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## Lotus (*Nelumbium Spp.*) Seed: A Nutrient Rich Food from Freshwater Wetland Ecosystem

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### Abstract

The seeds of lotus (*Nelumbium nucifera* Gaertn.) contain many functional ingredients. They can be eaten as raw or cooked and are often added to foods as ingredient. It contains multiple functional compounds, such as flavonoids, polyphenols, protein and polysaccharides. Low fat content and good proportion of high value amino acids confer the lotus seeds to have unique nutritional values. It has anti-oxidant activity, hypoglycemic, immune-modulatory, anti-bacterial, anti-inflammatory and gastro-intestinal regulatory effects. Furthermore, the nutritional composition, physiological functions and different processing methods of lotus seeds are very much associated with Hindu religious fervors and its consumption. It is a nutrient dense medicinal super food essentially requires judicious use for obtaining wonderful benefits for health and vigor of the individuals.

### Introduction

Lotus is an aquatic floating but rooted macrophyte, belonging to the family Nymphaeaceae. The flower is used for decorative purposes and in worship and the lotus seeds have been used as a functional food in all over Asia from ancient times. The crop is native to China, Indonesia, Thailand, Nepal, Sri Lanka and India, so origin of lotus is Southeast Asia. The seeds can be consumed in a form of raw, roasted, or ground and boiled into a syrup or paste after being peeled. It is a very important medicinal food and provides a vital role in nutrition, health, and cosmetics and is added to several foods. On a fresh weight basis, lotus seeds contain a variety of nutrients beneficial for the human body, including amino acids, proteins, active polysaccharides, as well as minerals. In a study on the nutritional ingredients present in lotus seeds, it was found that the seeds contain a certain amount of resistant starch (RS) (Yen *et al.*, 2006; Zhang *et al.*, 2015). RS is a type of starch that cannot be absorbed and used by a healthy small intestine, but can be fermented or partly fermented in the colon by coliform bacteria, resulting in decreased blood sugar and insulin levels, which, in turn, may help to prevent diabetes, hyper-lipidemia and colon metabolic diseases. As such, RS is a new functional food ingredient (Rastall, 2010). In general, these nuts are cholesterol and gluten free and have cooling and detoxifying effects. The protein of these nuts are unique in amino acids combinations like arginine, cysteine, isoleucine, leucine, lysine, methionine, proline, glutamine and asparagine which influence reproductive and anti aging processes.

### Variety

Until date no registered variety of lotus is released in India. Most of the varieties are named after their color of petals. Like White lotus and Pink lotus and Red lotus.

Pink lotuses are very common in India but they have smaller seeds. It has been found that white lotus are very productive (yield = 0.5-0.7 t dry nut/ha) or (20.0 × 10,000 cut flowers) 2.0 lakhs cut flower/ha.

### Climate

For plant growth and development it needs a little bit higher temperature 30-35 °C. However, fruit is generally harvested during cool months *i.e.*, June-September in India.

### Soil and Nutrient Management

As it is an aquatic crop it does not require specific soil for its cultivation. However, for commercial cultivation soil should be heavy, muddy and rich in organic matter. A fertilizer dose of 100:60:60 @ 0.5 t/ha is ideal for lotus cultivation.

### Crop Maturity

Crop can be transplanted from Oct-Nov. Flowering occurs in April-May of the next year.

### Harvesting

Harvesting season is May to August for White lotus and July to September for Pink and Red lotus.

### Yield

Yield is about 0.5-0.7 t dry lotus nut/ha.

### Economics

Net income is about INR 1.5-2.0 lakhs/ha.

### Nutri-Fact of Lotus Seed

As compared to makhana, lotus seeds are rich in nutritional value in terms of carbohydrates, proteins, vitamins *i.e.*, A, B, C and E and also minerals like sulphur, magnesium, sodium and potassium. It also has a lot of phytochemicals and has strong anti-inflammatory properties. Lotus seeds are low in fat and cholesterol. The unique combination of rich nutrients and low calories render lotus seeds a desired snack to satiate people between meal hunger pangs without compromising your health. A close perusal of the Table 1 revealed that the protein content of lotus seed is 16.2%, Carbohydrates 69.0% and total fat is 0.54%. Lotus is a nutrient dense medicinal super food. The several medicinal benefits of lotus seeds are envied by other wetland macrophytes and other terrestrial herbs. It is rich in antioxidants including vitamins, flavonoids and high value amino acids. In traditional systems *i.e.*, in Ayurveda and Siddha, lotus seeds are used like to treat internal and external inflammatory and degenerative diseases. Hence, it is recommended for many skin conditions caused due to inflammations as well as

