**Abstract**

*Euryale ferox* Salisbury (Nymphaeaceae), known as *Makhana*, is distributed in tropical and subtropical regions of south-east and East Asia. It grows as an exclusive aquatic cash crop in shallow water bodies in north Bihar and lower Assam regions of India. It has nutritional and medicinal properties and supports cottage industry. It is cultivated in ponds, lakes, tanks and other aquatic bodies. Classical texts books of Ayurveda gave limited information about *Makhana*. In BhavprakashNighnatu describe *Makhana*. Also various Nighantu author describes the *Makhana*. It is medicinal and nutritional herb is extensively used in Ayurveda and Chinese medicine. In India Makhana is used as food supplement and is contain of many dishes in Indian people food. In Ayurveda disease like *Daha, Raktapitta* and low quality of semen, Makhana is useful. In Chinese medicine treatment of diabetes mellitus *Makhana* having good impotence. So, these articles narrate the medicinal and nutritional properties of *Makhana*.

**Keywords**

Makhana, *Euryale ferox* Salisbury, Ayurveda, Nutrition
INTRODUCTION

Makhana (Euryale ferox Salisb) is an aquatic crop, belonging to the family of Nymphaeaceae. It is commonly known as Gorgon Nut or Fox Nut, and it is grown in stagnant perennial water bodies like ponds, land depressions, oxbow lakes, swamps and ditches. Makhana seeds are also called as Black Diamond\(^1\). It is a food item for the religious fast of various people. Popped Makhana is used in preparation of a number of delicious and rich sweet dishes, pudding and milk based sweets. Apart from these, Makhana is used for medicinal purposes as well, both in India and China as documented in the ancient literatures. The seed is analgesic and aphrodisiac, hence used in the preparations of a number of Ayurvedic medicines.

**Aim and Objective:** The present work aimed to review and give more information about nutritional value and medicinal uses of Makhana.

MATERIAL AND METHOD

This review was done by compiling of Pharmacology (Dravyaguna) and, magazines and research journals as well as PUBMED, MEDLINE database. The compiled information was review with the chemical composition, nutritional value and medicinal properties of Makhana.

**Plant description:**

E. ferox Salisb is stem less, prickly, aquatics herb with rootstock short and thick. The leaves are submerged, oblong, orbicular corrugated about 6-100 cm in diameter; reddish green above, purple below and densely spinous. The flowers are solitary, submerged, and epigynous with four persistent, thorny sepals inserted on the torus above the level of the ovary, together with many seriate petals. Most flowers are cleistogamous, but chasmogamous flowers may also be produced. The inferior, multicarpellary ovary develops into a spongy berry like fruit which is densely prickly, the size of an orange, and contains 30-40 pea size seeds with hard black seed coat and a mucilaginous aril. The pulpy aril keeps the seeds floating for a few days after they dehisce, before they finally settle down to the bottom of the water\(^2\).

**Makhana Scientific description:**\(^3\)

Kingdom-Plantae
Unranked-Angiosperms
Order-Nymphaeales
Family-Nymphaeaceae
Genus- Euryale Salisb.
Species- E. ferox
Binomial name- *Euryale ferox* Salisb.

**Ayurveda:**

*Makhana* is not describing in the BrihatTrayi texts. However the term ‘Ankolodya’ is used by Charaka⁴. Thakur Balvant Singh is considered as ‘Gilodya’ i.e.*Ceropogiatuberosa* Roxb. It may be concluded that ‘Ankolodya’ is substitute for *Padmabija*. (Seeds of Lotus)⁵

**Pharmacodynamics in Ayurveda:**

(Table 1)

<table>
<thead>
<tr>
<th>Nighantu</th>
<th>Rasa</th>
<th>Virya</th>
<th>Vipaka</th>
<th>Karma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illustrated DravyagunaVijnana[22]</td>
<td></td>
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</tr>
</tbody>
</table>

