

An Extensive Review on Lotus-Its Conventional Uses and Nutritional Benefits

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Abstract—Medicinal plants play a significant role in the new age of modern medicine. The national flower of India, Lotus (*Nelumbo nucifera*) is known for its spiritual and medicinal values. Lotus symbolizes purity as even as it is rooted in mud, the flowers float above the mud due to the long stalks, encouraging us to float above the earthly attachment and desires. And the human should be able to detach from the sins like the water drops sliding of the lotus petals. Lotus is a perennial, large and rhizomatous aquatic herb, which was traditionally used to treat gastrointestinal and bleeding disorders etc. Flowers are white to rosy, sweet-scented, and petals contain flavonoids which have antioxidant properties. Fruits are ovoid having nut like acne; seeds are black, hard and ovoid. The seeds are used in different cuisines and medicinally used to cure insomnia. The roots are rich in vitamins, minerals and dietary fibres. Therefore various parts of this plant can be incorporated in the diet to obtain its therapeutic benefits.

1. INTRODUCTION

Since prehistoric times, lotus was common along the banks of the river Nile, together with the closely related species 'sacred blue lotus' (*Nymphaea caerulea*). In ancient Egypt, different parts of lotus i.e. flowers, fruits and sepals were worshipped that were widely portrayed in the architectural motifs. From Egypt, lotus was carried out to Assyria and widely cultivated throughout Persia, India and China.

Nelumbo nucifera is popular by different names such as Bean of India, Chinese water lily, Indian lotus or lotus. It is widely cultivated in the tropical regions of Pakistan, India, China, Thailand and Australia ^[1]. It is an aquatic perennial that thrives in shallow ponds, lagoons and marshes that sends root like rhizomes into the mud while leaves rise above the water on 3 to 6 foot petioles. Its seeds may remain viable for many years under favourable environment, with the oldest recorded lotus germination being from that of seeds 1,300 years old recovered from a dry lakebed in north-eastern China ^[2].

Nelumbo nucifera is a large aquatic herb. In Sanskrit, lotus is called Kamala. There are two forms of lotus- the white lotus named as "Pundarika" and the red lotus known as "Rakta Kamala". The whole plant with flower is known as "Padmini" ^[1].

Every part of lotus i.e. flowers, rhizomes roots, stem, leaves fruits and seeds of *N. nucifera* has been claimed to possess various medicinal as well as culinary uses. Review on all of these parts is being performed in this review.

2. PLANT DETAILS: ^[3]

Taxonomic Classification:

Kingdom: Plantae – Plants;

Sub Kingdom: Tracheobionta – Vascular Plants;

Super Division: Spermatophyta – Seed Plants;

Division: Magnoliophyta – Flowering Plants;

Class: Magnoliopsida;

Subclass: Magnoliidae;

Super order: Proteanae;

Order: Proteales;

Family: Nymphaeaceae– Lotus Family;

Genus: *Nelumbo* Adans – Lotus;

Species: *Nelumbo nucifera* Gaen. – Sacred lotus.



3. HABITAT:

A range of shallow wetland habitats, including fresh water ponds, lakes, marshes, swamps and the backwaters of reservoirs.

4. USE OF LOTUS IN TRADITIONAL MEDICINE:

Several herbal medicines were used by mankind since ancient times. The indigenous knowledge of many tradition communities has been formulated, been documented and eventually become organized systems of medicine such as ayurveda, siddha, unani, and other systems out of India. In Ayurvedic medicine, the lotus plant is used as a diuretic and anthelmintic and in the treatment of vomiting, leprosy, skin diseases and nervous exhaustion^[4-6]. In popular medicine it is used in the treatment of tissue inflammation, leprosy, skin diseases, cancer and as a poison antidote^[6,7].

Rhizomes are given as a soothing agent in haemorrhoids and are useful in dysentery, chronic dyspepsia, and have nutritive, diuretic and cholagogue activities^[8-9].

The stem is prescribed in indigenous Ayurvedic medicine as a diuretic, anthelmintic, to treat vomiting, leprosy, skin disease and nervous exhaustion.

The leaves are used for the management of haematemesis, epistaxis, haemoptysis, haematuria, metrorrhagia and hyperlipidaemia^[10].

