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ETHNOPHARMACOLGY OF *ARTOCARPUS HETEROPHYLLUS*-AN UPDATED REVIEW

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Abstract

Since ancient times, medicinal plants have been used to treat illness and disease all throughout the world. They contain compounds with medicinal properties, and additional research on these molecules has resulted in the creation of novel medications. Nowadays, medicinal plants play an important role in the development of plant-based medications. *Artocarpus heterophyllus* is a type of tree. The plant belongs to the Moraceae family and is found primarily in the forests of India's western ghats. *Artocarpus heterophyllus* is rich in flavonoids, reducing sugars, proteins, and minerals. It has long been used to treat diarrhoea, wound healing, and other ailments. Ulcers, skin problems, and anti-bacterial, anti-inflammatory, anti-diabetic, and anti-fungal properties.

Keywords: Artocarpus heterophyllus, Traditional uses, Pharmacological actions.

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Introduction

The plant *Artocarpus heterophyllus* is a member of the Moraceae family. The nations of the tropics where jackfruit is typically grown include Sri Lanka, Bangladesh, Burma, the Philippines, Indonesia, Thailand, Malaysia, and Brazil. Jackfruits are a seasonal fruit that are widely accessible in the summer. The largest tree borne fruit in the world, it is a massive, evergreen tree that can grow to be between 10 and 30 meters tall. It also has a lengthy tap root and a dense crown. Boiling jackfruit seeds and including them into meals that contain 77% starch [1]. As an example, the fruit pulp and seeds are used as a cooling tonic, the roots are used to treat diarrhea, the leaves are used to stimulate lactation, and the ash from the leaves is used to treat various conditions [2].

It is a monoecious tree, and on the same tree, both male and female inflorescences can be found [3]. Cross-pollination is used for fertilization, and seeds are mostly used for propagation. Depending on the country, the entire fruit growth process can take anywhere between three and seven months from the time of pollination [4]. These oblong, cylindrical, dicotyledonous fruits have a length that varies from 22 to 90 centimeters and a

diameter that ranges from 13 to 50 centimeters. Individual fruits can weigh anywhere between 2 and 20 kilograms, while larger fruits have been known to weigh up to 50 kilograms [5].

Jackfruit seeds measure 2-3 cm in length and 1-1.5 cm in diameter, and they are spherical and light brown. The flesh surrounds them, and they are wrapped in a white aril that is covered by a thin layer of brown spermoderm. These have been reported to be high in both proteins and carbs [6].

Growth & Distribution

The jackfruit tree, *Artocarpus heterophyllus*, is native to the rainforests of Malaysia and the southern part of the Western Ghats of India. It has been intensively cultivated for generations in many parts of the tropics region, particularly in the Southeast Asia. Today, it is a significant fruit of India, Myanmar, China, Sri Lanka, Maldives, and Sri Lanka [7].

Botanical Description

Size and form

The evergreen tree *Artocarpus heterophyllus* is of modest size. It normally grows to a height of 10 to 20 meters with a stem diameter of 30 to 80 centimeters. The tree has a thick crown and a lengthy taproot. The rough, straight stem is clothed in a green or black bark. When a plant is injured, yellowish, sticky latex that covers every part of the plant seeps out [10].

Flowers

Due to the presence of both male and female structures on the same plant, this species is bisexual. Male flower heads are bloated, elongated, 1-4 cm long, and 1 cm wide. When pollen reaches maturity, it is covered with yellow and sheds quickly. Female flower heads are oblong and similar to male flower heads but do not contain pollen. A little green ring surrounds the stalks of the flower heads [11].

Leaves

The leaves are glossy, leathery, and oblong, oval, or elliptic in shape, measuring 4–25 cm long and 2–12 cm wide. The upper surface is deep green in color. Developing leaves are prematurely lobed. The leaves' apex is blunt and taper toward the base [11, 12].

Fruits

The main branches and trunk are where you'll find the fruits. A compound or numerous fruit called a jackfruit has a thick, rubbery, whitish to yellowish wall with an external rind that ranges in color from green to yellow-brown. The fruit was held together by its fibrous center. The fruit typically weighs between 4.5 and 30 kilograms. The fruits ripen in between 90 and 180 days [7, 11].

