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REVIEW

Nutritional and Health Benefits of Singhara – A Review Article[☆]

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Abstract

Background: *Trapa Natans* commonly known as Singhara or Paniphall in India. It is also known as Water Chestnut or Water Caltrops. It grows throughout the East of India such as in West Bengal, Jharkhand, and Bihar. Especially in Bihar, it is widely cultivated in Darbanga, Madhubani and Samasthipur district. Nuts are the edible part of the singhara and can be eaten boiled or sometimes roasted. Dried water chestnuts can be ground into flour to make a kind of porridge. Young nuts can be eaten raw with its greenish skin removed.

Method: An extensive literature survey was conducted using databases PubMed, ScienceDirect, Google Scholar. Articles were searched using terms related to 'Singhara', 'Water Chestnut', 'Benefits of Singhara'. Total 20 articles were reviewed in order to write this review paper. The studies involving Benefits of Singhara on Health were included in this article.

Result: The Singhara shell and core are rich in starch, dietary fiber, essential amino acids, certain types of phenols and minerals and have demonstrated various biological activities, including anticancer and antioxidant properties. Singhara contains several antioxidants that can reduce the risk of multiple chronic diseases and conditions. Other health benefits may include improve blood pressure, cancer prevention, weight loss and digestive health.

Conclusion: Singhara can be considered as safe, powerful plant with multiple medicinal and nutritional benefits.

Keywords: Singhara, Water chestnut, Water caltrop, *Trapa natans*, Aquatic plant, Anticancer, Antioxidant

1. Introduction

Water chestnut, commonly known as Singhara and Paniphall in India. Its botanical name is *Trapa Natans*. It belongs to the trapaceae family and is an annual aquatic free-floating plant that grows in shallow water bodies, ponds, or marshes. Water chestnuts are native to Europe, Asia and Africa [1].

2. Geographical, structural and historical description of Singhara

Singhara grows throughout the East of India such as in West Bengal, Jharkhand, and Bihar. Especially in Bihar, it is widely cultivated in Darbanga, Madhubani

and Samasthipur district. Its roots are rooted in the muddy soil bottom of the water, and its upper leaves float on the surface of the water. The thin stems vary in length depending on the water depth, and pinnate submerged leaves grow at the nodes. The leaves of the common species have serrated, rhomboid leaf blades with flat upper margins and clustered in a rosette at the top of the stem. They are dark green, shiny and slightly hairy above and often purplish brown below. The petiole bulges in the center and surrounds spongy aerial tissue that helps the leaf to float on water. The flowers are attached to the leaf axils of the floating leaves and attached to the stems. There are four sepals, four stamens, four white petals, and one pistil. The fruit is solid, 4–5 cm wide, purplish-brown, and has two 1-cm-long horn-like spines

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Fig. 1. Fresh Singhara.

on each side. Nuts are the edible part of the Singhara and are eaten boiled and sometimes roasted. Young nuts can be eaten raw with its greenish skin removed. It can be included in daily diet in multiple ways such as in the form of porridge, pakodas, paratha, puri, curry, kheer, halwa, chaat, cheela, etc. [2].

Singhara contain various nutrients such as starch and protein. In China and India, it has been used for food and medicine for a long time. The Rites of the Zhou (a book that appeared in China in the 2nd century BC) states that “worshippers should use bamboo baskets containing dried singhara.” Ancient Chinese healing books suggest that Singhara bark helps fight many ailments, including diarrhea and alcoholism. Singhara is also a useful herb in Indian Ayurvedic medicine [3,4]. It consists of minerals such as sodium, calcium, magnesium, phosphates, copper, manganese, iron, potassium and carbohydrates. The seeds, also called kernels, contain vitamins like vitamin C, vitamin A, nicotinic acid, thiamine, riboflavin, D-amylase and large amount of phosphorylase. Singhara fruit contains significant amounts of phytochemicals. It also contains carbohydrates, flavones, flavonoids, total phenolic content. Its pericarp contains tannins, flavonoids, glycosides and the seed

contains carbohydrates, fatty oils, phytosterols, saponins and fat [5] (see Figs. 1 and 2).

2.1. Botanical details

This review article summarizes the nutritional and health benefits of Singhara and ways to utilize it (Table 1).

Table 1. Botanical description of Singhara.

Taxonomical Classification	Vernacular Names
Kingdom: Plantae	Hindi: <i>singhara</i> ; <i>singhada</i>
Genus: <i>Trapa</i> ; L	Sanskrit: <i>jalphala</i> ; <i>smgtakah</i>
Family: Lythraceae	English: <i>water chestnut</i>
	Assamese: <i>paniphal</i>

3. Materials and methods

An extensive literature survey was conducted using databases PubMed, ScienceDirect, Google Scholar. Articles were searched using terms related to ‘Singhara’, ‘Water Chestnut’, ‘Benefits of Singhara’. Total 20 articles were reviewed in order to write this review paper. The studies involving Benefits of Singhara on Health were included in this article.

