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REVIEW ON PHARMACOLOGICAL ACTIVITIES OF *ARTOCARPUS HIRSUTUS LAM*

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ABSTRACT

The fruit known as "wild jack," or *Artocarpus hirsutus*, is a member of the Moraceae family and is frequently eaten. Its seeds are highly rich in polyphenolic components. The goal of the review is to indicate the biological diversity of *Artocarpus hirsutus*. Anti-inflammatory, anti-diabetic, anti-acne, anti-ulcer, analgesic, antioxidant, antimicrobial, wound-healing, anti-arthritic, antifungal, and anti-cancer properties were among the several therapeutic effects that emerged from the chemical composition.

KEYWORDS: *Artocarpus hirsutus*, chemical composition, Therapeutic effects, Anti-inflammatory activity.

INTRODUCTION

Artocarpus hirsutus Lam., also known as Wild Jackfruit, is a member of the Moraceae family. Typically growing 20–25 m tall and up to 5 m in girth, *Artocarpus hirsutus* is a tall, evergreen tree with edible, bright yellow, ovoid, spine-covered fruits and white, ovoid seeds. It grows well in any kind of soil and needs a warm, humid climate with lots of rainfall. It is found throughout the Western Ghats, from North Karnataka to the Malabar Coast and Travancore. Hortus Malabaricus, the oldest printed book on Asia's natural plant wealth, mentions it in its third volume provides extensive documentation of the medicinal benefits of

Artocarpus hirsutus, also known as wild jack, which is native to Kerala. It is said that a root and bark infusion can treat diarrhoea. The leaves are thought to treat chronic haemorrhage and venereal buboes when combined with white camphor and curcuma root, respectively. The unripe fruits are cooked and its juice is applied to the anus to increase the appetite and lessen bleeding pain. *Artocarpus hirsutus* seeds have also been used as anti-arthritic, Gastro protective, Anti-cancer, Anti-ulcer, Anti-oxidant, Anti-cancer and Anti-diabetic properties.[1]

PHARMACOLOGICAL ACTIVITY OF *ARTOCARPUS HIRSUTUS LAM* LEAVES

Analgesic and Anti-inflammatory Activity

Many health issues have been treated with *Artocarpus hirsutus Lam* in traditional medicine, Ayurveda, and folklore. The phytoconstituents present in the ethanolic leaf extracts of Artocarpus hirsutus Lam. were identified in this study. The protein denaturation method was used to evaluate the in vitro anti-inflammatory properties of *Artocarpus hirsutus Lam.*, as inflammatory diseases are primarily caused by the denaturation of tissue proteins. Substance which are restrict the denaturation of protein are meritorious in the anti-inflammatory drug development. From this investigation the ethanolic extract of *Artocarpus hirsutus* Lam is more effective than that of diclofenac sodium and it has anti-inflammatory activity.[2]

Anti-ulcer Activity

The ethanolic leaf extract of *Artocarpus hirsutus Lam* may possess properties of anti-ulcer. Preliminary phytochemical analysis revealed that the extract contains proteins, reducing sugars, steroids, alkaloids, flavonoids, saponins, and tannins. Studies on acute oral toxicity confirmed the safety of the extract at doses up to 2000 mg/kg. The leaf extract exhibited notable, dose-dependent anti-ulcer activity in both the rat pylorus-ligated gastric ulceration model and the ethanol-induced gastric ulcer model.[3]

Anti-arthritic Activity

Flavonoids and other active constituents were found in *Artocarpus hirsutus lam*, according to the qualitative phytochemical analysis conducted for this study. Based on the findings, it can be said that *Artocarpus hirsutus lam's* tender leaves have strong anti-arthritic properties. The extract's anti-arthritic properties in in vitro were assessed in relation to the denaturation of bovine albumin. The result shows that the extract inhibited the denaturation of proteins (albumin) in a concentration-dependent manner. The phytoconstituents like terpenoids, flavonoids and coumarin, glycosides, saponin and steroids shows the anti-arthritic activity.[4]

