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Review Article

A Review on A Medicinal Tree *Acacia Nilotica* and *Hibiscus Sabdariffa*

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ABSTRACT

Acacia and Hibiscus, two prominent genera in traditional medicine, have garnered significant attention for their diverse pharmacological properties. Acacia species are known for their rich phytochemical profiles, including tannins, flavonoids, and saponins, which contribute to their antioxidant, anti-inflammatory, antimicrobial, and wound-healing activities. Similarly, Hibiscus, particularly Hibiscus sabdariffa, is renowned for its high anthocyanin content, lending potent antioxidant, antihypertensive, and lipid-lowering effects. This review explores the medicinal activities of Acacia and Hibiscus, highlighting their bioactive compounds, mechanisms of action, and therapeutic potential. Additionally, we address recent advancements in their applications in modern medicine, emphasizing their roles in combating chronic diseases and promoting overall health. This comprehensive overview aims to bridge traditional knowledge with contemporary research, paving the way for future investigations and potential clinical applications.

INTRODUCTION

Medicinal plants have played a crucial role in traditional and modern medicine due to their bioactive compounds, which possess therapeutic properties. Among these, *Acacia nilotica* and *Hibiscus* species are well-known for their diverse pharmacological activities, making them valuable in herbal medicine across various cultures.[1] [The genus Hibiscus contains a number of species, but Hibiscus sabdariffa, or roselle, is the one most frequently used in traditional medicine. Hibiscus is

a plant that originated in tropical regions and has long been used for its therapeutic properties, which are mostly obtained from its calyces, leaves, and flowers.[2] Rich in flavonoids, anthocyanins, and organic acids, hibiscus offers several health advantages. Both *Acacia nilotica* and *Hibiscus* species are highly valued in both traditional and modern medicinal systems due to their many pharmacological qualities. Because of their antibacterial, antioxidant, anti-inflammatory, and other therapeutic properties, which aid in the

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management of a range of medical conditions, they are vital components of natural medicine and alternative treatments.[3]

Morphological Discription

1.Acacia nilotica

Acacia nilotica (L.), commonly known as the gum arabic tree, Egyptian thorn, or Babul, belongs to the family **Fabaceae**. It is a perennial tree that can grow in a variety of tropical and subtropical climates, often found in dry and semi-arid regions.

Height: *A. nilotica* is a medium-sized tree, typically growing to a height of 5–20 meters, but it can reach up to 25 meters in favorable conditions.

Trunk: The trunk is dark brown to black in color, with deeply fissured bark. It often exudes a gum that is used in medicinal and commercial applications.

Leaves: The leaves of *A. nilotica* are bipinnately compound, with each pinna consisting of small, feathery leaflets. The leaflets are oval-shaped, measuring about 1–2 mm long. The leaves are alternately arranged and finely textured, giving the tree a delicate, airy appearance.

Thorns: One of the key identifying features of *Acacia nilotica* is its straight, sharp thorns, which grow in pairs at the base of the leaves. These thorns are usually 2–5 cm long and help protect the tree from herbivores.

Flowers: The flowers are bright yellow and are arranged in globose heads or small spherical clusters. Each flower head measures about 1.2–1.5 cm in diameter, and the tree typically flowers from July to September. The flowers have a pleasant fragrance and attract a variety of pollinators.

Fruit: The fruit of *A. nilotica* is a leguminous pod, which is flat, thick, and indehiscent (does not split open when mature). The pods are grayish-brown to dark brown, about 7–15 cm long, and are constricted between the seeds, giving them a segmented appearance. The pods contain hard,

brown seeds, which are dispersed by animals and water.

Roots: The root system of *A. nilotica* is deep and extensive, which allows it to survive in arid conditions. It often forms a symbiotic relationship with nitrogen-fixing bacteria, enhancing soil fertility.[4,5]

Medicinal Use

1 Acacia nilotica

1.1Antibacterial Activity

Staphylococcus aureus, *Salmonella* species, and *Escherichia coli* are particularly susceptible to the broad-spectrum antibacterial properties of *Acacia nilotica*. This action is mostly caused by its high tannin content, which degrades microbial cell walls and inhibits enzyme function.[6] The antibacterial activity of the stem bark extracts is confirmed against *Shigella sonnei*, *Escherichia coli*, *Bacillus subtilis*, *Streptococcus viridan s*, and *Staphylococcus aureus* using the agar diffusion technique. One possible source of antibacterial agents is *Acacia nilotica*. [7] *Acacia nilotica* exhibits the highest action against three bacterial strains (*E. coli*, *S. aureus*, and *Salmonella typhi*) and two fungal strains (*Candida albicans* and *Aspergillus niger*).