The flowers are useful in the treatment of cholera, diarrhoea, fever and gastric ulcers^[6].

The seeds and fruits are used as a health food in Asia and to treat many diseases, including poor digestion, chronic diarrhoea, enteritis, palpitations, insomnia, spermatorrhoea, leucorrhoea, menorrhagia, leprosy, dermatopathy, tissue inflammation, fever, cancer and heart complaints, and as an antiemetic, diuretic, refrigerant and poisoning antidote,^[1,6,11-12]. Lotus seedpods are sometimes used as an herbal medicine for haemostatic function^[13]. The mixture of seed powder and honey is useful in the treatment of cough^[5].

Embryos of lotus seed are used in traditional Chinese medicine to treat high fevers (with restlessness), nervous disorders, cardiovascular diseases (e.g. hypertension, arrhythmia) and insomnia^[14].

5. AIMS AND OBJECTIVES:

The aims and objectives of the study are:

- To study the scientific literature on *Nelumbo nucifera*.
- To list out the traditional use of *Nelumbo nucifera*.
- To collect the physiological and therapeutic benefits of different parts of *Nelumbo nucifera* in a systematic manner.

6. REVIEW OF LITERATURE:

Rhizome:

The lotus root is really a wonder of nature. The lotus root has so many benefits that it was considered as sacred by different cultures as a miracle crop or "gift from the gods". Lotus root has a complex structure and rich in various nutrients which provide a lot of health benefits^[15].



➤ Health Benefits of Rhizome:^[16]

High nutritive value of rhizome is associated with several health benefits.

Addition of lotus root in the daily diet is an easy way to incorporate vitamins and minerals in the diet.

▪ Increases Blood Circulation:

Lotus root helps to improve the circulation of blood flow, so that all the organs in the body are properly oxygenated. Adequate oxygen help to maintain the body function in a smooth and better way. Lotus root is rich in copper and iron which encourages the production of red blood cells, preventing symptoms of anaemia from popping up.

▪ Regulates Blood Pressure:

Lotus root contains sodium and potassium. When these two elements work together, they help to maintain healthy blood pressure levels. Potassium and sodium have a sort of yin and yang effect: potassium strikes a fluid balance in the body, which helps to minimize the affect of sodium has on blood pressure. Sodium increases the blood pressure by constricting

blood vessels and blocking the flow of blood. Potassium dilates the blood vessels, ensuring that blood flows to and from the heart at a healthy rate.

▪ **Maintains Heart Health:**

By increasing blood circulation and regulation blood pressure, lotus root helps to improve cardiovascular health. The high fibre content of lotus root also helps to reduce LDL cholesterol levels, which can clog arteries and lead to such problems as heart attack, stroke, and heart disease.

▪ **Improves Digestion:**

Lotus root is loaded with dietary fibre, which helps to keep things regular and moving smoothly. Fibre helps to add bulk to stool and improves bowel movements thereby preventing constipation. Adding bulk to stools also helps prevent the development of diarrhoea. The rich fibre content also stimulates the release of gastric juices, helping to break the food down and absorb nutrients.

▪ **Promotes Mental Balance:**

Lotus root contains the B-vitamin pyridoxine. Pyridoxine is known to increase your sense of well-being and inspire mental stability. Pyridoxine has direct effect on neural receptors that control our mental state and mood. These receptors also influence stress levels and headaches.

▪ **Maintain Eye Health:**

Lotus root contains a significant amount of vitamin A, which is important to maintain our vision while preventing macular degeneration.

➤ **Culinary use:**

Lotus root can be used as vegetable. It can be washed, sliced, and prepared. It is normally used as a vegetable in Asian cuisines in soups. Deep-fried, stir-fried and braised lotus stem are also popular. Different healthy foods can be prepared using lotus stem. It is also used in the natural or a powdered form in traditional herbal medicine.

