

## Potentiality of adaptable monkey jack fruit (*Artocarpus lakoocha roxb.*): A review of its phytochemistry and pharmacology

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### Abstract

The tree of money jack fruit is mostly known for its wood and edible fruits due to its incomparable nutraceutical properties. The edible fruit pulp is believed to act as a tonic for the liver. This fruit is capable of offering numerous inhibitory factors such as antibacterial, antitubercular, antiviral, antifungal, antiplatelet and antiarthritic activities and consumption of this fruit reduces the risk of non-communicable diseases like cancer, CHD, neurodegenerative ailments. The fruit contains artocarpin,  $\beta$ -amyrin acetate and lupeol acetate having a potential antihyperglycemic and hypolipidemic effects that could be used as a lead compound for production of effective in diabetes and atherosclerosis medicine. Seeds also contain a lectin 'agglutinin' which exhibit anti-inflammatory, anti-viral, anticancer and anti-HIV properties. Monkey jack fruit is excellent source of ascorbic acid,  $\beta$ -carotene, and also a good source of Na, K, Fe, Cu, Mn and P. Tree bark containing 8.5% tannin is chewed like betel nut, and is also used to treat skin ailments. It yields a durable fiber good for cordage. Raw fruits and male flower spike (acidic and astringent) are utilized in pickles and chutney (sauce). The wood and roots yield a lavish color dye. Lakoocha seeds and milky latex are purgative. Studies showed that it has valuable pharmacological properties and used as many medicinal products. In this review paper, authors discussed the nutritional values and medicinal benefits and traditional uses of Monkey Jack fruit.

**Keywords:** nutrients, phytochemicals, antihyperglycemic, antiarthritic, lupeol acetate, oxyresveratrol

### Introduction

Badahar originated in India and slowly spread to the Southeast subcontinent in Asia to include Bhutan, Guyana, Nepal, Sri Lanka, Bangladesh, Singapore, Vietnam and Cambodia. The badahar perennial plant has been widely used as food and medicine, providing lots of health benefits. It has anti-oxidant, anti-inflammatory and purging qualities. Monkey Jack fruit (*Artocarpus lakoocha* Roxb., family Moraceae) an underutilized fruit, is a tropical fruit originated in India (Kerala & TN). It has been also reported in some subtropical areas of North India. In Ayurveda it is

known as Granthiphala, Kshudra Panas, Lakuch and Pitanaasha, while in Hindi various names like Dahu, Barhal, Beng, Dahu, Sans, Lokoocha are prevalent. Also, it is available in countries like Bangladesh, Bhutan, Nepal, Myanmar, Sri Lanka, Thailand, Malaysia, Singapore, Vietnam, Cambodia and Laos. In the foothills of the Himalayas in Nepal, the leaves and flowers of this tree also act as fresh fodder for lactating animals due to its excellent source of bioactive compounds. The lakoocha fruits (Fig. 2 & 3) are generally eaten fresh. Each fruit contains 20–30 seeds that are fleshy with thin seed coat.



Fig 1: Badhal Tree

The lakoocha tree is also valued for feed and timber. Lakuch which is durable outdoors as well as under water, is used for construction, furniture, boat making, and cabinet work. Traditionally, it is also taken as medicine for people suffering from liver-related diseases. The edible fruits and flowers are consumed as vegetables, pickles, and chutney due to its astringent and acidic flavor.



Fig 2: Badhal unripe Fruit



Fig 3: Badhal Ripen Fruit

The extract and bioactive compounds from the bark, leaves, seeds, and pericarp of the fruit have been shown to possess exceptional phytochemical, nutritional, and valuable pharmacological properties. It was also proved that antioxidant; anti-inflammation, antibacterial and cytotoxic activities have been found in medicinal plants and used as potentially therapeutic compounds. With more knowledge and scientific evaluation people are now adopting and habituated to use natural ingredients contain cosmetics instead of synthetic ingredients. On the other ways it can be considered as vast sources of vitamins, minerals, dietetic fibers and polyphenols which have lot of health benefits. Different parts of this tree like fruits and male flowers are eaten raw, boiled, steamed or roasted. Moreover, a tree also has an important source of firewood and its sticky latex is present everywhere of the tree and has many uses.

