

Foxnut as a Natural Laxative: Study on Its Efficacy and Mechanism in Constipation Management

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Abstract:

Constipation is a widespread gastrointestinal disease that is caused by insufficient dietary fibre consumption, water deficiency, and sedentary life. The current review is based on *Euryale ferox* Salish. Also known as foxnut or makhana, a nutrient-dense aquatic plant seed with possible therapeutic uses in constipation relief. Foxnut is rich in dietary fibre, flavonoids, alkaloids, saponins, phenolic acids, and essential minerals like magnesium, potassium, and phosphorus that together play a beneficial role in enhancing bowel movement and gut health. Its bioactive phytoconstituents enhance intestinal peristalsis, modulate water retention, maintain gut microbiota equilibrium, and demonstrate antioxidant and anti-inflammatory properties that defend the mucosal lining. The research also examines the development of a food product from foxnut and its acceptability in terms of sensory appeal, indicating its nutritional and medicinal value. Ayurvedic products like Makhana Churn and Sharkarayukta Dudhi also exhibit synergistic digestive and rejuvenating actions and are especially useful during pregnancy and postpartum care. In all, foxnut is a safe, natural, and inexpensive dietary regimen for the prevention and treatment of constipation. Additional pharmacologic and clinical research is needed to determine its ideal dosage and long-term safety.

Keywords: Constipation, *Euryale ferox* Salish, Phytoconstituents, Natural Laxative

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1.Introduction

Constipation is one of the most common gastrointestinal disorders, characterized by infrequent difficult, painful bowel movements, along with the sensation of incomplete evacuation. It is a significant health issue worldwide the condition can be acute or chronic, with chronic constipation lasting for at least three months affecting a substantial portion of the population, particularly older adults, women, and individuals with a sedentary lifestyle or poor dietary habits The pathophysiology of constipation is multifactorial and involves a variety of factors, such as inadequate dietary fibre, dehydration, altered gut motility, and underlying medical conditions. Some of the common causes of constipation include irritable bowel syndrome IBS can contribute to the development of constipation ¹⁻². Emotional and psychological stress, sedentary lifestyles and poor dietary habits, particularly a low intake of fibre also play a significant role the onset of constipation can contribute to the development of constipation. Emotional and psychological stress, sedentary lifestyles, and poor dietary habits, particularly a low intake of fibre, also play a significant role in the onset of constipation Herbal medicines are believed to offer various mechanisms for managing constipation, including increasing stool, stimulating colonic motility, improving gut fluid balance, and enhancing overall digestive function. Many of these herbs, such as senna, aloe vera, and psyllium, foxnut ³⁻⁴. Euryale ferox Salish., also known as Makhana, Gorgon nut, or Foxnut, belongs to Nymphaeaceae water lily². Makhana seeds are also known as the black diamond of wetlands. Aquatic plants are found in the tropical and subtropical parts of Southeast and East Asia. It is cultivated only commercially in North Bihar Mahbubani, Darbhanga, Katihar, Shariatic, Manipur, and parts of West Bengal and Madhya Pradesh in India. About 80% of the total processing of makhana in Bihar comes from North Bihar. Among the districts in Bihar, Madhu Bani and Darbhanga have the highest production share with nearly 20% contribution to the state's overall production, which equals 3000 MT. This is followed by Katihar with 18%, Purina with 15%, and Darbhanga with 14%, while the other districts contribute the balance ⁵⁻⁶.

2.NUTRITIONAL VALUE OF FOXNUT MAKHANA

Makhana Euryale ferox Salish. is a common dry fruit used by people because it has low fat, high carbs, protein, and minerals. Makhana seeds contain very less saturated fats, cholesterol, and salt and are rich in magnesium, potassium, and phosphorus ⁷. Euryale kernels contain a good amount of cysteine, methionine, glutamine, arginine, leucine, and isoleucine along with other amino acids that act as antioxidants and precursors to other long-chain amino acids required for normal bodily functions ⁸. Table 1

Voters	1952	2011	2016	2017
Humidity %	12.8	10.71	34.7	11.82
Cellulose %	76.9	70.77	57	75.04
Protein %	9.7	11.02	7.02	11.16
Fat %	....	0.41	0.3	0.51

Atomic number 15 %	....	0.08	0.066	0.028
Sulphur %	....	0.024	....	0.042
Calcium %	....	0.037	0.01	0.027
Magnesium %	....	0.01	0.011	0.006
Potassium %	....	0.042	0.036	0.37
Firm %	1.4	0.004	0.008	0.006
Powder %	0.4	0.418	0.3	0.62
Full	....	93.525	99.59	99.3