Seeds

The seeds are either light to dark brown or golden yellow in color. They have a 1- to 1.5-cm diameter, are spherical, and are surrounded by a thin, whitish membrane. The seeds can be kept for up to a month in cold, humid settings, although they are susceptible to fungus infection [7].

Phytochemical Constituents of Jackfruit

Numerous kinds of chemicals, including carotenoids, flavonoids, volatile acids, sterols, and tannins, have been found in jackfruit, and studies have shown that the concentration of these components varies with the variety. The ratio of carotenoids in jackfruit is thought to give it the diverse yellow to orange hues of color that they do because they are known to give foods a yellowish-red color [13].

Additionally, it has been claimed that the jackfruit plant contains artocarpine, artocarpetin, artocarpetin A, cycloheterophyllin, artonins A, artonins B, morin, dihydromorin, oxydihydroartocarpesin, cynomacurin, artocarpin, isoartocarpin, cyloartocarpin, artocarpesin [14].

Traditional Uses of Jackfruit

Leaves

Extract from leaves is used to treat asthma, prevent ringworm, and regulate diabetes. Heat from leaves relieves pain and heals wounds, abscesses, and ear issues. A mature leaf infusion used to treat gallstones. Jackfruit leaf ash is used to treat ulcers [15].

Seeds

Aphrodisiac properties of roasted seeds. Vitamin A is abundant in the ripe jackfruit's kernels. Seed extract aids in digestion and is beneficial for diarrhea and dysentery [15].

Woods

The wood has relaxing effects, and the pith is thought to promote abortion. Wood is utilized as fuel and for furniture [16].

Roots

The root extract is used to treat diarrhea, asthma, and skin conditions [16].

Latex

Latex can be used as an adhesive. The latex is made up of resins that can be used to make varnish.¹⁶

Fruits

The young fruit is used to pickle and prepare vegetables. The pulp of ripe fruit is consumed fresh or used to make regional specialties like chutney, jam, and jelly. It can also be used to flavor ice cream, beverages, and be turned into jackfruit honey [16].

Pharmacological Actions

Anti-Inflammatory effect

The fruit's artocarpesin content inhibits the production of prostaglandin E2 (PGE2) and nitric oxide (NO), which may offer a viable strategy for an anti-inflammatory impact.¹⁷ Cell culture experiments have also revealed that jackfruit flavonoids suppress the release of inflammatory mediators from mast cells, neutrophils, and macrophages.¹⁸

Antioxidant effect

The phenyl flavones derived from *Artocarpus heterophyllus*, such as cycloheterophyllin and artonins A and B, have antioxidant effects against lipid peroxidation. [19]. A. heterophyllus extracts (containing the pulp, leaf, and root bark) were shown to have moderate to high antioxidant activity. In general, the acetone extract was outperformed by the methanolic, ethanolic, and aqueous crude extracts of A. heterophyllus in terms of antioxidant activity [20].

Antifungal effect

The chitin-binding lectin known as jackin, which is contained in the seeds, inhibits the growth of *Saccharomyces cerevisiae* and *Fusarium moniliforme*.²¹ The leaf extract is claimed to be ineffective against *Aspergillus niger*, *Aspergillus rubrum*, *Aspergillus versicolor*, *Aspergillus vitis*, *Candida albicans*, *Candida tropicalis*, *Cladosporium cladosporioides*, *Penicillium notatum*, *Trichophyton mentagrophytes*, and *T. tonsuratum* [22].

Sexual behavior

Artocarpus heterophyllus's roasted seeds have aphrodisiac properties.²³ Preclinical studies have shown that feeding the seed (500 mg/kg) to rats reduced the number of mounts, number of intromissions, intromission ratio, copulatory efficiency, and increased the mount latency, intromissions latency, ejaculation latency, and intercopulatory interval at two hours but returned to normal at six hours [24].

Immunomodulatory effect

The primary protein in seeds, jacalin, has been discovered to have uses in the separation of human plasma

glycoproteins, the study of IgA-nephropathy, the analysis of O-linked glycoproteins, and the identification of tumors [25].