1.2Antifungal Activity

The plant successfully fights off a variety of fungal illnesses, including *albicans*, which causes yeast infections. Its antifungal properties are due to its tannins and polyphenols.[9] The bark's polyphenolic complex at 50% concentration showed the highest growth inhibition (56%) against *Fusarium oxysporum* when compared to controls. The extract showed 24% and 37% inhibition at the 10 and 25% dilutions, respectively, in *in vitro* testing. The floral extract demonstrated 65% inhibition against *Alternaris solani* conidial germination during a 10-hour treatment period. Using the agar diffusion method, the tests of the stem bark extracts verify the antibacterial activity against *Shigella sonnei*,



Escherichia coli, *Bacillus subtilis*, *Streptococcus viridans*, and *Staphylococcus aureus*. Antimicrobial agents may be found in *Acacia nilotica*. [10]

1.3 Antioxidant Properties

Packed with flavonoids and polyphenols, *A. nilotica* is a strong antioxidant that helps fend off oxidative stress and neutralise free radicals. This might aid in the prevention of long-term conditions including cancer and heart problems. [11] In the lipid peroxidation experiment, water extracts and fractions of *Acacia nilotica* have the ability to scavenge peroxy radicals, and the results demonstrate the plant's antioxidant activity. Using maceration extraction, the plant extracts' bark powder exhibited scavenging activity in a variety of solvents. [12] According to another research, *Acacia nilotica* is a readily available natural antioxidant source that may be used as a supplement to help treat diseases including cancer, diabetes, inflammation, and others that are mediated by free radicals. [13] Additionally, hydroxyl groups in phenolic compounds that may scavenge free radicals may be the cause of *Acacia nilotica*'s strong scavenging ability. [14]

1.4 Anti-inflammatory Activity

Flavonoids and phenolic chemicals, which block inflammatory mediators, are linked to *A. nilotica*'s anti-inflammatory qualities, which have historically been used to treat ailments including arthritis. [15]

1.5 Anti-hypertensive and anti-spasmodic activities

Using a methanolic extract of *Acacia nilotica* pods has been shown to lower arterial blood pressure and has anti-hypertensive properties that are not dependent on muscarinic receptor activation. *Acacia nilotica* inhibits the force and rate of spontaneous contractions in the rabbit jejunum and guinea-pig paired atria in in vitro experiments. Additionally, *Acacia nilotica* prevents K⁺-induced

contractions in the rabbit jejunum, supporting its antispasmodic action through calcium channel blockade, which may also account for the plant's ability to lower blood pressure in in vivo studies. [16] The isolated guinea-pig ileum is also subjected to an aqueous extract of *Acacia nilotica* seed, which reveals the sustained dose-related contractile activity. The extract causes a dose-related, substantial rise in blood pressure when administered intravenously. [17]

Fruit: The fruit of *Hibiscus* is a dry capsule, which typically contains multiple seeds. In *H. sabdariffa*, the fleshy calyx (the outer whorl of the flower) becomes swollen and bright red as the fruit matures, and it is this part that is harvested for its medicinal and culinary uses. The calyx is used to make hibiscus tea and other herbal products.

Roots: Hibiscus species generally have a fibrous root system

1.6 Antiplasmodial activities

The extract with the strongest effect on *Plasmodium falciparum* is ethyl acetate. According to phytochemical research, the most active phase was free of alkaloids and saponins and included terpenoids and tannins. [18] Significant efficacy against the chloroquine-sensitive strain of *Plasmodium berghei* in mice is demonstrated by crude methanolic root extracts of *Acacia nilotica*. [19]

1.7 Acetylcholinesterase inhibitory activities

One of the main goals of Alzheimer's disease therapy is to increase acetylcholinesterase. Because of its strong acetylcholinesterase inhibitory effects, *Acacia nilotica* has been shown to influence central nervous system functions. In order to treat Alzheimer's, further research is needed [20]

2. Hibiscus Sabdariffa

There are more than 200 species in the genus *Hibiscus*, which belongs to the family Malvaceae. Although other species, such as *Hibiscus rosa-sinensis*, are equally well-known, *Hibiscus*



sabdariffa (Roselle) is the most widely recognised species for therapeutic uses.

Morphological Description

Height: The majority of hibiscus species, including *H. sabdariffa*, are shrubs or small trees that range in height from one to three meters. On the other hand, *Hibiscus rosa-sinensis* may reach a height of five meters.