Table 1: - Nutrient Constituents of Raw seeds of *Euryale ferox* Salish Makhana

Makhana *Euryale ferox* Salish. due to containing less fat and rich in carbohydrate, protein and minerals it is utilized as a good food during Hindu's fasting of Navratri to satiate appetite and provide energy ⁹ In makhana apart from a good ratio of sugar, phenol and ascorbic acid, its amino acid index is greater than staple foods which indicate its special quality of food ¹⁰ Makhana possesses strong medicinal activity against various human disorders affecting the respiratory, circulatory, digestive, excretory and reproductive organs as suggested in the Indian and Chinese system of medicine Figure. 1 . All plant parts have astringent, tonic and non-obstructing qualities as illustrated in ancient texts ¹¹ Makhana seed pops in Koshy- Mithila region are advocated for the management of polyuria, steatorrhea, gonorrhoea, diarrhoea, stomach-ache, body ache, loss of appetite, weakness during and after delivery, general debility, sexual dysfunctions such as impotence, premature ejaculation and nocturnal emissions, sexual disinterest, vaginal discharges leukorrhoea , numbness, depression, weight loss, joints pain, diabetes, high BP, insomnia and beriberi by the local Vaidya's¹² . Low cholesterol, low sodium, gluten free protein and high K, Mg and fibre content make makhana seed pops highly beneficial ideal food for people with heart diseases, high blood pressure, diabetes, kidney diseases and obesity. High Mg content of makhana cleanses the arteries and controls blood flow. Because makhana seeds are rich in fibre, it also prevents constipation. Its kaempferol flavonoid in seeds and antiaging enzymes assist in healing damaged proteins and stopping inflammation in the body. It is very digestible to children through elderly people. Its astringent nature is advantageous for kidney thus suitable for individuals affected with urine infections It purifies body cells and spleen as well as avoids developing kidney stones. High Ca content in makhana seeds is useful in body aches and arthritis. Different workers have also reported the employment of makhana pops in the treatment of various diseases. J. Roi 1945¹³ . have described the seeds of makhana to be immensely useful in the treatment of stomach disease, pains of joints, micturition and seminal loss. The seed decoction is roborant since it raises secretions of hormones ¹⁴ . The seeds were reported to have been used as seminal-orgasmic tonic by. Farinaceous seeds have binding effect in the case of dysentery but when administered in over dose, constipation and flatulence occur. Its efficiency against disorders in the digestive system and weight loss is primarily because of antioxidant property, high dietary fiber content, low cholesterol

and extremely minute sized 1-3 μ starch granules ¹⁵. Seeds contain a high concentration of vitamins present in them and it is highly effective against beriberi disease caused because of Vitamin B deficiency ¹⁶. It has GRAHI absorbent/astringent effect as per Ayurveda, thus it absorbs water from the intestine and decreases the number of loose stools ¹⁷. No side effect seen with foxnut when taken less than 30 grams daily. When taken frequently or in excess, it produces side effects such as constipation rare and flatulence ¹⁸. Figure 1

1. Botanical Background

Classification ¹⁹

Kingdom	<i>Plantae – Plants</i>
Subkingdom	<i>Tracheobionta – Vascular plants</i>
Super division	<i>Spermatophyta – Seed plants</i>
Division	<i>Magnoliophyta – Flowering plants</i>
Class	<i>Magnoliopsida – Dicotyledons</i>
Subclass	<i>Nymphaeidae</i>
Order	<i>Nymphaeales</i>
Family	<i>Nymphaeaceae – Water lily family</i>
Genus	<i>Euryale</i> Salish.
Species	<i>Euryale ferox</i> Salish. – Foxnut / Makhana



Figure 1. Medicinal properties and therapeutic applications of *Euryale ferox* (foxnut/makhana) in human health, with emphasis on digestive and laxative effects

2. Phytoconstituents of Foxnut

Phytoconstituents of foxnut makhana Relevant to constipation management

Phytoconstituent	Phytoconstituent	Phytoconstituent
Nutritional fibres	Contain both soluble and insoluble fibers	Adds bulk to stool, softens it ,stimulates bowel movement peristalsis
Flavonoids	Includes kaempferol, quercetin, rutin	Antioxidant; supports gut lining integrity; aids smooth muscle relaxation
Alkaloids	Minor alkaloids reported; bioactive in GI modulation	May enhance intestinal motility and digestive enzyme secretion
Saponins	Glycosides with surfactant properties	Promote bile flow and mild laxative effect
Phenolic Compounds	Polyphenols like gallic acid, ferulic acid	Improves gut health via microbiota modulation; reduces oxidative stress
Tannins	Astringent polyphenols present in small quantities	Balances gut secretion; anti-inflammatory to intestinal mucosa