The lakucha fruit also manages to decrease the problems of hair loss and helps in the regrowth of hair from the hair follicles and also make hair shafts stronger. It is a blessing in the treatment of skin diseases where it effectively eradicates the darkening of the skin and brings a natural glow to the skin. Lakucha also obviously treats dysentery, arthritic swelling and cleans wounds. *Artocarpus lakoocha* is containing strong antioxidants and these are flavonoids and phenolic acids. The bark of the tree exhibit methanolic extracts that have strong antioxidant activity. Moreover,

heartwood extract also have potential skin whitening properties. The bark of the tree is rich in tannins (8.5%) and the powder of the bark can be used as a cure to the wounds and skin lesions. Traditionally, the flowers are used in the preparation of sabji, the unripe fruit is used for the pickling and ripe fruit is used for the extraction of juice and preparation of curries. This tree exhibit great potential of application in both food and pharmaceutical industry. Monkey jack fruit is excellent source of ascorbic acid (171.07mg /100g),  $\beta$ -carotene (3718.16  $\mu$ g/100g), and also a good source of Na (46 mg/100g), K (785 mg/100g), Fe (15.09 mg/100g), Cu (1.31mg/100), Mn (3.76mg/100) and P (66.06 mg/100). This fruit of multipurpose uses can be consumed as alternative nutritional food and plant used as raw materials of pharmaceuticals due to its pharmacological properties. It is time to say that the nutrient values of Monkey Jack fruit would be explore more and more to increases awareness among the people to consume for healthy life and to grow more plants for production of cosmetics and receive other useful benefits.