Stem: The stems of *Hibiscus* species are usually erect and branched. In *H. sabdariffa*, the stems are often red to purple, adding to the plant's ornamental value. Stems can be woody or semi-woody, depending on the species.

Leaves: The leaves of *Hibiscus* are simple, alternate, and often have a lobed or serrated margin. In *H. sabdariffa*, the leaves are deeply divided into 3–5 lobes, with serrated edges. They are typically dark green, but some species have purplish or reddish hues on their leaves.

Flowers: One of the most striking features of *Hibiscus* species is their large, showy flowers, which can range from 4 to 18 cm in diameter. The flowers have five petals, which can be red, pink, white, yellow, or orange, depending on the species. In *H. sabdariffa*, the flowers are typically pale yellow or white with a dark red center. The flowers are funnel-shaped, with a prominent central column of stamens (male reproductive organs). *Hibiscus* flowers usually bloom for a short duration but are abundant.

that supports their shrubby growth. In some species, like *H. sabdariffa*, the roots are taprooted, helping the plant to survive in drought conditions[21,22]

Medicinal Use

2.hibiscus sabdariffa

frequently used in folk medicine to cure fever, liver disorders, and hypertension, as well as to produce drinks and pickles. Antihypertensive, antioxidant, anticancer, anti-clastrogenic, hypolipidemic, hepatoprotective, anti-stress,

antispasmodic, antidiuretic, and antidiarrheal properties are said to be present in the plant.[23]

2.1Antidepressant activities

The antioxidant properties of roselle flower extract include quercetin, sianidin, β -carotene, and vitamin C, which are easily absorbed and metabolised components.[24] Oxidative stress reduces antioxidant defences and increases the production of free radicals, which play a significant part in the aetiology and progression of diabetes. The reduction of molecular oxygen from superoxide anions produces free radicals like hydrogen peroxide and hydroxyl radicals. Reactive oxygen species buildup causes cellular proteins, nucleic acids, and membrane lipids to be destroyed.[25]

2.3 Anticancer Activity

About 10 years ago, research into the *Hibiscus sabdariffa* plant's potential as an anticancer agent started, and the findings were promising. In a variety of human cancer cell types, the plant's crude extracts and pure chemicals have been shown to provide chemoprevention, selective cytotoxicity, cell cycle arrest, apoptosis, autophagy, and antimetastatic effects. Numerous polyphenolic chemicals found in *Hibiscus sabdariffa*, including delphinidin-3-sambubioside and protocatechuic acid, have been shown to induce apoptosis in human leukaemia cells and gastric cancer cells, respectively.[26] *Hibiscus sabdariffa* has been shown by several studies to have cytotoxic, antimutagenic, antimetastatic, antiproliferative, apoptotic, and antiangiogenic properties in both human and animal cancer cells. *Hibiscus sabdariffa*'s antioxidant and anticarcinogenic properties are attributed to the polyphenols that are present in the plant [26–32]. Hepatocellular carcinoma cell line Hep 3B was used to investigate the anticancer potential of *Hibiscus sabdariffa* leaf extracts (methanol, ethanol, ethyl acetate, and chloroform). The methanolic extract had a higher cytotoxic impact



than the other extracts[33] Hibiscus sabdariffa Linn extracts in ethanol, ethyl acetate, and hexane have been identified as possible natural anticancer agents against the lung cancer cell line A 549 [34]. In a different investigation, male Wistar rats given monosodium glutamate were used to test the effects of Hibiscus sabdariffa aqueous extract against cyclophosphamide (CPA). When compared to the positive control group, the group treated with Hibiscus sabdariffa aqueous extract showed a 91% decrease in micronucleus frequency, suggesting that it might be used as a chemopreventive agent to prevent carcinogenesis [35].

2.4 Hair Growth Promoting Activity

According to reports, Hibiscus Rosa-sinensis Linn offers a broad spectrum of medicinal benefits on many illnesses. Numerous conventional methods have been used to assess these therapeutic benefits. The current study investigated the ability of a petroleum ether extract of Hibiscus Rosa Sinensis leaves to stimulate hair development in male albino rats. A 2% ethanolic solution of minoxidil was used as a benchmark to examine the test sample's ability to promote hair growth. The pharmacological activities of the sample have been assessed using both qualitative and quantitative methods. When compared to conventional methods, the hair-promoting activity of Hibiscus Rosa Sinensis Linn's petroleum-ether extract is much higher.[36]