Amino acids & Proteins	Rich in arginine, glutamic acid	Support tissue repair in gut epithelium and smooth muscle contraction
Carbohydrates	Complex polysaccharides and resistant starch	Act as prebiotic, improving stool consistency and gut motility
Minerals Mg, K, P	Essential electrolytes	Maintain osmotic balance and peristaltic activity

2.1 Dietary fiber

The nutritional benefits of foxnuts have resulted in a tremendous increase in their application. Foxnuts are rich in fat, contain minimal calories, and are mineral-rich. Deficiencies of micronutrients can be fewer if the nutrient-rich foxnuts are used regularly to replace a diet ²⁰. Due to its high nutrient value, foxnuts can be consumed either in the popped state or as a powder which may be blended with other foodstuffs. Popping of foxnuts is said to enhance their phytochemical content and other bioactive compounds. A flavonoid named kaempferol, which also occurs in almond skin, occurs in foxnuts and contributes to their phytochemical activity. Research has shown its elevated amino acid index to contribute to the recovery of muscles after exercise, and that is an important cell metabolism component. In Bihar, the nutrient content of popped fox nuts in the "Swarna Videha" variety is 358% calorific, 79.8% carbohydrate, 8.7% protein, 0.5% fat, and 0.2% crude fibre and the iron and calcium contents are estimated to be 1.4% and 18.5%, respectively ²¹.

2.2 Flavonoids

Flavonoids like kaempferol, quercetin, and rutin found in *Euryale ferox* have strong antioxidant and gastrointestinal protective activities by regulating oxidative stress, inflammatory process, and smooth muscle function in the gastrointestinal tract. These bioactive polyphenolic molecules promote gastrointestinal health by various mechanisms like induction of digestive enzymes, maintenance of gut mucosal integrity, and smooth muscle relaxation facilitating effective intestinal transit ²². Flavonoids from the extracts of foxnut have been found to enhance the activity of antioxidant enzymes particularly superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GAP) which cumulatively augment nutrient hydrolysis and uptake and protect intestinal cells from oxidative damage ³. This helps to preserve the barrier function of the gut and curb diseases such as constipation accompanying impaired peristalsis or epithelial stress ²³.

2.3 Alkaloids

Alkaloids present in *Euryale ferox* foxnut represent an important class of nitrogen-containing bioactive compounds that contribute to its therapeutic and digestive benefits. Studies have indicated the presence of various indole and isoquinoline alkaloids in foxnut seeds and seed coats,

which exert mild prokinetic and antioxidant effects, enhancing gastrointestinal motility and overall digestive health 1,2 . These bioactive act by stimulating digestive enzyme secretion and improving gut smooth muscle contraction, thereby promoting efficient food transit and preventing the accumulation of undigested residues—a common factor contributing to constipation ²⁴ . Certain alkaloids isolated from *Euryale ferox* have shown neuroprotective, anti-fatigue, and hepatoprotective activities, suggesting systemic effects beyond the gastrointestinal tract 4 . Their ability to enhance acetylcholine release and modulate enteric nervous signalling contributes to improved peristaltic rhythm and gut motility, facilitating regular and comfortable bowel evacuation ²⁵ .

2.4 Saponins

Saponins are naturally occurring glycosidic compounds known for their surface-active, antioxidant, and gut-modulatory properties. In *Euryale ferox* foxnut , saponins have been identified as one of the key bioactive phytoconstituents, contributing significantly to its digestive, hypolipidemic, and anti-inflammatory effects 26 These compounds act on the gastrointestinal tract by stimulating the secretion of digestive enzymes and promoting acid metabolism, thereby improving the digestion and absorption of fats and reducing intestinal stasis a common factor in constipation and indigestion ²⁶⁻²⁷ .

2.5 Phenolic Compounds

Phenolic compounds are among the most abundant bioactive phytochemicals in *Euryale ferox* foxnut , primarily responsible for its strong antioxidant, anti-inflammatory, and gut-protective activities 1,2 . These compounds include gallic acid, catechin, chlorogenic acid, ferulic acid, and ellagic acid, which act as potent free-radical scavengers and contribute to the overall health-promoting potential of foxnut ²⁸⁻²⁹ .

