

Water Chestnut The Nutritional Powerhouse

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Introduction

Trapa natans L., a member of the family-Trapaceae, Order-Myrtales, Subfamily-Rosidae, Class-Magnoliopsida, Subclass-Rosida, and Division-Magnoliophyta, is also known as the “singhara nuts” or “water chestnut” or “bull nut” in English, “singhara” or “simkhata” in Hindi, and “karimbolam” or “vankottakkaya” in Malayalam. It is an annual, free-floating-leaved aquatic plant found in freshwater wetlands, lakes, ponds, and slow reaches of rivers. The plant has two types of leaves: finely divided, feather-like submerged leaves that extend down the length of the stem, and undivided floating leaves arranged in a rosette at the water's surface. The floating leaves are rhomboid, fan-shaped, toothed along the edges, 2-6.5 cm in diameter, longer than wide, denticulate, dentate, serrate, or incised along the entire base, with an acute apex, crimson color, and thickly hairy or villous below. While the plant's cord-like stems usually range in length from six to eight feet, they can grow up to 16 feet long and are buoyant and spongy. Numerous branched roots

anchor the stems to the bed of the water body. The flowers are white, slightly raised above the water, with a short conical beak in the middle, often thorn-shaped, through which nitrogen protrudes, and two spikes in two corners, with another pair of spikes often missing. Water chestnut requires full sun, slow-moving, nutrient-rich fresh waters, and a soft substrate. The nut, the plant's fruit, has four sharp, horn-like projections, each with a spine bearing several barbs. It is primarily grown for human consumption, either dried to make flour for preparing flattened bread called chapatti or in the form of sweet dishes of various types, depending on individual taste. Despite its high nutritional value, the water chestnut has not received full attention from food processors because it is only available for two to three months each year.

Water chestnuts are found across Europe, Asia, and Africa. Water chestnut production in India is led by Madhya Pradesh, Uttar Pradesh, Bihar, and Odisha. It is widely grown in India, particularly in Bihar, Madhya Pradesh, Uttar Pradesh, West Bengal, Odisha,

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Jharkhand, Karnataka, and Jammu and Kashmir. The fruit of the water chestnut is classified into two types based on its morphology: thorny and thornless. Bihar is home to only the red thorny fruit-type water chestnut. However, both thornless and thorn-bearing fruit plants can be found in Madhya Pradesh and Uttar Pradesh. For the varietal development effort, water chestnut material was gathered from the Darbhanga districts of north Bihar and Madhya Pradesh. Of the 13 thornless germplasms collected, eight were red and five were green. Odisha, Jharkhand, and Uttar Pradesh were also chosen for their thornless germplasm. It can be found throughout temperate and tropical Asia and central and southern Europe.

Nutritional composition of Water Chestnut

This fruit has a variety of health benefits, including anti-inflammatory, anti-diabetic, anti-microbial, immunomodulatory, neuroprotective, anti-ulcer properties, and more. Chestnut offers a range of nutrients and antioxidants. Water chestnuts are rich in flavonoids, low in calories, fat-free, and packed with beneficial nutrients. The crop's worth has been rising lately because of its high yield and nutritional value, which includes proteins, carbohydrates, fiber, and minerals. In fresh and dry chestnuts, 22.30% and 71.55% of it is carbohydrate, respectively. The fresh fruit had 4.40% protein content, while the dry

fruit had 10.80% protein content. The seeds contained 32 and 102.85 mg calcium, 1.4 and 3.8 mg iron, and 121 phosphorus in 100 g, in fresh and dry fruit, respectively. In 100 g of fresh and dried water chestnut seeds, they provided 115.52 and 354.85 Kcal of energy, respectively. On average, chestnut fruit contains 40-45% water, 3-6% protein, 3-5% fat, 40-45% carbohydrate, and 1.3% ash. Nevertheless, these values could differ depending on the ecological circumstances, species, group, and procedure. The core of water chestnut is rich in protein (up to 20%), starch (52%), tannins (9.4%), fat (up to 1%), sugar (3%), minerals, etc. It is also a beneficial source of fiber and vitamin B as well as Ca, K, Fe, and Zn. The water chestnut provides essential minerals, proteins, lipids, carbs, vitamins (B1, B2, B5, B6, E, A, and C), fiber, polyphenols like phenolic acids and flavonoids, and hydrolysable tannins.