### Nutritional properties & Pharmacological applications of monkey jack fruit

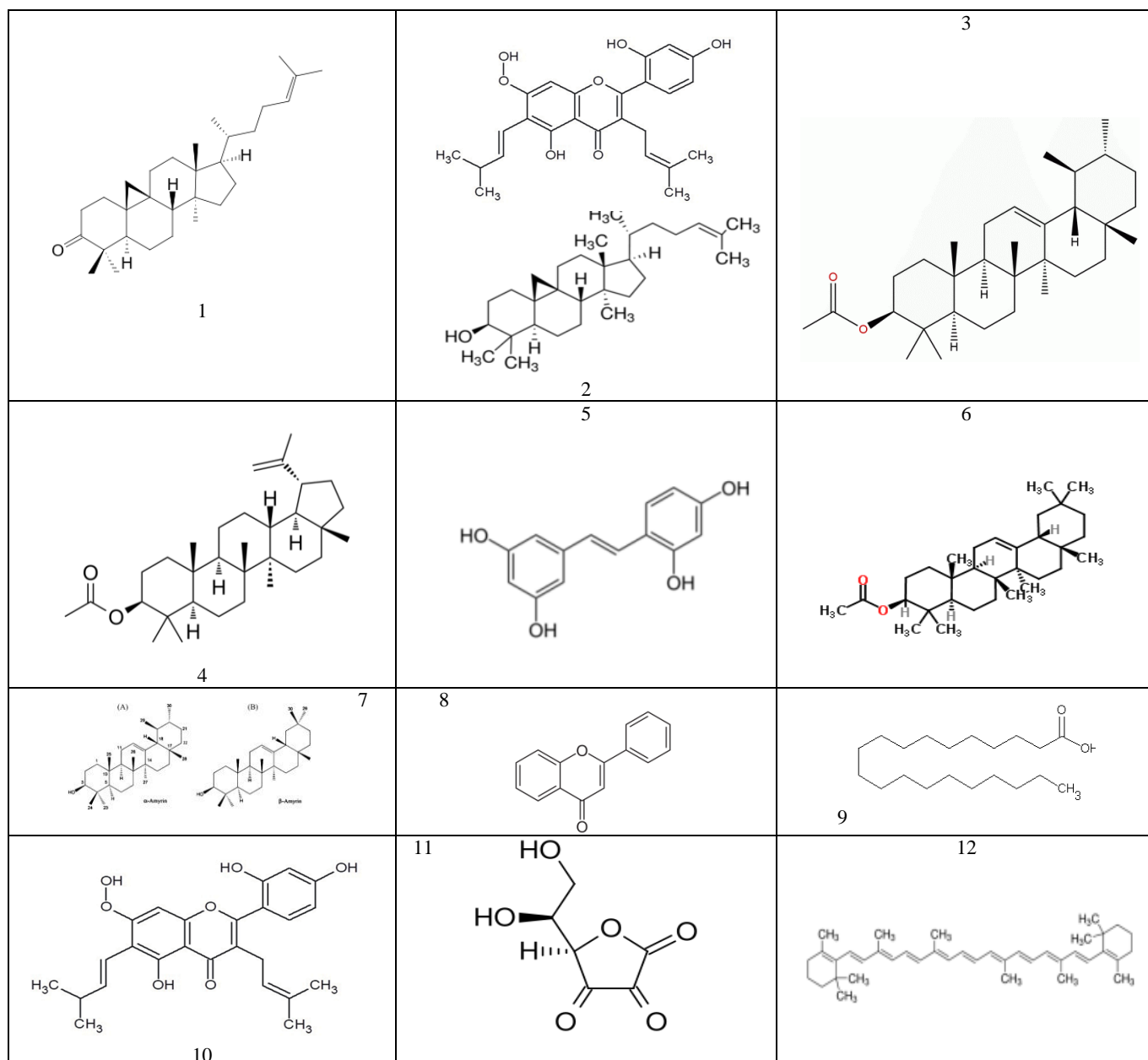
Monkey jackfruit is a good source of carbohydrates, fat, protein, dietary fiber, minerals (phosphorous, iron) and vitamins (vitamin A, Vitamin C, Vitamin B1). discusses the nutritional values of the monkey jackfruit. The fruit contains a large amount of moisture i.e. 81.32 to 86.95% but the nutrients can be concentrated by drying the pulp to a powder. There are some pharmacological activities has been found into plant and these are anti-inflammatory, antiviral, anticancer and anti-HIV properties. The consumed A. Lakoocha fruit pulp is act as refresher of liver as well as seeds and milky latex can used as purgative. Tree bark contains 8.5 percent tannin and is used to treat skin lesion. Powder formed bark is applied to cure any wound and also used to draw out purulent matter from any abscess. The seed and bark of the plant are useful for stomach and liver disease. The unripe fruit is hot, sour, sweet, causes tridosa impotency, loss of appetite, blood complaint. The ripe fruit is sour sweet, tonic to liver. The seed are good purgative for children. The juice and seeds from this plant are used as purgative and the bark is used as astringent. A. lakoocha plant is used in traditional Thai medicine for anti-inflammatory therapy and as well as an anti-skin aging agent. Studies revealed that the lotion containing plant heartwood extract-loaded liposomes had better skin whitening effect than the lotion containing non-encapsulated plant heartwood extract. Anti-glycation and anti-oxidation of phytocompounds can prevent cellular aging. The root of A. lakoocha is an astringent and is used as a purgative; while saturated extract is used as a poultice for skin ailments and bark is used to treat headache. Tree bark containing 8.5% tannin is chewed like betel nut, and is also used to treat skin ailments.

