A SHORT REVIEW ON NUTRITIONAL, PHYTOCHEMICAL AND PHARMACOLOGICAL POTENTIAL ACTIVITY OF JACK FRUIT (*Artocarpus heterophyllus*)

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Abstract

The jackfruit, scientifically known as Artocarpus heterophyllus Lam., is a tropical climacteric fruit that belongs to the family Moraceae. It is native to the Western Ghats of India but is also widely cultivated in other parts of Asia, Africa, and even some regions of South America. According to legend, it is the largest edible fruit that can be found anywhere in the world. In addition to being rich in carbohydrates, jackfruit is also rich in a variety of vitamins, minerals, and phytochemicals. Both the seeds and the meat of the jackfruit can be consumed in either a raw or cooked form; however, when the jackfruit has reached its peak ripeness, the flesh can be consumed as a fruit rather than a curry. Jackfruit that has been cooked down and pureed has been incorporated into the recipes for a wide range of foods, such as jams, jellies, marmalades, and even ice creams. Traditional medicine makes considerable use of the anticarcinogenic, antibacterial, antifungal, anti-inflammatory, wound-healing, and hypoglycemic characteristics that the many components of the jack tree possess. Despite all of the wonderful qualities that it possesses, the fruit is not utilised to its full potential in the regions in which it can be produced. The purpose of this review is to disseminate the information that jackfruit has a variety of dietary and health benefits, with the end goal of jackfruit being incorporated into the production of commercially available foods.

Keywords: **Phyto-chemical, Herbal, Traditional Medicine, Pharmacological Activity**

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Introduction

The scientific name for the fruit is Artocarpus heterophyllus, and it is classified as a member of the Moracea family, which is indigenous to Southeast Asia [1–3]. As a significant cash crop, it is cultivated in large quantities in the majority of tropical countries, including Bangladesh, India, Burma, the Philippines, Pakistan, Sri Lanka, Malaysia, and Thailand, as well as sections of Brazil, Queensland, Africa, and other areas of Australia, the United States, and other regions of Australia. There is a huge selection of fruit available in Bangladesh, making it easy to find exactly what you're looking for. More than seventy different kinds of fruit are native to Bangladesh. The jackfruit and the mango are the fruits and plants that are considered to be Bangladesh's national symbols, respectively [5, 6].

Fig: 1 Artocarpus heterophyllus fruit

The Madhupur tract in Bangladesh is the location of the country's largest fruit tree [8]. The jackfruit, also known as "poor man's meal," is a fruit that can be eaten that grows on the jackfruit tree. [10]. It is the fruit that is consumed the most frequently in Bangladeshi communities, whether they are urban or rural. Its production volume is the fourth greatest in the world, behind only banana, mango, and pineapple [11]. Jackfruit is the third most produced fruit in Bangladesh, which places it in third place overall in terms of fruit output. A

multitude of health advantages can be derived from the jackfruit tree, its fruit, and even its branches. When the fruit has reached its full maturity, it can be consumed as a fruit; however, when it is unripe and still green, it can be prepared and eaten like a vegetable. The edible bulbs of a ripe jackfruit are normally consumed fresh or processed into canned foods; it is claimed that the weight of the fruit's seeds accounts for between 10 and 15 percent of the whole fruit weight. The plants are utilised by people in Asia due to their therapeutic properties, which include antibacterial, antidiabetic, antioxidant, antiinflammatory, and antihelmintic powers [12]. [12] 2 megajoules of energy for every kilogramme of the weight of the mature perianth. In addition to that, the fruit has the ability to offer [13]. The phytonutrients in jackfruit have lignans, flavones, and saponins, which have been shown to have anticancer, antiulcer, antihypertensive, and antiaging properties [14]. This fruit is loaded with a wide variety of nutrients, including carbohydrates, minerals, carboxylic acids, dietary fibre, and vitamins. People who live in rural areas can meet their daily nutritional needs by eating seeds that are high in minerals and other nutrients found in the soil. Jackfruit seed flour is an excellent and inexpensive source of these essential nutrients because it contains protein, carbohydrates, and dietary fibre.