SEEDS

Anti-cancer Activity

Diterpenes, cardiac glycosides, Flavonoids, saponins, tannins, phenols, and steroids were found in fruit seeds of *A. hirsutus*, according to phytochemical analysis of the plant extract and qualitative studies. GC-HRMS (Gas Chromatography-High Resolution Mass Spectrometry) analysis revealed high levels of glycerides, flavonoids, palmitic acid, diterpenes, ester, aldehyde, pyrans, phenols, phytols, vitamin E and fatty acids. Hoechst staining, Acridine orange ethidium bromide (AO/EB), JC-1 staining and dual staining demonstrated that MAH (Marketing Authorization Holder) activated an intrinsic mitochondrial pathway to cause apoptosis in breast cancer cells, with MCF-7 (Michigan Cancer Foundation-7) cells exhibiting a more pronounced apoptotic response. The Bcl-2 (B-Cell Lymphoma 2) gene and Bcl-2 protein expressions were found to be significantly downregulated upon treatment with MAH, with MCF-7 exhibiting the most notable downregulation, according to real time qPCR and western blot analysis. The anticancer effect of MAH may be attributed to the various phytochemicals present in the extract, as demonstrated by GC-HRMS and qualitative phytochemical analyses. The present study demonstrated that the methanolic extract of *Artocarpus hirsutus* seeds exhibited anticancer activity against both hormone-independent and hormone-dependent breast cancer cell lines. Additionally, the *A. hirsutus* seed methanolic extract might be more advantageous for hormone-dependent breast cancers.[5]

Anti-diabetic Activity

A single intraperitoneal injection of freshly made streptozotocin at a dose of 30 mg per kg caused rats to develop diabetes. When the blood glucose level was ≥ 250 mg/dl, diabetes was induced. All rats underwent the Oral Glucose Tolerance Test (OGTT), and the outcomes are assessed. Phytochemicals such as phenols, tannins, flavonoids, stilbenoids, benzofurans, and lecithin were detected in the obtained ethyl acetate extract after the extraction process was finished. Rats with diabetes treated with ethyl acetate extract had significantly lower blood glucose levels than rats given streptozotocin.[6]

Anti-oxidant Activity

Artocarpus hirsutus seeds serve as a valuable reservoir of secondary metabolites. The presence of components known to have both physiological and medicinal properties was discovered through phytochemical analysis of the different seed extracts. Phytochemicals including phytosterols, flavonoids, fixed oils, phenols, tannins, carbohydrates, and proteins were found in the plant extracts after analysis. Phenolic compounds can be isolated from all extracts using the HPTLC solvent system (toluene, ethyl acetate, and formic acid). Phenolic compounds were detected in the HPTLC fingerprints of both roasted and non-roasted ethanolic seed extracts, but were absent in all other types of seed extracts. Therefore, for commercial purposes, the seed extract of ethanolic extract cannot be substituted with any seed extract of other. In comparison to the reference standard ascorbic acid, both different *Artocarpus hirsutus* seed extracts demonstrated strong antioxidant activity in the study. The reports of this study showed that water, methanol, and ethanolic seed extracts had stronger antioxidant activity than other extracts.[7]

BARK

Anti-bacterial Activity

The agar diffusion technique on Muller Hinton agar was employed to evaluate anti-bacterial activity. Stipule samples and powdered bark from each species were individually weighed and extracted using Soxhlet apparatus with solvents including distilled water, ethanol, chloroform, benzene, acetone and petroleum ether. Test microorganisms such as Pseudomonas aeruginosa, Bacillus subtilis, Salmonella typhi and Escherichia coli were used for the assay. The molten agar medium was poured into sterile petri dishes and incubated at 37°C for 24 hours. All six solvents acetone, ethanol, chloroform, benzene, distilled water and petroleum ether exhibited significant antibacterial effects, as indicated by large zones of inhibition.[8]

Anti-acne Activity

The phytoactives from the stem bark of *Artocarpus hirsutus* were used as anti-acne agent. The ethanolic stem bark extract of *Artocarpus hirsutus* provided two phytoactive constituents 1. Pyranocycloartobiloxanthone A, 2. Artonine E. In vitro anti-acne activity of compounds 1 and 2 were evaluated by agar well diffusion method.[9]

Anti-microbial Activity

The agar well diffusion method was employed to evaluate the anti-microbial activity of *Artocarpus hirsutus* bark extract. *Bacillus subtilis, E. coli and Pseudomonas aeruginosa* were selected for investigation. Muller Hinton agar plates were prepared by spread plating and wells were made. Two different concentrations of the aqueous bark extract were introduced into the wells, followed by incubation for 24 hours. Notably, even at lower extract concentrations, *Pseudomonas aeruginosa* and *E. coli* exhibited inhibition. The observed antimicrobial activity of the extract may be attributed to the presence of phytochemicals such as alkaloids, tannins, and saponins.[10]

