



Makhana: A valuable aquatic food crop

¹Alok Kumar* and ²Anjali Kumari Jha

Introduction:

Makhana is the processed product from the fox nut or gorgon nut (*Euryale ferox*), which is acknowledged as a superfood due to abundance of therapeutic and nutritional qualities. Gorgon nut is the monotypic genus of the family Nymphaeaceae which is distinguished by its round form, black colour, and hard seed coat (shell), which has a

diameter that ranges from approximately 4.5 to 15 mm. It originated in South-East Asia and China, but can be grown in many parts of world. The only nations that grow makhana as a crop are China and India. The commercial value of makhana seeds is found in their popped condition. The starchy white puffs are delightful and exceedingly healthful, and are marketed as a premium dry fruit product of

Makhana Seed and Popped Makhana's Nutritional Value

Parameters	Makhana Seed	Popped Makhana
Carbohydrate (% by wt.)	57.0	79.8
Protein (% by wt.)	7.2	8.7
Fat (% by wt.)	0.3	0.5
Moisture (% by wt.)	34.7	10.4
Total Ash (% by wt.)	0.3	0.4
Crude Fiber (% by wt.)	0.5	0.2
Amylose (%)	19.0	18.2
Calorific Value (K.cals/100g)	259	358
Phosphorus (mg/100 g)	66.1	53.2
Potassium (mg/100 g)	35.6	42.0
Iron (mg/100 g)	0.8	1.4
Calcium (mg/100 g)	9.5	18.5
Magnesium (mg/100 g)	11.3	13.9
Sodium (mg/100 g)	48.2	71
Copper (mg/100 g)	0.3	0.5
Manganese (mg/100 g)	0.9	1.3
Zinc (mg/100 g)	0.9	1.1

¹Alok Kumar* and ²Anjali Kumari Jha

¹ Research Scholar, Department of Pomology and Post Harvest Technology, UBKV, Cooch Behar

² Research Scholar, Department of Vegetable and Spice Crops, UBKV, Cooch Behar

makhana. In Chinese and Ayurvedic medicine, makhana seeds are frequently used and have been shown to have therapeutic benefits for treating a variety of ailments, such as splenic hypofunction, persistent diarrhoea, renal disease, and severe leucorrhoea.

In India's north Bihar and lower Assam districts, it is grown as an exclusive aquatic cash crop in shallow water resources. Bihar is the largest makhana producing state in the country. About 80 percent of total Makhana production in the country is produced by Bihar only. In Bihar it is grown in districts like Darbhanga, Madhubani, Sitamarhi, Saharsa, Supaul, Araria, Purnea, Kishanganj and Katihar. Devotees eat makhana as a non-cereal meal when they fast. The ingredient makhana is used to make a variety of delectable and rich desserts, including puddings, vermicelli, halwa, kheer, and flour. The flour derived from Makhana is utilised in place of Arrow Root. Additionally, the flour is utilised as a thickening in various food preparations and to prepare delectable delicacies like sweet meat, soups and kheer.

Ponds, lakes, tanks, and other water bodies are used for its cultivation. The starchy kernel of the nut, which is inelibly attached to the raw nut, is the edible portion. Hence, it is manually popped using the conventional method (Jha and Prasad 1990), as no other popping technique is currently in use. The

technique known as popping involves heating the moisture-containing nut to a high temperature and then abruptly releasing pressure to induce the kernel to expand volumetrically. The popped kernel, often referred to as makhana in India, is the inflated nut kernel that is obtained through this method.

For makhana farming in ponds, nursery is not necessary; however, for field cultivation, 500 m² is needed to raise nursery for transplantation in a one hectare area. Twenty kilo grammes of healthy makhana seeds are sown in a well-prepared nursery in December or January that has been supplemented with fertilisers and organic manure, all while keeping an adequate water level. In March, seedlings are ready to be transplanted. In order to prevent any harm to the roots, young makhana plants should be carefully removed from the nursery and transplanted in a field that has been prepared in March or April. A gap of 1.25 metres should be maintained between plants and lines.

Almost two months after transplanting, in May, flowering and fruiting begin, and they last until October or November. After flowering, the fruits require about 40–45 days to reach full maturity. After then, the fruits begin to burst and the seeds, which have a pinkish covering, continue to float on the water's surface. They settle on the field's

bottom after two to three days. Given the extreme unsynchronization of fruiting, flowering, and rupturing in nature, a practical decision regarding the amount of time to allow for fruiting and rupturing must be made prior to harvesting in order to minimize yield loss and allow for the crop that will follow in the cropping sequence on the same field. Farmers that employ scientifically developed cultivation procedures can obtain an improved variety that can yield up to 3.0 t/ha of seeds. Usually, a team of twenty to twenty-five skilled workers takes a week to harvest one hectare of pond.

The first makhana variety, "Swarna Vaidehi," was developed by the Research Centre for Makhana (RCM), Darbhanga, Bihar. It is advised for growing in the Mithila region of Bihar. Sabour Makhana-1 is also suitable for this region, which is characterized by very thin seed coat, high in yield good quality of makhna pop recovery.

It is possible to double crop makhana on the same field; other crops that can be planted after makhana on the same plot of land include rice, berseem, wheat, water chestnut, etc. Fish can also be integrated with makhana for increased system productivity and farm incomer provided the water depth is at least one metre.

Processing of makhana

Processing of makhana involves cleaning, drying, storage, size grading, preheating, roasting, polishing and packing. The processing stages that turn a raw seed into popped makhana greatly boost the value of makhana. Following the transition from seed to pop, the makhana's value almost doubles.

Health benefits of makhna

- Makhana is high in nutritional content and may complement a diet while aiding in the maintenance of a healthy weight. It also helps with weight loss because it is low in fat and cholesterol.
- Makhana seeds are a great source of fibre, which helps to maintain a healthy digestive tract and encourage bowel movements, which helps to avoid constipation.
- Makhana are also rich in thiamine, which has a vital role in supporting neurotransmission, which is necessary for normal nerve activity, as well as in supporting cognitive function.
- Makhana is a great source of calcium, magnesium, and proteins—all of which are necessary for the normal growth and development of bones and teeth.
- The dietary advantages of makhana also support improved metabolism and liver function.
- Due to their high antioxidant content, fox nuts and lotus seeds are excellent

foods to prevent ageing. To fully benefit from makhana's anti-aging properties, it is preferable to consume it roasted rather than fried.

- Makhana's low calorie content and glycaemic index make it a beneficial food for controlling blood sugar levels and diabetes.
- Men and women can both benefit from makhana while managing infertility issues. Improving the quality of semen and delaying premature ejaculation are two advantages of makhana for both men and women.
- Since makhana has a high protein and carbohydrate content, it may be used as a gluten-free substitute by those who are allergic to wheat.

Challenges

The shortage of qualified labour is a problem for foxnut growers. In order to cultivate and harvest foxnut, labourers must spend hours in the water. However, it is challenging to locate competent labourers in the region. Two essential elements of foxnut cultivation are controlling weeds and harvesting the crop correctly. Each phase requires a lot of labour, and it takes a lot of time and effort to complete.

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