Table 1: Proximate composition of lotus seed kernel at RCM, Darbhanga

Sl. No.	Bio-chemical ingredients	Quantity
1	Moisture (%)	10.5
2	Total Ash (%)	0.52
3	Total Fat (%)	0.54
4	Protein (%)	16.2
5	Crude Fibre (%)	2.10
6	Carbohydrates (%)	69.0
7	Minerals, Vitamins and Flavonoids (%)	0.50

prescribed as a diuretic by some physicians. Due to presence of high K and Zn, lotus seeds have the potential and used to keep insomnia at bay. It is also effective against diarrhea and indigestion. Lotus seeds are aphrodisiac and these seeds to possess cancer preventive properties. It has also been found that lotus seeds are traditionally used to improve heart health. This might be because it is a rich source of K, Magnesium and folate. The Arginine content of the lotus seeds improves blood flow in the arteries and helps in eliminating of blockages in the channels. This helps to reduce the risk of getting heart attacks. It is very much effective against coronary heart diseases. Some important anti aging amino acids are present in lotus seeds in heavy quantity. Therefore, these seeds have become a regular feature in many cosmetics and skin creams. The enzyme, L-isoaspartyl methyltransferase present in lotus seeds, which slows down cell degeneration by managing damaged proteins and boosting collagen synthesis within and thus the ageing process. Lotuses are a wonderful medicinal food and inherently have a low glycemic index (Guo *et al.*, 2015). Hence, they restrict a sudden spike in blood sugar levels after taking meals. Insulin response in the cells was also monitored in the body by lotus seeds and also maintains glucose content in the bloodstream within the normal range. Hypertension and high blood pressure are commonly found in diabetic patient. A lotus seed stabilizes blood pressure levels in the body and minimizes the risk of mis-happening. Due to the presence of high amount of K, Mg and high value amino acids and its ratio Leucine/Isoleucine (> 1.8) or total of Arginine + Proline + Lysine (> 3.5%), lotus seeds are supposed to have calming effects and are antispasmodic, which means, your nerves relax better and you get better sleep. The presence of iso-quinoline alkaloids in lotus seeds helps in the dilatation process of the blood vessels and helps immensely in alleviating depression and anxiety thus improving blood supply to the brain. The resistant starch present in lotus seeds activates intestinal motion to help smoothen bowel movements. Lotus seeds are rich in micro and macro-nutrients and dietary fibers, which rendering it as a digestive booster. It works by boosting the secretion of gastric juices to help improve digestion. It

is used in ayurvedic diarrhea treatment as well as anti-diarrhea supplements. Lotus seeds are often used in as kidney detoxifier. A lotus seeds are rich in fiber contents and RS and act as an appetizer and improves your desire for food. Lotus nut production and different processed products are depicted in figure 1 to 8.

## Usages

**A** 100 g dried lotus seeds supply 332.0 calories and contain 64.0% carbohydrates, 2.0% fat, 15.0% protein and 14.0% moisture (Table 2). The seeds rich in Vitamin B, particularly thiamine at 43% of the Daily value (DV), and



Figure 1: Lotus field



Figure 2: Lotus flower



Figure 3: Lotus fruit immature



Figure 4: Lotus nut



Figure 5: Lotus nut



Figure 6: Lotus pop



Figure 7: Lotus flour



Figure 8: De-husked whole lotus nut of commerce (Internet source)



Table 2: Proximate composition of lotus seed (USDA, 2014)

Sl. No.	Bio-chemical ingredients	Quantity
1	Moisture (%)	14.0
2	Total Ash (%)	3.0*
3	Total Fat (%)	2.0
4	Protein (%)	15.0
5	Dietary Fibre (%)	2.0*
6	Carbohydrates (%)	64.0
7	Calorie	332.0

\*Calculated from other sources

numerous dietary minerals, such as manganese (116.0% DV) and phosphorus (63.0% DV) (USDA, 2014). Lotus seeds also content high amount of tannin. Therefore, roasting or boiling before use is suitable. Daily recommended dose is 7.0 g for adult and 3.5 g for the children. Every 7.0 g lotus seed kernel contains about 4.5 g carbohydrates, 0.14 g fat and 1.2 g protein, which provides 23.24 cal energy.

### Conclusion

Lotus nut contains very high protein content along with different nutrients, flavonoids and vitamins. It is nutrient dense medicinal super food. Apart from usage as food, it has also different pharmaceutical values.

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