### Major Phytochemicals

Various compounds (Fig. 4) have been isolated from the plant such as cycloartenone (1), cycloartenol (2)  $\alpha$ - amyryl acetate (3) leupeol acetate (4). The oxyresveratrol, (2, 4, 3', 5'-tetrahydroxystilbene) [5],  $\beta$ - amyryl acetate (6) and  $\alpha$ - $\beta$  amyryl (7) are the major constituent of aqueous extract of *Artocarpus lakoocha* seeds which has been revealed as a natural anthelmintic and isolectins which exhibit high

haemagglutination activity. Seeds also contain a lectin 'agglutinin' which exhibit anti-inflammatory, anti-viral, anticancer and anti-HIV properties. Minerals such as Zn, Cu, Mn, and Fe are present in the fruit. The plant of *A. lakucha* have contained tannins, flavonoids (8) and phenolic acids, these are strong antioxidants. The fruit is a poor source of proteins, good source of carbohydrates and excellent source of fat. The major sugars present in jackfruit are fructose, glucose and sucrose. The fat is particularly present in the seeds of the fruit and is a mixture of saturated and unsaturated i.e. palmitic, oleic, stearic, linoleic, lauric and arachidic acids (9). Artocarpin, an isoprenyl flavone (Fig. 10) has also been isolated from roots of *Artocarpus* species. It is also a good source of  $\beta$ -carotene which is a

precursor of vitamin A. It is also rich in ascorbic acid i.e. Vitamin C (Fig. 11). Both ascorbic acid and  $\beta$ -carotene (Fig. 12) antioxidant activities and  $\beta$ -carotene also helps in the normal vision. Besides these, this fruit is also a good source of minerals. It is an excellent source of iron i.e. 28.4 to 80.2 mg/ 100g (<dv). Nutritional composition of monkey jack fruit: Moisture (%) 81.32 – 86.95; Carbohydrates (%) 1.32 – 8.62; Fat (%) 3.17 -15; Proteins (%) 0.12 – 0.51; Fibre (%) 1.84 – 10.21; Ash (%) 1.5 – 5.33' Energy (Kcal) 72.53 – 114.87; Calcium (%) 0.083 – 0.26; Potassium (%) 0.76 – 1.47; Magnesium (%) 0.098 – 0.15; Zinc (ppm) 19.82 – 24.92; Copper (ppm) 7.81 – 12.84; Iron (ppm) 284.95 – 802.01; Ascorbic acid (mg/100g) 171.07;  $\beta$ -carotene ( $\mu$ g/100 g) 3718.16



**Fig 4:** Chemical structures of cycloartenone (1), cycloartenol (2)  $\alpha$ - amyirin acetate (3) leupeol acetate (4). The oxyresveratrol, (2, 4, 3', 5'-tetrahydroxystilbene) [5],  $\beta$ - amyirin acetate (6) and  $\alpha$ - $\beta$  amyirin (7) flavonoids (8) arachidic acids (9), Artocarpin, an isoprenyl flavone (Fig. 10), Vitamin C (Fig. 11),  $\beta$ -carotene (Fig. 12)

#### Traditional uses and benefits of consuming Monkey fruit

Extract of the fruit reduces hair loss and stimulates the propagation of hair, skin diseases, herpes can make it fade away the darkening of the skin. It may also treat arthritic

swelling, dysentery and clean wounds. Fruit pulp act as refresher of liver as well as seeds and milky latex can used as purgative. Tree bark consists of 8.5 percent tannin and is used to treat skin lesion. Powder formed bark is applied to

cure any wound and also used to draw out purulent matter from any abscess. Seed and bark of the plant are useful for stomach and liver disease. Ripe fruit is sour sweet, tonic to liver. Seed are good purgative for children. Root is used as refresher and the leave are used in treating dropsy. Powered form heartwood extract has been using as an effective and economical skin-whitening agent. lakoocha plant is used in traditional Thai medicine for anti-inflammatory therapy and as well as an anti-skin aging agent. lakoocha extract was effective for the treatment of taeniasis. lakoocha is widely used as medicinal plant for the treatment of some specific diseases in India. Dried aqueous extract of A. lakoocha has been used for treatment of tape worms. Root of A. lakoocha is an astringent and is used as a purgative. Saturated extract is used as a poultice for skin ailments and bark is used to treat headache. Fruit can be used as food supplement to combat malnutrition and reduces the risk of several diseases. Sap and juice of the bark is applied externally to boils, pimples, cuts and wounds. Macerated bark is used as a poultice for treating skin ailments. The bark is used to treat headache.