**Table 2 Chemical Composition Makhana**[23]

<table>
<thead>
<tr>
<th>Determination</th>
<th>Whole starch</th>
<th>Protein free starch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (%) from seed meal</td>
<td>52.5</td>
<td>n.d</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>14.4</td>
<td>13.5</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>15</td>
<td>0.15</td>
</tr>
<tr>
<td>N (%) by kjedahl method</td>
<td>1.36</td>
<td>Nil</td>
</tr>
<tr>
<td>Protein (%) by amino acid analysis</td>
<td>7.32</td>
<td>Trace</td>
</tr>
<tr>
<td>Total carbohydrate (%)</td>
<td>77.33</td>
<td>86.85</td>
</tr>
<tr>
<td>Amylose (%), potentiometrically</td>
<td>n.d.</td>
<td>25.3</td>
</tr>
<tr>
<td>Amylopectin (%), with respect to amylose</td>
<td>n.d.</td>
<td>74.7</td>
</tr>
</tbody>
</table>

**Major chemical constituents:** Amino Acid composition of the seed protein has been reported⁶.

**Chemical Composition:** (Table 2)

**Nutritive Value:**

*Makhana (Euryale ferox Salisb.)* having low fat content, high contents of carbohydrates, protein and minerals. The calorific value of raw seeds (362 k cal/100g) and puffed seeds (328 k cal/100g). The chemical constituents are 0.02 calcium 0.9 phosphorus and 0.0014 irons⁷. Nutritional studies shows that edible parts of the seeds contains 12.8% moisture, 9.7% protein, 0.1% fat, 76.9% carbohydrate, 0.5% mineral matters, and 1.45% iron besides a good proportion of sugar, ascorbic
acid and phenol. Amino acid index is higher than in staple foods, which signifies its unique food quality. 

**Antidiabetic and Antihyperlipidemic of E. Feroxsalis**: The extract of *E. Feroxsalis* seeds extract protect β-cells against ROS-mediated destruction by improvising the levels of antioxidant enzymes and minimizing hyperglycemia which could be due to release of insulin from remnant and recovered β-cells in pancreas in STZ-induced diabetic rats as confirmed by the ultrastructural, histopathological studies. The research clearly indicates that ethanolic extract of *E. Feroxsalis* may be utilized as important source of natural antioxidants with antidiabetic and antihyperlipidemic potential and can be used as plausible food additives or as a functional food in future.

**Medicinal properties of Makhana**: 
1. The seeds contain sufficient amount of vitamins so, used to treat beriberi, a disease caused by deficiency of Vitamin B1.
2. Feeding of *E. ferox*, stimulated humeral immunity and suggested its applications in mothers after delivery and invalids.
3. Makhana alleviates Vata and Pitta Dosha. It strengthens the heart and is very useful in anemia. Makhana increases quality and quantity of semen, prevents premature ejaculation, increases libido and helps in female infertility. It strengthens body and increases energy level. Because of its aphrodisiac properties it is grouped under *Vrishyadi* group. The herbs under this group are used in *Vajikarana* therapy. Makhanna increases stickiness of secretions by increasing moisture level in body. Hence it increases quality and quantity of semen and useful in impotence. It helps to increase the fertility in women and reduces *Vata* and *Pitta*. It strengthens the body and reduces burning sensation and quenches thirst.
4. Makhana is used as a tonic and for the treatment of leucorrhoea and good immunostimulant.
5. **Diabetes** - Diabetes is a metabolic disorder, which is accompanied by high blood glucose levels. It is a result of improper functioning of the pancreas, which secretes the insulin hormone. Fox nut is a sweet and sour seed. These seeds contain starch and protein which is excellent for diabetes.
6. **Anti-aging**: Makhana is rich in antioxidants which works as age lock system and makes us younger for much longer. Makhana is effective for individuals with
high risk of premature ageing, premature white hairs, wrinkles and other signs of aging\textsuperscript{15}.

7. **Chinese medicine:** According to principles of traditional Chinese medicine fox nut or Makhana is used to strengthen spleen and kidneys. It is indicated in conditions like spermatorrhea, premature ejaculation, neuralgia, incontinence, chronic diarrhea etc. According to herbalists it is helpful in preventing early discharge of semen and restores sexual vigor in older men. Makhana helps in conditions like arthritis, erectile dysfunction and premature aging. This herb has antioxidant properties and helps in digestion, rejuvenates respiratory system and prevents frequent urination\textsuperscript{16}.