3.1. Ethics

The study got Publication Guidelines and Monitoring Committee (PGMC) approval from Sri Ramachandra Institute of Higher Education and Research, Chennai.

4. Results

4.1. Traditional uses of Singhara

Singhara is also known in the Ayurvedic medicine as Shurungataka [1]. Shurungataka is a beneficial medicine that is quoted in most Ayurvedic encyclopedias and lexicons in relation to its various properties



Fig. 2. Kernel of Singhara.

and mechanisms of action. Some common synonyms for shurungataka are as follows - Jalakanda, given its aquatic properties, and Trikona-Kanda, because of its triangular shape. It is deemed that this medicine also contains Madura Kashaya Rasa (because of its sweet & astringent taste), Sheeta Veerya (having cold potency and anabolic properties) and Ruksha Guru (dry and heavy on digestion). It also treats imbalanced pitta-dosha (one of the three vital forces involved in metabolism). Therefore, Shurungataka can treat some diseases caused by pitta-dosha [6]. Shurungataka can also be used as a diuretic, pittahara can also be used to treat its symptoms and etiology [7]. The drug can also be used as a blood coagulant, mainly for postpartum bleeding [8]. Considered one of the most important anti-fracture agents in Ayurveda, Gandha Thaila also helps strengthen bones [5]. Other Ayurvedic preparations prescribed along with medicines (Shungataka) are prescribed for shiroroga that is diseases related to the head, in case of broken bones Eladi taila is given, Vrushya ghruta and Apathyakarasarasa are given as aphrodisiacs [5]. Shurungataka paste can be applied along with other pittahara dravyas, including ghee [9].

4.2. Chemical composition of Singhara

Singhara is composed of carbohydrates, phytosterols, fatty oils, glycosides, flavonoids, and saponins found in the pericarp portion of fruit. Singhara is composed of both organic and inorganic components. Biochemical analysis of singhara fruits revealed the presence of carbohydrates, phosphorus, and proteins in fresh and dried fruits. Singhara also contains small amounts of fiber, ash, fat and water. Studies have found that both fresh and dried seeds produce sufficient amounts of energy [10]. Organic ingredients in Singhara include carbohydrates, vitamins and vitamin B complex (pyridoxine, riboflavin, thiamine, nicotinic acid, pantothenic acid), amylase, vitamin C, vitamin A,

D-amylase, and phosphorylase. Singhara also contains 2-, 3-, 23-trihydroxyl-12-en-28-acid, ursolic acid and cycloeucaenol [11].

4.3. Nutrition facts about Singhara

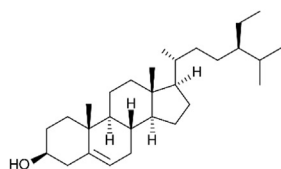
Studies on the nutritional content of Singhara fruit revealed the presence of ash, crude fiber, moisture, lipids, total-soluble sugars, reducing sugars, presence of non-reducing sugar, starch. Both red as well as green varieties of singhara consist of total phenols, vitamin C, water soluble protein, beta carotene. Minerals commonly found in Singhara are potassium, iron, zinc, copper, phosphorus, manganese and sulfur. Both types often contain tryptophan, leucine, free amino acids, tyrosine, glutamic acid, alanine, and lysine. In contrast, both green as well as red varieties contain proline, glutamine, asparagine, arginine and cysteine. Thus, it indicates that singhara are very nutritious in human life [5] (Table 2).

Table 2. Nutrient profile of 100g of Singhara (IFCT 2017).

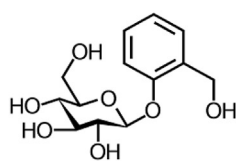
Nutrient	Amount Per 100g
Energy	95.6 kcal
Carbohydrates	21.46 g
Protein	0.86 g
Total Fat	0.37 g
Calcium	37.15 mg
Phosphorous	62.83 mg
Iron	0.77 mg
Total Fiber	3.02 g
Vitamin C	5.26 mg

4.4. Chemical structure of phytochemical constituents [12–15]

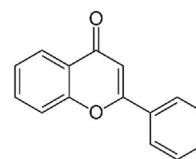
The chemical structure of phytochemical constituents of Singhara are mentioned below:



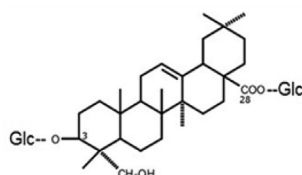
Phytosterols (C₂₉H₅₀O)



Glycosides (C₄₅H₇₄O₁₈)



Flavonoids (C₁₅H₁₀O₃)



Saponins (C₅₈H₉₄O₂₇)

5. Discussion

5.1. Utilization of Singhara

Fruits are regarded as an important foundation of the food chain system, especially in times of scarcity. Fruits of singhara are a basic food source and are savory and sweet. Nuts are eaten raw, fried or boiled. The dried kernels are ground into flour, which can also be used as a substitute for wheat flour. Kernels contains protein, fiber, fat, minerals, and carbohydrates. It also contains copper, iron, iodine, phosphorus, calcium, potassium, magnesium and vitamins such as thiamine, vitamin A, vitamin C, riboflavin, nicotinic acid. Studies conducted have indicated the presence of phosphorylase, tannin, and β -amylase in kernels [16].