**Culinary uses**

Fruits are generally sweet sour pulp eaten fresh but mostly made into curries. Unripe fruit and male flower spike of A. lakoocha are used to prepare curries, pickles and sauce. Different parts of this tree like fruits and male flowers are eaten raw, boiled, steamed or roasted. Broad, flat seeds are edible. Bark contains tannin and is chewed as a substitute for betel nut. Juice (Fig. 5) can be extracted by pressing from the ripe fruits. The male flowers are used to prepare sabji (cooked vegetable). Pickle is prepared from the unripe fruits of Artocarpus lakoocha. Pulp (Fig. 6) of the fruit is being used in curries as its taste is sweet and sour. Fruit and spike of male flowers are used to make delicious sauce. The fruits are usually tart when eaten fresh and can be made into curries. The green or unripe fruits and male flowers are used in pickles, curries and sauces. The flat and broad seeds can be eaten too. The bark of badahar can be used as an alternative to betel nut.



**Fig 5:** Badhal Pulp



**Fig 6:** Badhal Juice

**Conclusion**

The paper is an overview of different aspects of medicinal properties and phytochemistry of Artocarpus lakoocha.

Monkey jackfruit is a high fruit yielding tree with a history of traditional uses. The fruit contains less moisture in comparison to other fruits and is denser source of nutrients. The fruit also has medicinal properties and the pulp of ripe fruit is used as tonic for the liver. The skin of the fruit is used to treat wounds and skin lesions. Although, it has been used for the food and medicinal purposes since ancient time but its modern applications are limited. The ripen fruits is generally eaten fresh. Unripe fruit and male flower spike of A. lakoocha are used to prepare curries, pickles and sauce. This is used to treat skin lesions while the powder from the bark is used to reduce abscesses and cure wounds. It is also useful for stomach and liver diseases. The softened or pulp of the bark is used for treating headaches.



**Fig 7**

The sap and juice of the bark can be applied on boils and pimples as well. A great laxative especially for children and also treats liver and stomach diseases. Badahar is very nutritious and can even be used to fight malnutrition. The extract made from the badahar fruit stimulates hair growth and reduces hair fall and improves skin conditions like darkening. When properly eaten, the badahar fruit prevents a number of diseases according to study. It prevents diseases such as diabetes, cancer, coronary heart diseases and neurodegenerative ailments. This plant has several immunity properties such as antibacterial, antioxidant and reducing inflammation and has overall health improving benefits to the human body. Eating the badahar fruit purges the body and refreshes the liver. This fruit is full of nutrients and is even used to prevent malnutrition. The seed and bark of the plant are reported to be effective in the treatment of stomach and liver disease. Some pharmacological activities found into this plant are anti-inflammatory, antiviral, anticancer and anti-HIV properties. This fruit has ultimately grabbed the attention of various scientists and Ayurvedic physicians who are looking out for various ways in which this magical fruit can be used. According to study, it has been seen that the proper consumption of the Monkey fruit results in the prevention of diseases like cancer, diabetes, neurodegenerative ailments and coronary heart diseases. It also possesses anti-inflammation, antibacterial, antioxidant and cytotoxic properties which are vehemently used as potential therapeutic attributes. It is an important ingredient in many. It is used in the context of anti-inflammatory

therapy and works really well as an anti-aging skin agent with an additional skin whitening effect.

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