8. Euryale ferox seed is consumed medicinally or for food in China. The study on Makhana revealed it to contain significant antioxidant activity, which may be associated with its medical applications as a proteinuria inhibitor of diabetic nephropathy\textsuperscript{17}.

9. Makhana seeds benefit the spleen, kidney, and heart. The seed also has calming properties that alleviate restlessness, palpitations, and insomnia. It is also rich in calcium. It is a highly regarded herb for restoring sexual vigor and youthful energy in older men. It regulates blood pressure, relieves numbness and aching near waist and knees. It is suitable for arthritis, helps fighting impotency and premature aging. Makhana is very useful for women during and post pregnancy period. It is also helps your respiratory system, veins and digestion. Popped Makhana contains almost 12\% of protein (excellent especially for vegetarians) It reverses the aging process over a period of time\textsuperscript{18}.

**Discussion:** Makhana is very useful drugs for medicinal purpose as well as food supplement. Makhana also named as Fox nut, *Phool*Makhana, lotus seeds, Gorgon nut, Euryale Ferox. The plant fox nut belongs to the family Nymphaeaceae. It grows in water and is found in India, Korea, China, Japan and Russia. In India, it is popularly known as Makhana. They are the edible seeds of lotus flower which can be roasted or fried. These are used in many dishes of India. They are also considered as very pious food and used in many rituals. Along with this they are also highly beneficial in terms of nutritional values. Makhana is superior to dry fruits such as almonds, walnut, coconut and cashew nut in term of sugar, protein, ascorbic acid and
phenol content. Makhana seeds are low in saturated fats, sodium and cholesterol and are high in magnesium, potassium and phosphorus. It contains easily digestible protein, carbohydrate, moisture, fat, total minerals, phosphorus and iron. These chemical constituents are very useful for human body and they also provide rich source of nutrition. It is avoid constipation due to having high fiber. Makhana is helpful in diarrhea and improving appetite. Makhana contains flavonoids which are antioxidants and reverse the adverse effects of free radicals in the body. They also prevent the inflammations in the body. These free radicals are the main cause of many degenerative diseases like diabetes mellitus, heart problems. Makhana is known as anti-aging foods because of powerful antioxidants. It acts as an aphrodisiac and increases quality and quantity of semen, prevents premature ejaculation, increases libido and helps in female infertility. Fox nuts regulate the blood pressure as they are low in sodium and high in potassium, So a very beneficial food for the hypertensive people. Makhana contain iron, so it is also helpful in anemia. According to Ayurveda, Fox nut alleviates Vata and PittaDosha due to Madhura rasa, MadhuraVipak and SheetaVirya. Makhana is Raktapittahara, Garbhashtapan, Vrsya, Balya properties and mainly indicate in Sukrameha and Daha. Makhana having good source of energy, carbohydrate, protein and mineral, so it will be use the management of Protein Energy Malnutrition (PEM). According to the Chinese medicine, fox nut or Makhana is used to strengthen spleen and kidneys. According to herbalists it is helpful in preventing early discharge of semen and restores sexual vigor in older men. It is also recommended for the women during pregnancy and post natal weaknesses. Makhana regulates blood pressure, relieves numbness and aching near waist and knees. It increases moisture level in body tissues. They also helps to lower the blood sugar levels, so a healthy snack for diabetics.

**CONCLUSION**

Makhana is herb is use to nutritional food as well as me medicinal purpose. In Ayurveda it is very useful drug many disease. In Chinese medicine Makhana use for treat to spleen and kidney disease.
REFERENCES
8. RN Mandal, GS Saha, NS Sarangi, Harvest and processing of *Makhana* (*Euryale ferox Salisb*)- An unique assemblage of Traditional Knowledge, Indian Journal of Traditional Knowledge, Vol .9 (4), October 2010, pp 684-688