Geographical Distribution

It is quite likely that the Western Ghats of India, which is where wild jackfruit groves used to be found, are the jackfruit's native habitat. It has been cultivated for millennia, and as a result, it has spread throughout the tropical regions of the world, particularly Southeast Asia, where it has evolved into a native species.

Fig: 2 Geographical Distribution of *Artocarpus hetrophllus*

Phyto-chemical Distribution

All four triterpenoids have been isolated, including the triterpenoids cyclolanost-3 one-24,25 and the triterpenoids 9-1 and 9-19. Artoheteroids A-D, morin, artocarmin A, albanin A, euchrenone A, norartocarpanone, and

steppogenin were all isolated from A. heterophyllus as lavonoids.

Two new tetracyclic triterpenoids, 9,19-cyclolanost-3-one-24,25-diol (24 R) and 9,19-cyclolanost-3-one-24,25-diol (24 S), as well as two well-known chemicals, cycloartenone and cycloartenol, were recovered from the ether extract of dried latex of Artocarpus heterophy Detailed spectroscopic and chemical approaches revealed the structures.

Heterophylol, a unique phenolic chemical that was previously described in another study, has been isolated from the root of Artocarpus heterophyllus. A total of nine recognised flavonoids have also been identified. Flavonoids 5,2′-dihydroxy-7,4′-dimethoxyflavanone and 8-(γ,γ,-dimethylalllyl)-5,2′,4′-trihydroxy-7-methoxyflavone are the names given to the novel flavonoids.

In terms of its nutritional profile, jackfruit has a water content of 6.7 percent, followed by glucosides at 38.0 percent, lipids at 0.7 percent, protein at 1.7 percent, and cellulose at 1.7 percent (59.0 percent). In addition to sucrose, it contains fatty acids, ellagic acid, and other other vital nutrients, including amino acids such as arginine, cystine, histidine, and lysine, in addition to various other essential elements, such as tryptophan and threonine. Two new flavone pigments have been discovered in A. heterophyllus. One of them is named cycloheterophyllin (C30H30O7), and the other is Heterophylol (C30H30O7), which is a phenolic molecule with an unusual structure. Tannins, sapogenins, cycloartenone, cycloartenol, sitosterol, and cycloartenol are some of the estrogenic chemicals that have been discovered in the leaves and stem of the plant. The root contains cycloartenone, betulinic acid, ursolic acid, and -sitosterol among other bioactive compounds. The Jacalin protein, which is found in the seeds of A. heterophyllus, has 133 amino acid residues in its heavy chain component, and its light-chain component has 20 to 21 amino acid residues. It is highly specific for Thomsen-Friedenreich antigen disaccharide O-glycoside even when it is in its sialylated form (Gal1-3GalNAc). Because of this, jacalin has proven to be an effective instrument in the study of O-linked glycoproteins, including human IgA1. Because of its remarkable capacity to stimulate human CD4+T cells, jacalin has emerged as a useful diagnostic tool for people living with HIV-1. The root bark of A. heterophyllus was the source for the discovery of two novel 2,4,6-trioxygenated flavanones, which the researchers referred to as heteroflavanones A and B. Both the 5-hydroxy-7,2,4,6-tetra methoxyflavanone and the 8-(, -dimethylallyl)-5-hydroxy7,2,4,6-tetra methoxyflavanone structures have been solved. In order to determine that artocarpesin, norartocarpetin, and oxyresveratrol are all types of phenolic compounds, spectroscopic techniques were utilised. Crocetin, a dicarboxylic carotenoid, was revealed to be among the carotenoids that were discovered in A. heterophyllus. Other carotenoids that were discovered were -carotene, -carotene, and -zeacarotene.