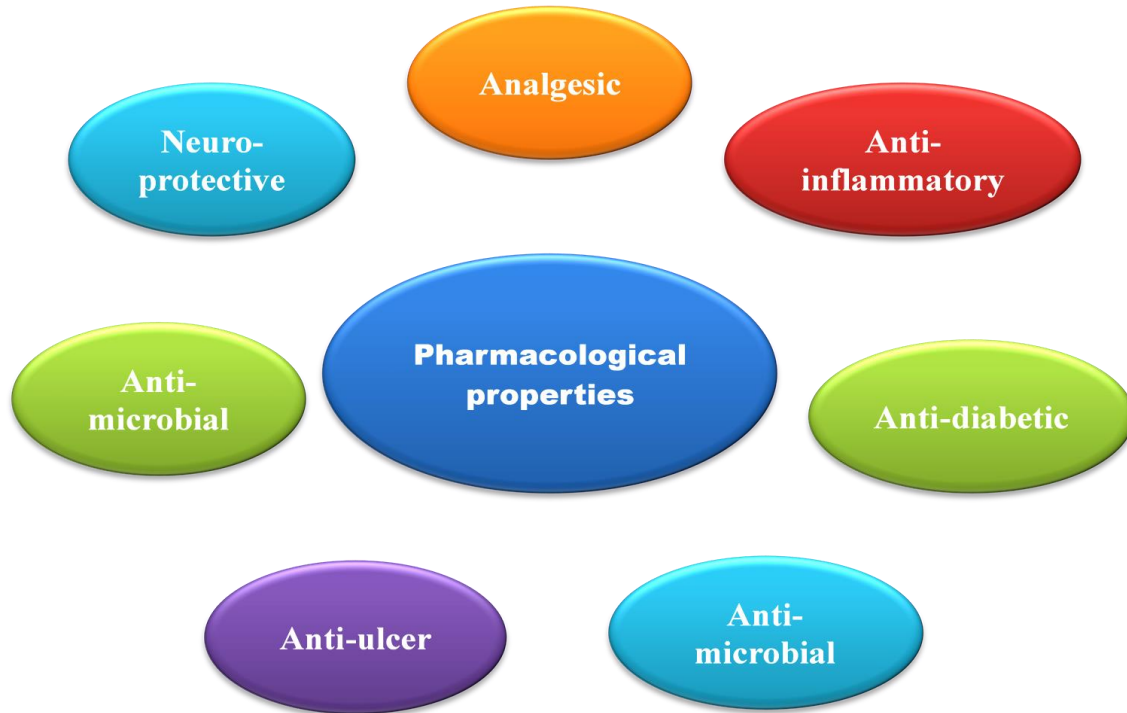
Ten phenolic compounds have been identified in the leaf extract of *Trapa natans*, including three phenolic acids - gallic, ellagic, and ferulic acid, along with quercetin 3-O-galactoside (hyperoside), which are the most prevalent compounds. Phenolics are the key components in the water-based fruit extract of *Trapa natans* L. that have garnered significant interest among researchers due to their potent antioxidant properties. The aqueous extract of *Trapa natans* L. fruit has strong in vitro

antioxidant activity against free radicals, supported by its high polyphenol content.

Carotenoids, phenolic acids, phytosterols, and polyphenolic compounds like flavonoids, proanthocyanins (PAC), and stilbenes, along with phytates, sphingolipids, alkylphenols, and lignans, are found in water chestnut and listed in nutrient databases. The amount of phytochemicals in nuts can vary significantly based on the type of nut, genetic factors, conditions before and after harvesting, and how they are stored. Genotype plays a role in determining levels of phenolic acids, flavonoids, stilbenes, and phytosterols. During the roasting process, it was discovered that isoflavones, flavanols, and flavanol in nuts can withstand higher temperatures compared to anthocyanins, PAC, and trans-resveratrol. Nutrients found in nuts have been associated with antioxidant, anti-inflammatory, antiproliferative, antiviral, chemopreventive, and hypocholesterolaemia properties. Water chestnuts are rich in antioxidants like flavonoids, flavones, and total phenol contents. The seeds of water chestnut fruits contain carbohydrates, saponins, phytosterols, fixed oils, and fat. On the other hand, the pericarp extract of water chestnut fruits contains tannins, flavonoids, glycosides alkaloids, saponins, steroids, and phenolic compounds.

Medicinal properties

Feeding pregnant women water chestnut flour porridge helps prevent postpartum bleeding and promotes healthy growth, also aiding in treating hypertension during pregnancy. The dehydrated seeds are utilized for managing miscarriage and halting bleeding in females. It additionally promotes the release of milk from the mammary gland. The liquid obtained from water chestnuts can remove bile and phlegm tumors and heal various ailments. It also enhances male sexual potency. Water chestnuts are utilized for treating inflammations and blood impurities. These are substances that can increase energy levels, reduce tiredness, and help control excessive bleeding from the injury. One cup of water chestnuts contains 362.1 mg of potassium, making them a rich source of this mineral. This mineral is necessary for correct muscle and neural operation. Regulating salt levels controls fluid retention and blood pressure. The juice of water chestnuts is utilized for diarrhea and dysentery treatment, while the fruit is utilized for sore throats, anemia, fractures, bronchitis, and leprosy. Water chestnuts are perfect for fighting the summer heat due to their great ability to cool down. They possess various healing and additional characteristics as well. Furthermore, combining water chestnut powder with water is an effective remedy for cough.