ROOT

Anti-oxidant Activity

The phytoconstituents present in chloroform extract such as, carbohydrates, terpinoids, saponins, phenolic compounds, alkaloids, flavonoids. The ethanolic extract showed the presence of glycosides, carbohydrates, alkaloids, phenolic compounds, terpenoids, flavonoids and steroids. The free radical scavenging activity of root extracts of *Artocarpus hirsutus* was carried out by DPPH (1, 1-Diphenyl, 2-picry hydrant) method. The ethanolic and chloroform extract was evaluated and compared with standard ascorbic acid. The chloroform extract shows IC50 (Half maximal Inhibitory Concentration) value of 10µg/ml and ethanolic extract shows IC50 value of 7µg/ml and IC50 value of standard ascorbic acid is 40µg/ml. Hence at low concentration the chloroform and ethanolic extract of dried roots of *Artocarpus hirsutus* showed higher ant-oxidant activity when compared with standard ascorbic acid.[11]

Anti-carcinogen Activity

The dried roots of ethanolic and chloroform extract of *Artocarpus hirsutus* showed cytotoxic activity were evaluated on colon cancer cell line HT-29 and compared with standard drug 5-fluorouracil by using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. The IC50 value of ethanolic and chloroform extract is 51.05µg/ml and 58.7µg/ml respectively. IC50 value of standard 5-fluorouracil was found to be 8.8µg/ml. The ethanolic extract was more effective than chloroform extract so the ethanolic extract selected to assess the cytotoxicity against the normal vero cell line. Thus the erhanolic extract inhibit the growth and more toxic against the cancer cell line.[12]

FRUIT

Anti-microbial Activity

The anti-microbial activity of fruit extract of *Artocarpus hirsutus* were tested against fungal and bacterial strains. Acetone extract isolated from fruit of *A. hirsutus* have good active anti-bacterial activity. The organism such as *S. Aureus, Klebsiella species, enterobacter species* were taken. The acetone extract showed maximum zone of inhibition against *S. Aureus*. The phytochemical preparations with high flavonoid and saponin contents have been reported to exhibit anti-microbial activity against pathogenic microorganism.[13]

Anti-oxidant Activity

Various in vitro assays, including the DPPH free radical scavenging assay and the reducing power method, were used to evaluate the antioxidant potential of the methanolic extract of *Artocarpus hirsutus* fruit. The DPPH radical scavenging activity of the extract increased with concentration, reaching 27.6% at 250 µL. Although the extract demonstrated lower scavenging activity compared to the standard antioxidant BHA (Butylated Hydroxyanisole), it still showed a concentration-dependent antioxidant effect.

In the reducing power assay, Notable activity was observed in the methanolic fruit extract of *Artocarpus hirsutus*. The reducing power increased with concentration, although it remained lower than that of the standard, ascorbic acid. At 500 mg/L, the extract had an absorbance of 0.46 compared to 1.10 for ascorbic acid at 40 mg/L. These findings suggest that the methanolic extract of *Artocarpus hirsutus* fruit possesses significant antioxidant properties.[14]

CONCLUSION

Artocarpus hirsutus lam commonly used tree by folk people for agricultural, food, health care uses and timber purpose. Ethnobotanical studies show that various parts of this tree are useful for pain, snake bite, swelling, venereal buboes, hydrocele, chronic haemorrhage, pimples and cracks of the skin, joint pain and rigidity, asthma, ringworm infection, wound healing, fractures, abdominal problems like ulcer, diarrhoea, etc. The phytochemical screening of *Artocarpus hirsutus* plant parts showed the presence of phytochemical constituents namely alkaloids, carbohydrates, glycosides, saponins, flavonoids, Terpenoids, protein and tannins in various proportions in aqueous extracts which have great medicinal and pharmacological properties. *Artocarpus hirsutus* has been traditionally used in various ethnomedicinal practices and has demonstrated diverse pharmacological activities. It possesses notable phytochemical and nutritional properties and shows no adverse effects on living cells.

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