2.6. Tannins

Tannins are the most widespread secondary metabolites of plants and are widely recognized as one of the large groups of antioxidants polyphenols. They occur in many foods and drinks such as coffee, tea, wine, grapes, blueberries, pomegranate, and strawberries. They are widely distributed in leaf, wood, bark of trees, fruits, and roots. In fact, tannin constitutes 5–10% of the dry weight of plant leaves ³⁰⁻³¹ .

3. Aim and objective

To comprehensively review and critically analyse the existing scientific literature on *Euryale ferox* foxnut / makhana with respect to its potential role in the prevention and treatment of constipation, and to propose directions for future research .

3.1 Literature search

To review the nutritional and phytochemical composition of *Euryale ferox*, especially its dietary fibre, polysaccharides, phenolic compounds, flavonoids, and other bioactive constituents, which might influence bowel function.³² For example, *Euryale ferox* is reported to be abundant in fibre and polyphenols. The review by Jiang et al. 2022 describes the phytochemical profile and medicinal-food homology of *E. ferox*.³³ To examine studies in vitro or animal that have evaluated the effects of *Euryale ferox* or its extracts on gastrointestinal physiology e.g. motility, stool frequency, stool consistency, water retention, transit time, and related parameters even if indirectly related. Evidence for constipation relief is scarce; some references discuss *Euryale ferox* as a “fair source of dietary fibre” and as beneficial for digestion more generally.³⁴ Liaquat M, Pasha I, Ahsan M, Salic A. Roasted fox nuts *Euryale Ferox* L. contain higher concentration of phenolics, flavonoids, minerals and antioxidants, and exhibit lower Glycaemic Index GI in human subjects. Food Production, Processing and Nutrition. 2022 Jan 18;4(1):1. The “superfood” review indicates that due to its appreciable dietary fibre, *E. ferox* “is also good for constipation” and may serve as an effective food in that regard.³⁵ To explore and propose possible mechanisms by which *Euryale ferox* may relieve constipation, including:³⁶ Increasing stool bulk via its fibre and polysaccharides; Enhancing water retention in stool and softening faeces; Stimulating peristalsis or smooth muscle activity in the gut; Modulation of gut microbiota / prebiotic effects; Anti-oxidant, anti-inflammatory, or mucosal protective effects that maintain gut health.

4. Methodology

The purpose of the study was to develop a food product with fox nuts as an ingredient of main importance, combined with almonds, dates, flax seeds and clarified butter, and check its acceptability. The study design included an experimental design that involved the formulation, standardization and acceptability testing of the product.³⁷ Purchasing of ingredients; All the ingredients fox nuts, almonds, dates, flax seeds and clarified butter were purchased from local Chennai supermarkets.³⁸⁻³⁹ Preparation of standardisation of the food item; Popped fox nuts were roasted and then powdered to flour. The flour with roasted almonds with skin, roasted flax seeds, dates and clarified butter were formed into a ball.³⁹ Sensory analysis of the formulated product; 15 participants between 21 and 23 years of age were chosen through convenience sampling for analysis of the acceptability of the formulated product. Sensory characteristics like appearance, colour, flavour, texture and overall acceptability of the formulated product, were analysed using a 5-point Hedonic scale.

5. Therapeutic Application

5.1 Nutritional Properties of Makhana Churn

Makhana is known for its rich nutrient profile. It contains essential proteins, carbohydrates, and fats, making it a good source of energy. Its high content of Sattvic qualities is believed to promote calmness and stability, which is beneficial during pregnancy. Makhana Churn is also considered an excellent source of magnesium, potassium, and antioxidants, which support the heart, regulate blood pressure, and provide relief from stress and fatigue, common during pregnancy.⁴⁰

5.2 Medicinal Benefits of Makhana Churn

Makhana has been extensively used in Ayurveda for its cooling and Vita balancing effects. It is a mild Rasa Yana rejuvenator that supports the strength of the uterus and maintains the health of both mother and foetus. It is believed to help with Primera diabetes, Shasta respiratory issues, and Chronic Stress through its ability to calm the mind and reduce anxiety⁴¹. Additionally, its high fibre content aids in digestion, which is crucial for pregnant who often face digestive issues.

5.3 Nutritional Benefits of Harkara yukata Dudhi

The combination of Harkara sugar and Dudhi milk forms a nutrient-dense food with multiple health benefits. Harkara is considered an excellent Anupama vehicle for many herbs and food substances, improving their bioavailability. When combined with Dudhi, it enhances the absorption of nutrients and promotes the growth of Oji⁴². The combination of milk's natural proteins and fats, along with sugar's quick energy release, makes this preparation vital for sustaining energy levels and promoting healthy fetal growth.