In comparison to the results obtained with the other extracts, the methanolic extracts proved to be the most successful in destroying the bacteria. When compared to the extracts of the other two organisms, the fruit latex methanolic extract did not have any effect on 12.5 mg of P. aeurginosa or E. coli. In both the antibiotic that was tested them in and the methanolic extract of A. heterophyllus fruit latex, we discovered that B. subtillis exhibited the same level of activity. P. aeruginosa organisam has a moderate amount of activity when it is mixed with a methanolic extract of A. heterophyllus fruit latex at a concentration of 100 micrograms per millilitre. The bacteria known as P. aeruginosa can be discovered in virtually any natural setting. It is possible to find residues of it in the intestines of humans and animals, as well as in the soil and surface waters where it has been present, as well as on plants. The most common types of infections found in patients who are being treated with ventilators include

infections of burn wounds, infections of post-operative wounds, chronic pyelonephritis endocarditis in drug addicts, sepsis, and malignant otitis externa. In addition to this, it is a common reason why patients get sick when they are in the hospital. It is possible to determine the mechanism of any antibiotic medication by looking at the morphology, shape, and size of the bacteria involved.

The numerous architectural arrangements of these molecules are depicted in Figure 2.

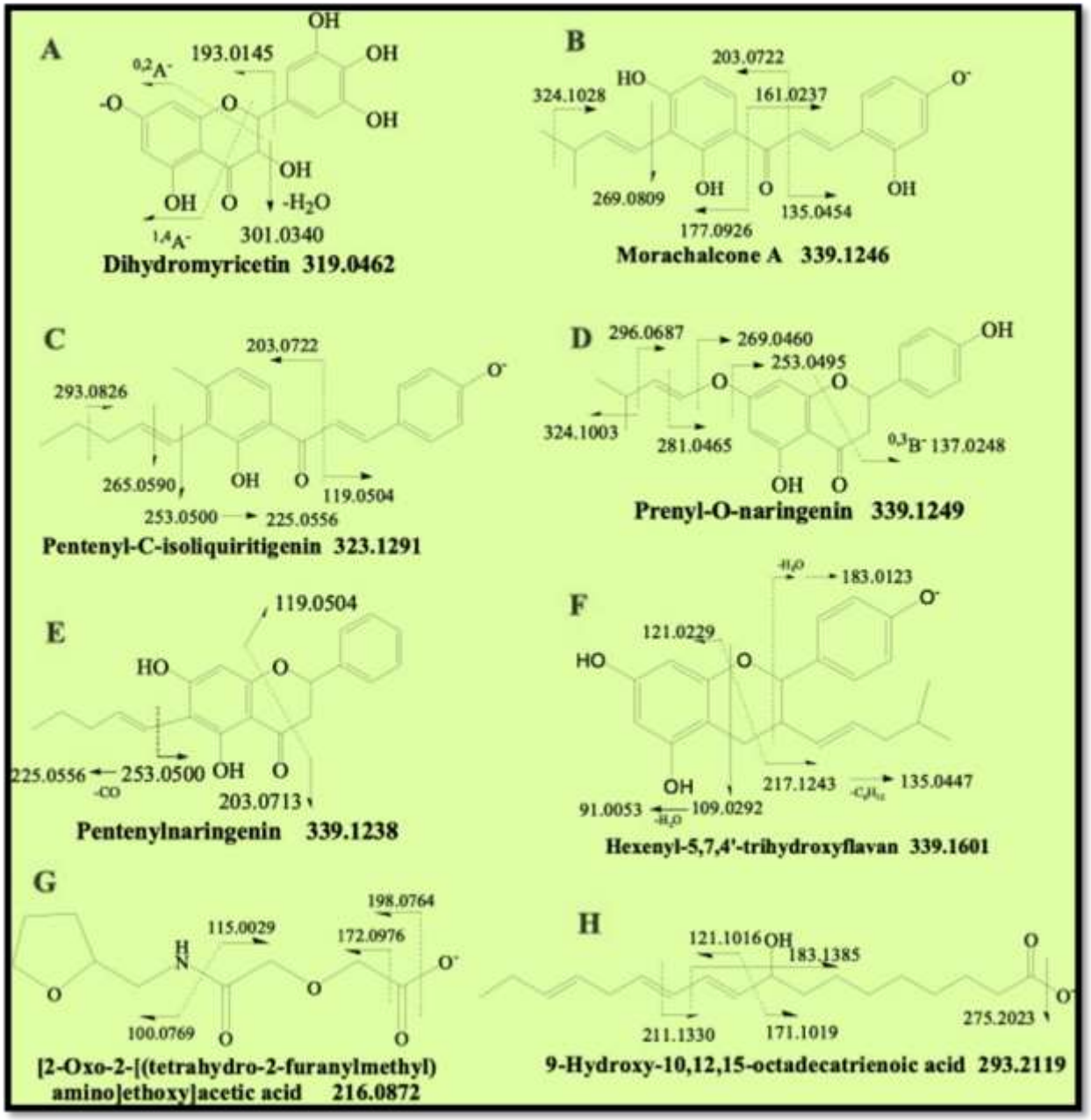

Fig: 3 Chemical compounds present in *A. Hetrophyllus Plant*

Pharmacology Activity

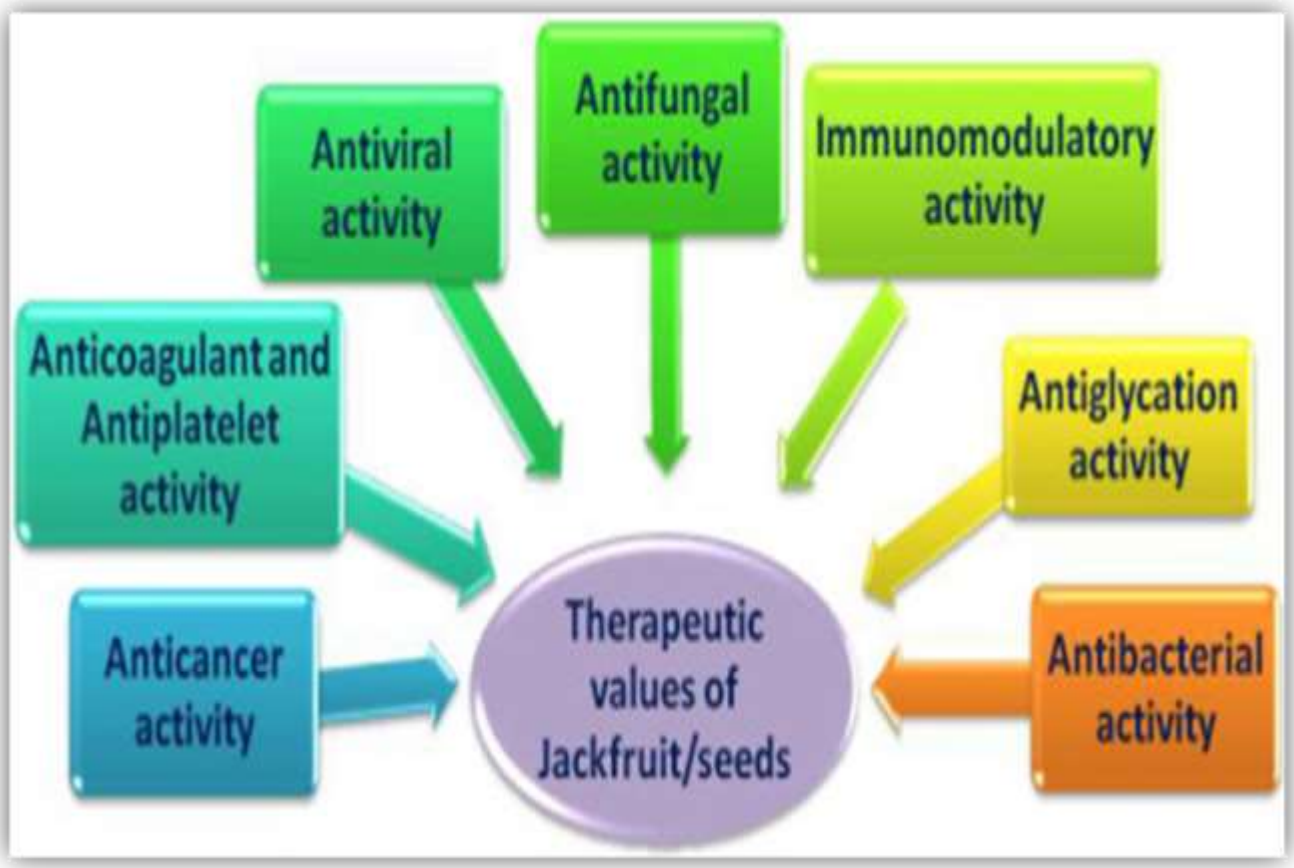

Fig: 4 Pharmacological Action of Artocarpus heterophyllus fruits and seeds

Anti-inflammatory & Anti-cancer:

According to the findings of this research, the extract was well tolerated in mice, as evidenced by the fact that all of the animals survived the whole duration of the trial. This provides support for an acceptable safety profile for the active component artocarpin. A 48-hour period of cytotoxicity was discovered in HCT116 colorectal cancer cells, with IC50 values of less than 10 mg/L (6.48 mg/L) and less than half those of CCD-18Co, a normal colon cell line. This cytotoxicity was observed over a period of time. At 48 hours after treatment with artocarpin, colon cancer cell lines SW480, HT-29, HCT15, and HCT116 were shown to exhibit IC50 values of 15 M (or 6.55 mg/L), whereas the normal colon cell line CCD-18Co had no discernible effect. The time- and concentration-dependent effect on HCT116 cells was demonstrated by the decrease in IC50 after 48 hours (6.48±0.63 mg/L) and 72 hours (4.23±0.08 mg/L) in comparison to the value at 24 hours (9.38±1.26 mg/L). This suggests that the extract or its metabolites likely exploit a pathway impacting cellular replication. Artocarpin's cytotoxicity has been demonstrated in the past in a number of different cancer cell lines, such as those from the breast (T47D and MCF-7), bone (U-2 OS, MG63 and HOS), colon (SW480, HT-29 and HCT15), lung (A549), prostate (PC-3), and the central nervous system (U-87, MGU86 and U118), in addition to its efficacy in breast, bone, colon, and prostate models in vivo.

Anti-diabetic Activity

Hyperglycemia is the medical term for the condition known as diabetes. Diabetes causes

pancreatic β cells to become dysfunctional, which leads to decreased insulin output in diabetics. In this investigation, the diabetic rats that had been produced by alloxan had decreased levels of insulin and had lost their β-cell integrity. However, the pancreatic morphology was restored in mice treated with