Stem:

Lotus stems are long, plump and light brown in colour and the height of the stem may vary between 2 to 4 meters. When the outer skin of the stem is peeled and then chopped in to pieces, you can find small holes inside it, which are nothing but air cubicles running through the entire lotus stem. This lotus stem is loaded with full of nutrition and has some tremendous health benefits. [27]



➤ **Health Benefits of Lotus Stem:** ^[17]

▪ **Digestive and Bowel Health:**

Lotus stems or kamal kakdi are rich in fibre. Dietary fibre adds bulk to the food, helps in bowel movement and prevents constipation.

▪ **Regulates Blood Pressure and Blood Sugar:**

Lotus stem is beneficial for patients with diabetes and high blood pressure. It helps in regulating blood sugar levels as well as the blood pressure. High potassium content of the stem regulates the blood pressure effectively.

▪ **Lotus Stem Helps In Lowering The Cholesterol:**

Lotus stem or kamal kakdi is beneficial in lowering the cholesterol because of its high fibre content. Fibre actually binds with the fat present in the food and thus, greatly reduces the overall absorption of fat in the body. Consuming fibre rich foods like lotus stem on a regular basis and cutting down drastically the processed food from the diet will help in keeping healthy body for long.

▪ **Heart Disease:**

Lotus stem is also beneficial for heart health. This is because of the calcium content of the stem influence the heart function.

▪ **Anti-oxidant Properties:**

Consumption of lotus stem increases the intake of antioxidants. Edible lotus stem is proved to contain tryptophan, an amino acid, that influences antioxidant activity. These antioxidants protect the cell damage by free radicals.

▪ **Weight Loss Benefits:**

Lotus stem helps in reducing weight. Being loaded with fibre, low in calories and rich in nutrients, it is a perfect food which should be included in a weight loss plan.

▪ **Enhances Immunity:**

Lotus stem or kamal kakdi is rich in vitamin C. Vitamin C develops immunity in the body and fight against the viral infections. So, lotus stem has some great benefits towards the immune system.

▪ **Bone Strength:**

Lotus stem is rich in calcium. This, the calcium content presents in the stem influences the bone strength and bone density.

▪ **Skin and Hair Health:**

Lotus stem helps to maintain healthy skin and hair. Lotus stem is highly rich in vitamin C which is an excellent antioxidant and greatly prevents free radical damage. Vit-C helps in collagen production. Collagen is highly essential for healthy skin, hair as well as bones. Apart from this, lotus stem or kamal kakdi is rich in copper, which is very much beneficial for healthy hair.

▪ **Mental Health and Lotus Stem:**

Lotus stem is rich in B vitamins, especially niacin, folic acid, thiamine, pyridoxine, and Pantothenic acid. Deficiency of these vitamins leads to memory loss, irritability, tension and headaches. So, in order to preserve mental clarity, vitamin B rich vegetables such as lotus stem can be added to the diet.

➤ **Culinary Uses:**

- Lotus stem can be eaten raw, in the form of salads. It can be mixed with finely sliced

shallots, cucumber and little lime juice to enhance the flavor.

- Lotus stem salad can be eaten with crispy pork and prawns.

- Lotus stem pickle is also tasty. It is prepared by mixing canned lotus stem with presoaked chick peas and cranberries, while adding all the pickle ingredients like fenugreek seeds, ginger, garlic, turmeric and red chilli powders, salt, lime juice and cracked black peppercorn and black mustard seeds along with nigella seeds.

- Lotus stem curry is also tasty. It is prepared by adding boiled and peeled lotus stem to the prepared ginger-garlic-green chilli paste with onion and tomatoes chopped and cooked in it. After adding lotus stem, garam masala, salt and other spices are added.

This goes well as an accompaniment with rotis or even rice.

- Stir fried lotus can be prepared with sliced lotus stem, sliced spring onions and capsicum with addition of ginger, garlic and green chilli paste. This recipe can be had with multi grain roti to improve its nutritive value.

Leaves:

Lotus leaves are flat and broad, reaching up to 18 inches in diameter. The leaves are usually collected in the summer and autumn and dried before being cut into small pieces, powdered or processed into pills. The leaves can grow

extremely large at times, reaching more than 18 inches in diameter. They are typically collected in the summer and autumn, cleaned, then dried in the sun and cut into small pieces.