2.5 Anti-Pyretic Activity

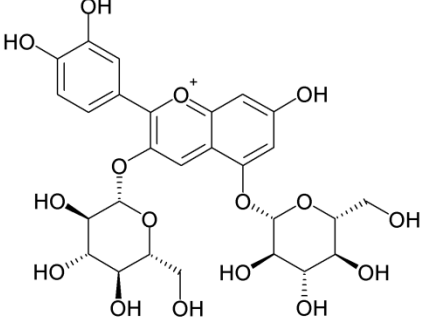
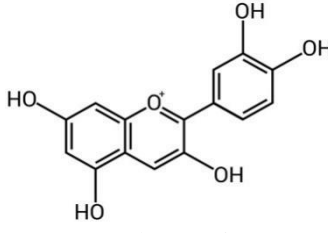
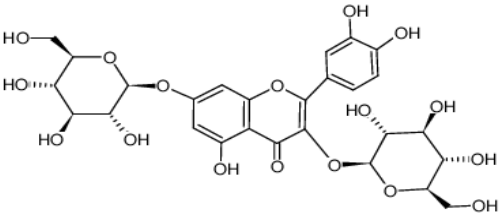
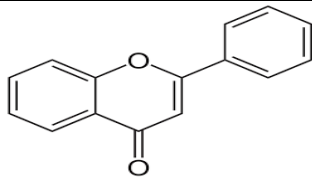
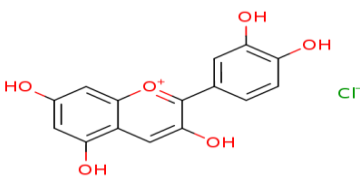
was documented, and local populations have long utilised Hibiscus Rosa Sinensis to cure fever. However, there is little evidence to back up the antipyretic properties. The white-colored flowers of Hibiscus Rosa Sinensis and Hibiscus Rosa Sinensis var. Alba were employed as ethanolic

extracts. Heavy metal screening, phytochemical analysis, and acute toxicity testing were used to assess the safety of the extracts. Rats were injected with Brewer's Yeast s.c. to cause fever, and in the first model, four extracts were administered at levels of 5 and 50 mg/kg. The test doses for the investigation were determined by conducting an acute toxicity test. The reference medication was 100 mg/kg of ibuprofen. Rats' temperatures were recorded using a digital thermometer. Therefore, it was determined that, when compared to the positive control group, a substantial ($p < 0.05$) decrease in the overall temperature was achieved with white flower extract at 5 mg/kg and 50 mg/kg. This implied the potential for its therapeutic efficacy as a plant-based antipyretic agent, which is also asserted by practitioners of traditional medicine [37].

2.6 Hypolipidemic Activity

was assessed using seven groups of male Wistar rats weighing between 180 and 230 grammes, with six in each group ($n = 6$). The first group served as a control, while the second, third, and fourth groups received oral doses of Hibiscus Rosa Sinensis flower extracts at 80 mg/kg, 160 mg/kg, and 240 mg/kg b. w. once daily for five days, followed by the same dosages for thirty days. The blood was drawn and allowed to coagulate using the cardiac puncture procedure. Serum was separated in order to estimate the levels of TG, TC, LDL, HDL, and VLDL. a notable rise in HDL levels and a decline in TG and serum cholesterol levels. Consequently, Hibiscus Rosa Sinensis extract has hypolipidemic and hypocholesterolemic properties. Phenolic active principles were shown to be in charge of raising HDLC and decreasing TC and LDLC in hypercholesterolemic rats [38].

TABLE 1 : Plants and their chemical components with corresponding mechanism of action

Plant	Chemical components principle bioactive compound	Mehanism of action	Reference
Hibiscus rosa-sinesis	 <p>Cyanidin 3,5-diglucoside Anthocyanin</p>	Cell Membrane Disruption	[39]
Hibiscus rosa-sinesis	 <p>Anthocyanin</p>	Inhibition of Enzyme Activity	[39]
Hibiscus rosa-sinesis	 <p>Quercetin-3,7-diglucoside Flavonoids</p>	Inhibition of DNA/RNA or protein synthesis	[39]
Hibiscus rosa-sinesis	 <p>Flavonoids</p>	Plasma memben dispurtion	[39]
Hibiscus rosa-sinesis	 <p>Cyaniding chloride</p>	Mytocondriyal dysfunction	[39]

CONCLUSION

In summary, this analysis of early and contemporary research papers validated a number of the therapeutic benefits of extracts from Acacia pods, stem bark, roots, and leaves. Antimicrobial, antiparasitic, antidiabetic, antihyperlipidemic,

anticancer, antimutagenic, antipyretic, anti-inflammatory, antinociceptive, antiulcer, antihypertensive, antispasmodic and antidiarrheal, and antioxidant properties were among the numerous therapeutic benefits that were mentioned in this study.

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