glibenclamide and EAH stem bark after only 21 days of treatment in both groups. Histological examinations of the pancreas have shown that the treated groups had a higher HOMA-index (cell function) than the diabetes control group does, which lends credence to the idea that the pancreatic islets have been regenerated. It was discovered that diabetic rats given various dosages of EAH stem bark had a significant decrease in HOMA-β index, which indicated an improvement in insulin sensitivity and an increase in peripheral glucose absorption. This was the case despite the diabetic rats still having normal blood sugar levels. It is possible that phenol, an antioxidative component that is contained in the extract, is what is responsible for the antihyperglycemic actions of EAH stem bark. Diabetes mellitus that is accompanied by chronic lipid peroxidation is a very prevalent phenomenon. According to the findings of this research project, an inefficient antioxidant system may be to blame for the increased lipid peroxidation that is associated with diabetes. The levels of an endogenous radical scavenger that are either abnormally high or abnormally low are believed to be indications of oxidative stress. Enzymes such as SOD, GPx, and CAT are free radical scavengers that protect the organism from the damaging effects of oxidative stress. A decrease in enzyme activity has been associated to diabetes mellitus, which may be owing to the over usage of these enzymes in the process of decreasing free radicals. After alloxan induction, it was discovered that the level of lipid peroxidation in the liver increased, which was in line with findings from earlier studies. It is probable that the antioxidant enzymes that were found in diabetic rats that had been treated with EAH stem bark prevented additional damage to membrane lipids.