➤ **Health Benefits of Lotus Leaves:** ^[18]

- Healthy Heart (Increases blood flow and lowers blood pressure)
- Reduces anxiety and stress
- Promotes healthy Liver functions
- Stopping internal bleeding (For Example: Urine in the blood)
- Treats diarrhoea
- Treats ringworm
- Helps weight Loss by increasing metabolism
- Has anti-bacterial and anti-fungal properties.

Lotus leaf tea:

Lotus leaf extract, when combined with L-carnitine, "might represent a treatment option for obesity-related diseases." The mixture was shown to prevent adipogenesis i.e. formation of fatty tissue. Various studies revealed that lotus leaf reduces fat and carbohydrates absorption, increased energy expenditure

and accelerated lipid metabolism. Lotus leaf helps in reduction of body weight. Lotus leaves contain high concentrations of phytochemicals which are the compounds produced by plants to protect themselves against bacterial and fungal infections. Lotus leaf contains alkaloids, flavonoids and tannins. The isoquinoline, alkaloids in lotus leaves have sedative and antispasmodic properties, which may relieve indigestion. Both flavonoids and tannins are powerful antioxidants that have been associated with weight loss and cardiovascular health.^[19]

Flower Petals and Stamens:

The flowers of lotus are solitary, large, 10-25 cm in diameter, fragrant and have peduncles arising from the nodes of the rhizome, and 1-2 cm long sheathing at the base. The sepals, petals and stamens are spirally arranged, passing gradually one into another.



➤ Phytochemistry

Flavonoids, the primary constituents of the petals of *Nelumbo nucifera*, are known to have antioxidant properties and antibacterial bioactivities. [26] Several flavonoids have been identified in the stamens of *N. nucifera*. These include kaempferol and seven of its glycosides: kaempferol 3-O-β-D-galactopyranoside, kaempferol 3-O-β-D-glucopyranoside, kaempferol 7-O-β-D-glucopyranoside, kaempferol 3-O-α-L-rhamnopyranosyl-(1-6)-β-D-glucopyranoside, kaempferol 3-O-α-L-rhamnopyranosyl-(1-2)-β-D-glucopyranoside, kaempferol 3-O-α-L-rhamnopyranosyl-(1-2)-β-D-glucuronopyranoside, kaempferol 3-O-β-D-glucuronopyranoside, kaempferol 3-O-β-D-glucuronopyranosyl methylester, myricetin 3',5'-dimethylether 3-O-β-D-glucopyranoside, quercetin 3-O-β-D-glucopyranoside, nelumboside A and nelumboside B. It also contains two isorhamnetin glycosides: isorhamnetin 3-O-β-D-glucopyranoside and isorhamnetin 3-O-α-L-rhamnopyranosyl-(1→6)-β-D-glucopyranoside.^[18-20] Some non-flavonoid compounds,

including adenine, myo-inositol, arbutin and β-sitosterol glucopyranoside, have also been identified in stamen extract^[20].

➤ Health Benefits of Flower Petals and Stamens:

▪ Hypoglycemic Activity:

Sun-dried flower powder of *N. nucifera*, as well as the aqueous and alcoholic extract of the flower, produced significant hypoglycaemia in fasting normal albino rabbits^[1].

▪ Anti obesity Activity:

N. nucifera is an important medicinal plant known for its antiobesity action in various preclinical models. Both methanol and successive water extracts of *N. nucifera* petals had an effect on inhibition of lipid storage in adipocytes and on increasing lipolysis. Overall, methanol extract of *N. nucifera* petals showed better activity than successive water extract^[21].

▪ Antioxidant Activity:

The methanol extract of *N. nucifera* showed strong antioxidant activity in the ONOO⁻ system and marginal activity in the DPPH and total ROS systems. Several flavonoids present in lotus stamens also possessed potent antioxidant activity^[12]. The glycosides nelumboside A, nelumboside B, isorhamnetin glycoside and isorhamnetin rutinoid isolated from *N. nucifera* stamens showed potent antioxidant activity in DPPH and ONOO⁻ assays^[22].