5.2. Usage as a food

Singharas grows throughout the East of India such as in West Bengal, Jharkhand, and Bihar. Especially in Bihar, it is widely cultivated in Darbanga, Madhubani and Samasthipur district. Singhara is widely consumed in the Northern regions of India and is versatile. It can be boiled, grilled, roasted and even turned into sweet and savory dishes. Nuts are the edible part of the singhara and are eaten boiled and sometimes roasted. Young nuts can be eaten raw with its greenish skin removed. It can be included in daily diet in multiple ways such as in the form of porridge, pakodas, paratha, puri, curry, kheer, halwa, chaat, cheela, etc.

5.3. Usage in medicine

Singhara is considered as a crucial ingredient in various preparations such as appetizer, astringent, diuretic, chilling, tonic, nourishing, and antidiarrheal. It is also found to be useful in certain cases such as inflammation, bronchitis, sore throat and fatigue. The juicy formulations help treat eye infections [1].

5.4. Usage in traditional treatment

In olden days, singhara was used to treat irregular fevers, dry coughs, sore throats, weakness, fatigue, dental ailments, tuberculosis, and various other sexual disorders [13].

5.5. Usage for STDs, fertility and pregnancy

Singhara lotus can be included for itchy chest, lower abdomen and thighs. Singhara mixed with

milk is common, for neurasthenia and leucorrhoea, sweets prepared are prescribed in two to four doses. In olden days, the hakims used to suggest singharas as a powder, taking singhara, Kamarkas (Kino), & white sugar. Seven portions were made, and one portion was suggested each day [17].

5.6. General usage

- ✓ Singhara dried fruit/seed powder is widely used to make breakfast as it is highly nutritious.
- ✓ Powdered compounds are used in treatment of polyuria and edema. It also stops bleeding.
- ✓ Powdered compound strengthens the body and is used as a supplement for muscle weakness.
- ✓ The singhara powder is also likely to treat women at risk of abortion [18].

5.7. Health benefits of Singhara

Singhara contains various antioxidants that may reduce the risk of multiple chronic diseases and conditions. Consuming singhara may provide other health benefits, including:

- ❖ Improvement in Blood Pressure: Potassium in Singhara may reduce the risk of high blood pressure and stroke associated with heart disease. Studies have showed that people who consume large amounts of potassium are likely to have significantly reduced risk of high blood pressure and stroke.
- ❖ Cancer Prevention: The antioxidants found in Singhara may reduce the risk of developing cancers. Research shows that antioxidants found in singhara can significantly slows down the growth of cancer cells.
- ❖ Weight Loss: Those on a weight loss plan can benefit from the low-calorie content of singhara. Singhara are a high-capacity food that can curb hunger without adding many calories to diet.
- ❖ Digestive Health: Singhara is rich source of fiber, that helps the body to digest food more efficiently. Fiber helps in digestion by helping the food to pass through the large intestine. It softens the stool and expels it smoothly [19].

5.8. Toxicity and side effects of overconsumption of Singhara

Apart from the above-mentioned health benefits, Singhara has following side effects –

- ❖ Stomach ache, vomiting and nausea can occur on excessive consumption of singhara.
- ❖ Singhara has been found to possess hypoglycemic properties. Thus, diabetic person on medications or individual with low blood sugar levels should consult healthcare professional before taking singhara.
- ❖ Singhara has been known to reduce blood pressure. Thus, hypotensive people are advised not to take singhara in any form.

Therefore, further research is required to fix the average amount to be consumed. Thus, singhara is considered as safe, powerful plant with multiple medicinal and nutritional benefits.

6. Conclusion

A methodological literature review of the Ayurvedic system, shows that singhara plays an important role in the treatment of polyuria, diarrhea, dysuria, general weakness, fever, sexually transmitted diseases, sore throat, etc. It is powerful plant with multiple medicinal and nutritional benefits. The unique composition of singhara provides a variety of nutritional and medicinal benefits, including anticancer, hepatoprotective, antihyperglycemic, and antioxidant effects. The singhara shell and core are rich in starch, dietary fiber, essential amino acids, certain types of phenols and minerals, and have demonstrated various biological activities, including anticancer and antioxidant properties. Singhara contains various antioxidants that can reduce the risk of multiple chronic diseases and conditions. Other health benefits may include improved blood pressure, cancer prevention, weight loss and digestive health. Thus, Singhara can be considered as safe, powerful plant with multiple medicinal and nutritional benefits.

Source(s) of support

Nil.

Conflict of interest

Nil.

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