Anti-osteoporotic activity

In order to treat osteoporosis, it may be necessary to inhibit the activity of the protein cathepsin-K, which plays a role in osteoclast-mediated bone resorption. Flavonoids derived from A. heterophyllus were found to have IC50 values ranging from 1.4 to 93.9 μM. These flavonoids are known to lower Cat-K.

Anti-oxidative property:

According to the findings of our study, we investigated whether or not the polysaccharides have the ability to get rid of free radicals and influence the release of nitric oxide (NOx) from cultured cells. In the course of our experiment, the concentration of the compound as well as the length of the incubation period had an effect on the emission of NOx. When we evaluated DPPH radicals, we found that the polymer that we tested induced cancer cells to generate NOx while simultaneously reducing reactive oxygen species. This was discovered after discovering that the polymer reduced reactive oxygen species (ROS). The activation of NF-B or AP-1 transcription factors by the polymer could result in an increase in NOS activity and, as a consequence, an increase in NOx production. The production of nitrogen oxides by macrophages was shown to be boosted by a fucose-containing sulfated polysaccharide from the brown alga *Ascophyllum nodosum*. This polymer was isolated from the leaves of *Plantago palmata*. Additionally, it was demonstrated that the alga *Hypnea musciformis* produced a sulfated polysaccharide fraction that caused an increase in the amount of NOx released by neutrophils. The production of nitrogen oxides was significantly cut down by polysaccharides derived from *Phellinus baumii*, which were then applied to macrophages that had been transformed by the Abelson murine leukaemia virus. Despite this, the research conducted by Diao et al., which utilised polysaccharides derived from *Bletilla striata*, was unable to

replicate this conclusion. It is possible to achieve a wide range of results by varying the period of treatment, the concentration of the polysaccharides, the origin of the polysaccharides, and the type of polysaccharides employed. This lends credence to the idea that the impact of plant polysaccharides on human and animal cells might be either beneficial, neutral, or detrimental. It is commonly accepted that the polysaccharides that can be found in plants has anti-oxidative characteristics. Researchers discovered that polysaccharides derived from *A. heterophyllus* Lam. (jackfruit) pulp as well as polysaccharides derived from *Cordyceps sinensis* were successful at scavenging DPPH• and •OH radicals. Polysaccharides derived from a wide variety of plant sources have been demonstrated in earlier research to possess a strong antioxidant capability. The results of our investigation were able to support and substantiate these findings. They are something that should be taken into consideration and have the potential to be utilised for either medicinal or culinary purposes.

Conclusion

There are numerous applications for the jackfruit. It is a flexible ingredient that may be used either cooked or uncooked, raw or ripe, and it can be utilised in both sweet and savoury cuisines. In recent years, jackfruit's popularity has soared, perhaps as a result of the health benefits that it offers. Jackfruit pulp and seeds contain a variety of high-value compounds, some of which may be beneficial to one's health. The high bioactive content of jackfruit makes it a fruit crop that is not only delicious but also exceptionally healthful. The findings of the study indicate that vitamins and minerals on their own are not sufficient to counteract the pervasive malnutrition that is prevalent in rural India.

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