▪ Hepatoprotective Activity:

Studies revealed that oral administration of a 50% hydroalcoholic extract of *N. nucifera* flowers (200 and 400 mg/kg) was effective against carbon-tetrachloride- and paracetamol-induced hepatotoxicity in rats. The hepatoprotective mechanisms of flower extract might be due to prevention of lipid peroxidation, inhibition of cytochrome P₄₅₀ activity, stabilising of the hepatocellular membrane, and enhancement of protein synthesis^[23].

▪ Anti allergic Activity:

A stamen methanol extract containing kaempferol inhibited key receptors and attenuated immunoglobulin E-mediated allergic reactions^[24].

➤ Uses

- Lotus flowers have a beautiful fragrance, and are used in cooking of rice and other Asian dishes^[25].
- The flower petals are used as garnish, smoked, floated in soups, and the fresh petals are used as a wrap in Asia. It is also said that the petals steeped in wine or tea have a calming effect.
 - Lotus stems are often used in salads.
 - Dried stamens are used to make tea.
 - They are also used to make eye drops.

Seeds:

Fruit is an aggregate of indehiscent nut-lets. Ripe nutlets are ovoid, roundish or oblongish up to 1.0 cm long 1.5 cm broad, with hard smooth, brownish or greyish black pericarp which is faintly longitudinally striated, pedunculated and one seeded. Seeds fill in the ripe carpel. Lotus seeds are edible and has been used since ages as traditional medicine to treat various ailments such as cancer, skin disease, diuretics and poison antidote [26]. Seeds are also used in the treatment of hyperdipsia, dermatopathy, halitosis, menorrhagia, leprosy and fever [27]. Seed extract have shown to possess hepatoprotective and free radical scavenging activity.

➤ **Types of *Nelumbo nucifera* (Lotus) Seeds:** [28]

Two types of dried lotus seeds can be found commercially; brown peel and white. The former is harvested when the seed head of the lotus is ripe or nearly ripe and the latter is harvested when the seed head is still fully green, but with almost fully developed seeds. White lotus seeds are deshelled and de-membraned.

**Health Benefits of Seeds:**

➤ **Alkaloids and Flavonoids:**

The embryos contain small amount of alkaloids which acts as an antispasmodic agent and prevents diarrhoea [28].

➤ **Antioxidant:**

Lotus seed extracts are hepatoprotective and have free radical scavenging and anti fertility properties [29].

➤ **Antifertility Activities:**

Studies revealed that the petroleum ether extract of lotus seed resulted in suppression of genesis of steroids in ovary as well as testis. The result indicated suppression of steroidogenesis in both ovary and testis of the female and male rats respectively. The seed extract is also anti oestrogenic in nature in case of female rats and anti spermatogenic in male rats. [30-32]

➤ **Hepatoprotective Activity:**

Ethanol extract of lotus seeds showed hepatoprotective activity. The extract also gave protection against cytotoxicity caused by carbon tetrachloride and aflatoxin B₁ [33].

➤ **Hypoglycemic activity:**

Studies revealed that *N. nucifera* seed extract had hypoglycaemic effect on streptozotocin-induced diabetes in rats [34].

➤ **Antiobesity and hypolipidemic Effect:**

Ethanol extract of *N. nucifera* have inhibitory effect on adipogenesis and has a beneficial effect on reducing adipose tissue weights, ameliorating blood lipid profile, and modulating serum leptin level in rats fed a high-fat diet [35]

➤ **Culinary Uses:**

- Raw seeds of these plants are consumed as snack in their fresh or dried form.
- They are used to make “Lotus Seed Paste” which is used in numerous Chinese desserts and pastries.
- This paste is also used in Japanese cuisine as a filling for cakes and desserts.
- They are cooked in syrup to make “crystallized seeds” which can be consumed as nuts.
- These seeds are also used for preparing soups, congee and other dishes.

7. CONCLUSION:

Lotus is considered as “sacred flower” in India. It is also our national flower. Though lotus, has generated from the dirty ponds and stagnant lakes, it has several nutritional benefits on human health. Different parts of the plant have culinary as well as medicinal uses. It has antioxidant, hypoglycaemic, antiobesity properties etc in general. This flower is found abundantly in lakes, ponds, wet lands etc. in our country. Therefore future studies can be done on lotus to investigate its other nutritional and pharmacological properties so that it can be used as a low cost food as well as an important herbal medicine.

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