Antidiabetic effect

Artocarpus heterophyllus leaf extracts heated to a high temperature have been reported to enhance diabetes patients' glucose tolerance.²⁶ The hypoglycemic impact of jackfruit seed aqueous decoction was shown to be superior to that of tolbutamide, which was utilized as a positive control. When 5, 10, and 20 ml/kg of fresh decoction were delivered, a concentration-dependent impact was seen. The authors also discovered that preserving the decoction at room temperature did not reduce the hypoglycemic activity of the aqueous extracts, implying its use [27].

Antibacterial effect

Broad spectrum antibacterial activity is produced by the crude extract of barks, stem and roots, stem and root heartwood, leaves, fruits, and seeds when combined with methanol.²⁸ In the minimum inhibitory concentration assay by broth dilution method, the whole aqueous extract possessed the highest inhibitory activity against *L. monocytogenes* (237.8 µg/ml); while the ethyl acetate fraction showed the highest effect on *E. coli* (225.6 µg/ml), *S. enteric* (444.7 µg/ml), *E. faecalis* (234.5 µg/ml), and *S. aureus* (221.9 µg/ml); and the aqueous fraction against *S. typhimurium* (342.4 µg/ml). None of the leaf samples were effective on *B. cereus* and the MIC was observed to be N1000 µg/ml, while the positive control streptomycin sulphate was effective on all the organisms and at lower concentrations in the range of 16 to 105 µg/ml, suggesting their limited potentiality as possible antibacterial agents [29].

Anthelmintic effect

It will be discovered that the seeds have nematicidal effects on certain worm species.³⁰ among all the extracts, Ethyl acetate extract performed the best. It shows that the action is caused by non-polar components. The presence of secondary metabolites such as alkaloids, flavonoids, and triterpenoids contributes to the anthelmintic activity. Several studies have found that alkaloids and flavonoids have anthelmintic action [31, 32].

Chemical Structures for Active Constituents

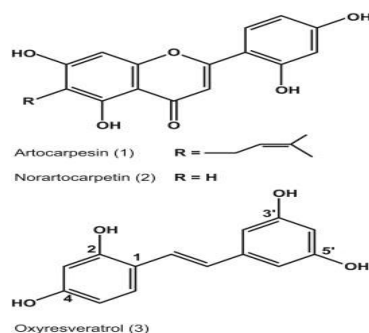


Fig:1 Structures of artocarpesin (1), norartocarpetin (2), and oxyresveratrol (3) isolated from the ethyl acetate extracts of the fruits of *Artocarpus heterophyllus*.

Conclusion

The readily available fruit *Artocarpus heterophyllus* is regarded as a poor man's diet since it has a high nutritional content and is underutilized. It has been discovered that the tree's many sections have therapeutic properties. In terms of medicine, it can be used to treat skin conditions, wound healing, aphrodisiacs, and bacterial and inflammatory conditions. Polyphenols, flavanone, flavonoids, fatty acids, reducing sugars, proteins, and minerals are among the chemical elements found in *Artocarpus heterophyllus*. In addition to these studies, there are still a wide range of other potential scientific investigations that can pinpoint its therapeutic and pharmacological capabilities.

Tropical trees like the jackfruit are a great source of vitamins, minerals, dietary fiber, phytochemicals, and nutrients including carbs and proteins. Numerous health benefits of jackfruit, such as its anticarcinogenic, antibacterial, antifungal, anti-inflammatory, wound-healing, and hypoglycemic qualities, have been identified by prior studies. However, it is regarded as an underutilized fruit on a commercial scale, primarily because of the higher percentage of inedible portion that results in more waste generation, difficulty peeling and separating the edible bulbs from the rind, ignorance of proper postharvest practices, and insufficient processing facilities in the regions where they are grown.

Therefore, following proper postharvest procedures and turning jackfruit into minimally processed products, like precut jackfruit, may persuade more people to consume jackfruit, and turning jackfruit waste into useful products may help with waste management. Only a few recent studies have concentrated on increasing the shelf life of jackfruit and adding value to jackfruit trash by turning it into other goods and renewable energy sources. However, further studies need to be done to determine potential jackfruit industrial uses and how best to handle the waste produced during jackfruit processing. Thus, we can draw the conclusion that *Artocarpus heterophyllus* is an essential fruit in terms of both nutrition and medicine.

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Conflict of Interest

Authors are declared that no conflict of interest

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All authors are contributed equally.

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