5.4 Medicinal Effects of Sharkarayukta Dudhi

The combination of milk and sugar in this formulation provides both immediate and long-term benefits for maternal and fetal health. It promotes Madhya mental strength and Bale strength, contributing to the overall well-being of both the mother and fetus. Additionally, Sharkarayukta Dudhi is said to support lactation and improve maternal digestion, which is essential during pregnancy for both nourishment and detoxification⁴³. Supports Digestion; Post-delivery, women often experience sluggish digestion, and Makhana helps restore proper digestive function by regulating Vita and Pitta. Boosts Energy Levels: The Rasa nourishing essence of Makhana provides essential nutrients to improve energy levels and reduce postpartum fatigue. Balances Hormones: The calming effects of Makhana assist in balancing the hormonal shifts that occur after childbirth⁴⁴.

5.5 Combined Benefits

When used together, Makhana Churn and Shark ray okta Dudhi support Garba Pushti fetal nourishment and the mother's vitality. These two substances provide a synergistic effect, balancing Vita, Pitta, and Kaph, promoting a balance environment for the growing foetus, enhancing immunity, and stabilizing maternal Agni digestive fire. They help in promoting the healthy development of fetal tissues and support overall well-being during pregnancy⁴⁵.

Formulation	Guna Qualities	Karma Actions
1. Makhana Churn	Singha unctuous, Madhura sweet Lagh light Guru heavy Shital cooling	Vita and Pitta pacifying Ramayana rejuvenate Astringent, Antioxidant Improves digestion, Promotes fertility

		Supports uterine health
2. Harkara	Pushkar, Brahmana Pittas Amaka	Improved maternal energy antioxidant sopor
3. Dudhi	Kelaniya, Ojasvardhaka, Pushti	Better fatal growth prematernal vitality

5.6. Makhana churn in Postpartum Care

After childbirth, a mother's body undergoes significant changes, and Makhana churn plays an avital role in aiding recovery. Its cooling and calming properties help regulate the digestive system, which can often be disturbed post-delivery due to hormonal fluctuations. Additionally, Makhana is rich in antioxidants and essential nutrients, which help rebuild tissue and improve strength ⁴⁶.

6. Safety and Precautions

In literature, there are certain references regarding the conventional application of makhana and specifically regarding the possibility of badly popped seeds kernels damaging gums and teeth or posing a risk of choking. But as elucidated in Section 3.3, such un popped or badly popped seed shells are all eliminated at the cleaning process by polishing and handpicking. So, poorly popped seeds are extremely unlikely to be starting ready-to-eat snack packs of roasted and flavored makhana ⁴⁷. Excessive consumption is likely to have a constipating effect, as indicated by the applicant. However, due to the low weight/volume of the TF, the applicant believes that it is extremely rare that high quantities of >125 g are ingested daily ⁴⁸. There are no other known adverse effects reported to be linked with the ingestion of makhana from the information presented within the dossier.

7. Future Research Directions

Advantages of modification in diet. Highly spiced diet, fast food, packed meals and a fibre-free diet are digested with problems, and beverages like coffee and cold drinks that include caffeine seem to have a dehydration effect, resulting in constipation. Due to irregular bowel habit, it will increase frequency of defecation and constipation, and change the consistency of stool. Rubbing the anal canal pushes the anal cushion, which creates many problems. The food plan that's mild, smooth and fibrous aids in easy digestion and smooth defecation without causing constipation. Such a diet additionally allows for the maintenance of maharani, which plays a critical role in anorectal problems; these easy measures of food plan can change the face of the ailment with much relief. ⁴⁹ Advantages of modification in lifestyle. Utkatashana, excess straining and excess sitting may also cause extra strain at the local site through which the haemorrhoids protrude and will worsen pain and bleeding. Shalala Avraham keep the perianal region clean, reduces ache and swelling over there, and additionally helps to pacify the vitiated Apana Vayu, which plays the key role in pathology, to help improve digestion and ordinary defecation ⁵⁰.

8. Conclusion

The foxnut *Euryale ferox*, also referred to as makhana, has a rich nutritional and phytochemical profile that makes it a promising treatment for constipation. Dietary fiber, flavonoids, alkaloids, saponins, and phenolic chemicals all help to maintain gut health, improve digestion, and enhance bowel motility. By preserving intestinal mucosa and controlling gut microbiota, its anti-inflammatory and antioxidant qualities additionally improve gastrointestinal function. Foxnut is a natural, healthy, and affordable dietary supplement that may be a potential addition to the treatment and prevention of constipation. To establish its efficacy, appropriate dose, and long-term safety in the treatment of constipation, additional clinical and pharmacological studies are necessary.

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