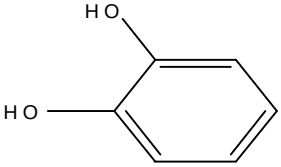
Apigenin



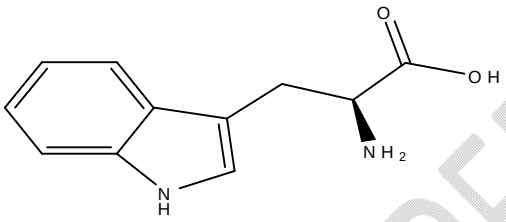
Threonine



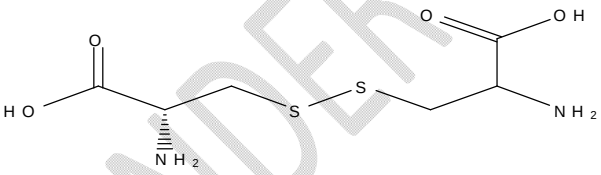
Kaempferol



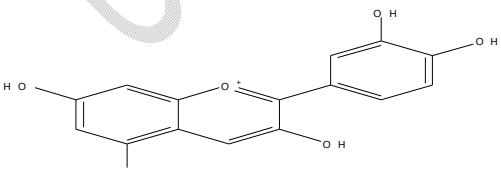
Pyrocatechol



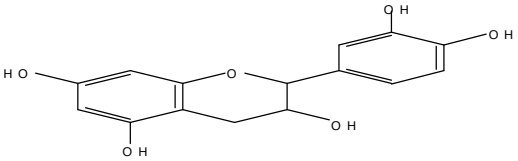
Tryptophan



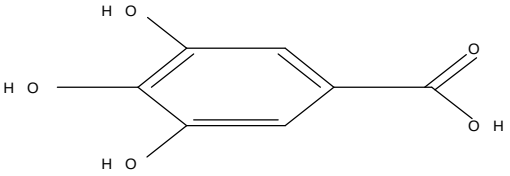
Cystine



OH Cyanidin

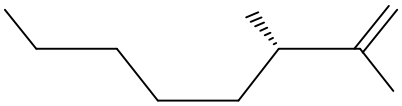


Catechin



Gallic acid

H_2NH_2O



OH

Lysine

Figure 2: Bioactives from *Acacia nilotica Linn*

3. PHARMACOLOGY

3.1. Antioxidant activity

Acacia species are a rich source of polyphenolic compounds, known to have strong antioxidant properties that help in the prevention and therapy of various oxidative stress-related diseases including cardiovascular, neurodegenerative, and cancer. Methanolic extract of the plant contains Kaempferol which is responsible for the antioxidant activity of the plant. (Singh B.N, et al 2009).

3.2. Antiplatelet Aggregatory & Anti-quorum sensing

Activity: The extract of the plant block platelet aggregation mediated by platelet agonists, arachidonic acid, ADP, platelet-activating factor, and collagen. It blocks the aggregation of platelet induced by the Ca^{+2}-channel (Dymock W, 2005)

3.3. Antibacterial activity

The plant extract showed potent antibiotic activity against four bacterial species: gram-positive; *Bacillus subtilis*, *Staphylococcus albus*, *Streptococcus faecalis*; gram-negative, *Escherichia coli* and two fungal species: *Candida albicans* and *Aspergillus flavus* (Chaubal R, Tambe A, 2006)

3.4. Antifungal activity and Antiviral activity

Acacia nilotica species can be regarded as promising resources for antibacterial drugs due to their highly active nature. Antifungal activity of methanolic extracts and aqueous extract of *A. nilotica* with percentage inhibition ranging from 34.27± 1.45 to 93.35±1.99.Dried fruits of *Acacia nilotica* are active against *C. albicans* and are used to treat oral (Jansen, P.C.M,2005). Methanolic extract of the plant is active against two animal viruses: Newcastle Disease and Fowlpox Viruses.

3.5. Antimicrobial Activity

Antimicrobial activity of the crude ethanolic leaf extract of *Acacia nilotica*Linn against *Campylobacter coli* isolated from goats. The highest zone of inhibition was observed with the 70 mg/ml concentration has studiedtheantimicrobial activity of ethanolic extracts of the stem bark against *Streptococcus viridans*, *Staphylococcus aureus*, *Escherichia coli*, *Bacillussubtilis*, and *Shigellasonnei*usingtheagardiffusion 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. has explored the antimicrobial activities of the crude ethanolic extracts of five plants against multidrug-resistant (MDR) strains of Escherichia coli, Klebsiella pneumonia, and Candida albicans and ATCC strains of Streptococcus mutants, and different strains ofmicroorganism (Saini M.L.,2008 and Mahesh B,2008)

3.6. Antimalarial activity

The root extracts of *A. nilotica*were active against *Plasmodium berghei* and *Plasmodium falciparum* in mice.*In vitro* Antimalarial activity against CQ sensitive (3D7) and CQ-resistant (Dd2 and INDO) strains of *P. falciparum* in culture using the fluorescence-based SYBR (Ali A.J.,2010). *A. nilotica* was reported with significant activity and IC50 was found at 13µg/mL *Acacia nilotica*hasthe highest Antiplasmodial activity *in vitro* against *Plasmodium falciparum* 3D (chloroquine-sensitive) and Dd2.(Chloroquine-resistant and pyrimethamine sensitive) organisms (Khan Rosina,2009)

3.7. Anti-Diarrhoeal Activity

Acacia nilotica has been reported to be very useful in treating diarrhea andcoughinhumans.Thepowderedbarkof theplantwith a littlesaltisusedfortreatingacute diarrhea. Methanol and chloroform extract exhibit activity against Escherichia coli. (Chaubal R. et al 2006).It reduces the number of unformed feces and decreased the intestinal transit of charcoal.

3.8. Antispasmodial activity

The aqueous extract of seeds of *Acacia nilotica* shows spasm genic activity on the isolated guinea-pig ileum. The mechanism behind it may be an increase in calcium influx that results in muscle spasms (Tahir A.E, et al, 1999)

3.9. Antihypertensive activity & Vasoconstriction activity

Methanol extract of *Acacia nilotica* pods causes a decrease in arterial blood pressure at a dose (3–30 mg/kg). It produces an inhibitory effect on force and rate of contraction in guinea-pig paired atria.Aqueous extract of *Acacia nilotica*possesses vasoconstriction by increasing calcium ion influx which is responsible for vasoconstriction action in guinea-pig ileum. The extract shows dose-dependent sustained contractile activity Eline (M.B. Ouedraogo, 2004)

Conclusion:

The various extracts of*Acacia nilotica have nine* different pharmacological activities, proved in most animal studies. Further in-vivo evaluation can help to develop the new drug dosage forms.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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