Pharmacological properties of Water Chestnut

Value Additions of Water Chestnut

In the past, water chestnut has been consumed once boiled. In India, this nut has a high nutritional value and is used to prepare sweets and premium chapatti. It is a nutritious food with few calories that is becoming popular for creating snacks for individuals of all economic statuses worldwide. Singhara is mainly cultivated in India for the purpose of being consumed by humans. It is typically eaten as a vegetable, dried into flour, and used in sweet dishes based on individual taste. The fruit kernel of the water chestnut is tasty and packed with carbohydrates, proteins, and necessary minerals. Water chestnut is a highly favored starchy sweet dessert in Asian countries due to its delicious taste, sweetness,

and tender fruit. Water chestnut starch exhibits lower syneresis when compared to corn starch. When preparing frozen products, it can conveniently be used instead of corn and potato starch.

Culinary uses

The corms, which have a light hue, are the edible part of the nut. It is typical to eat them uncooked. They can also be utilized once they have been lightly boiled. They are utilized in the production of cakes, specifically water chestnut cake. Singhara is rich in carbohydrates, fiber, vitamins, and minerals. They are crispy and crunchy. The crisp consistency and subtle freshness of water chestnut make it unique. It maintains its crispness after being cooked or preserved. It is

suitable for consumption either raw or cooked, and can serve as a meal extender as well. When mixed with coriander, rice, noodles, ginger, sesame oil, and bamboo shoots, among other components, they have a crunchy and crispy texture. It plays a crucial role in the well-known Thai dessert 'tabtimkrob' and can be enjoyed in various forms like powder, juice, cake, flour, sliced, raw, and steamed.

Remove the outer brown layer of a freshwater chestnut to uncover the white flesh underneath. It is possible to consume the flesh in its raw state. They can be fried, grilled, boiled, or sautéed to bring a sweet, crispy touch to a dish. Depending on the meal, they may be presented in their entirety, cut into slices, chopped into small pieces, or finely ground. Commonly, they are utilized in stir-fries, chop suey, and various curries. Candied or pickled water chestnuts are popular snack choices among people. Instead, you can dehydrate water chestnuts, crush them, and combine them with flour or use them to thicken a sauce.

Water chestnut in Food Industry

Food enrichment involves adding lacking or missing nutrients to enhance the quality of the food. The main aim of food production is to ensure people have safe and nutritious foods for a healthy and enjoyable life. Chestnut flour is commonly used in a variety of foods including cake, cookies, pasta,

creamy puddings, bread, morning cereals, soups, sauces, and gravies. Due to the possible impact of chestnuts on nutrition and health, there is a growing interest in them every day. The popularity of chestnut flour is increasing in the food sector because of its nutritional and sensory attributes. Due to its E and C vitamins, unsaturated oils such as omega-3 fatty acids, dietary fiber components, phenolic and antioxidant components, and highly nutritious content, the inclusion of chestnut flour in food enrichment is believed to be advantageous for human health. The cosmetics industry also has a strong demand for chestnut flour. Milky puddings, bread, baby formulas, pasta, and flakes can all be made using chestnut flour. Chestnut flour contains a significant amount of protein, sugar, starch, dietary fiber, essential amino acids, and a low level of fat. It also contains significant amounts of vitamins B, C, and E, along with potassium, magnesium, and phosphorus. It is believed that utilizing chestnut flour at this point is beneficial since many gluten-free products lack vitamin B, iron, and fiber. Due to its nutritional content, chestnut flour is also utilized in the making of gluten-free bread.

Conclusion

Water chestnuts can be found in Europe, Asia, and Africa. Chestnut offers different nutrients and antioxidants. Despite being filled with beneficial nutrients, water

chestnuts are low in calories and fat-free, yet have a high flavonoid content. The crop's value has been rising due to its high yield and nutritional benefits, including proteins, carbohydrates, fiber, and minerals. A brief annual crop can be added to low-input cropping systems as a feasible alternative crop for sustainable horticulture. Freshwater chestnuts possess twice as many antioxidants as traditional chestnuts. Water chestnut kernels contain higher levels of potassium, zinc, vitamin B, and vitamin E than canned water chestnuts. Eating water chestnuts can aid in decreasing free radicals in the body and also lower blood pressure, among other advantages. Water chestnuts are a great way to boost your nutrient and antioxidant intake, making them a beneficial choice for any diet.

