



## Review Article

# Eleocharis Dulcis An Overview

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### ARTICLE INFO

Published: 07 Nov. 2024

**Keywords:**

Trapa natans, Eleocharis Dulcis, Astringent, harsh, stomachic, diuretic.

**DOI:**

10.5281/zenodo.14052423

### ABSTRACT

The water chestnut, scientifically known as *Trapa natans*, is a vital plant in Ayurvedic medicine from India for a variety of gastrointestinal, genitourinary, liver, kidney, and spleen issues. Astringent, harsh, stomachic, diuretic, or febrifuge are all possible properties of this disinfectant. We performed a simulated investigation on nuts and fresh fruits that are quite juicy. The findings revealed that the novel organic substance had a substantial quantity of minerals, such as potassium, iron, and manganese, with little amounts of unprocessed lipids. Additionally, the research verified that the natural fruit had a high concentration of these nutrients. We used crispness and hardness as our main characteristics for our sensory analysis. Although it may be found in tropical areas of Africa and Australia, the water plant *Eleocharis dulcis*, a member of the Cyperaceae family, comes originally from Asia. The edible corm portion of *E. dulcis*, a commonly consumed aquatic vegetable, has a  $44.46 \times 10^4$  hm<sup>2</sup> planted area in China. This research aims to explore the potential of *E. dulcis* corm as a new food source for sufficient nutrition and health benefits by reviewing its nutrients, phytochemicals, functions, processing, and food products. Fruit and vegetable beverages make up the bulk of the present crop of *E. dulcis* corm foods, which are still in their early stages of development and classification. Finally, the unrealised potential of the unappreciated *E. dulcis* corm as a healthy and nourishing new food source is considerable.

### INTRODUCTION

Water chestnut and Chinese water chestnut are two names for the grass-like sedge *Eleocharis dulcis*, which is native to Asia, tropical Africa, and Oceania. The tasty corms of this plant make it a common harvest in many countries. Not nuts at all,

but rather aquatic veggies that love marshes, underwater spaces, or muddy soils, water chestnuts are a wonderful gem. The possible maximum height of the stem-like, tubular green leaves is around 1.5 meters, or 5 feet. The water caltrop and the water chestnut share a name,

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**Relevant conflicts of interest/financial disclosures:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



although they are completely unrelated. Their crisp, white flesh makes these small spherical corms delicious fresh, lightly fried, grilled, pickled, or canned. Use them in a lot of Chinese dishes. The majority of Chinese people eat them raw, with a little sugar added sometimes. One common ingredient in dim sum is water chestnut cake, which may be prepared using ground chestnuts [01-03].



**Fig no - *Eleocharis dulcis***

Their cell walls are cross-linked and reinforced by certain phenolic chemicals, such as oligomers of ferulic acid, which gives them the uncommon quality of staying crisp even after being cooked or canned. Tiger nuts, lotus roots, and spurge nettle roots are among the veggies that share this characteristic of staying crisp in this way. The puchiin antibiotic found in the corms remains effective even when heated to high temperatures. Not only are the corms delicious, but the leaves have other uses as well, such as mulch, compost, and cattle feed [04-07]. The plants' surfaces may spread fasciolopsiasis if consumed raw. *Eleocharis dulcis*, more often known as water chestnut, is a weed that thrives in marshy coastal marshes. The water chestnut is a puzzle tree that is a member of the Cyperaceae family. The organic matter included in water chestnuts is beneficial to soil and plants alike. Many bioactive components, which are compounds found naturally in plants and are responsible for its flavour, scent, and

colour, are present in every plant. An essential part of plants are their bioactive components, which are parts of compounds that have practical use [08]. Steroids, terpenoids, tannins, saponins, flavonoids, and phenols are among the bioactive components found in water chestnut. The bioactive component of water chestnut has antimicrobial properties, among other advantages. *Hydrochlorococcus aureus*, *Escherichia coli*, and *Listeria monocytogenes* were tested for antibacterial activity in water chestnut (*E. Dulcis*) tuber skin extraction and fractionation. Puchiin antibiotics found in water chestnut juice were effective against *S. aureus*, *E. coli*, and *Aerobacter aerogenes*. The goal of preservation is to keep an item fresh for a longer period of time. Cold temperatures are used for the preservation of typical foods. It is essential to add chemicals that may extend the storage life of catfish fillets since this approach is thought to be less effective. Water chestnut extract, with its bioactive components, may provide a novel option for extending the shelf life of catfish fillets by acting as a natural antibacterial agent. In this way, the quality of the catfish fillets may be preserved for a longer period of time in storage. You may extend the shelf life of catfish fillets by using water chestnut, which has chemicals that suppress microbial development and activity [9-13].

#### **Cultivation [14-18]-**

Paddies that are 2-7.5 m (7-25 ft) broad and up to 100 m (330 ft) long are ideal for mechanised crop cultivation, or hydroponics may be used. Always keep it immersed in around 10 cm (4 in) of water, as it is an aquatic plant. Optimal soil temperatures for the crop are 14–15.5 °C, or 57–60 °F, and they must be maintained continually. The germinating temperature of the corms is 13.6 °C, or 56.5 °F. An optimal soil pH ranges from 6.5 to 7.2 and is sandy loam. There are two kind of underground rhizomes that this plant may produce. In environments with lengthy days, rhizomes spread out horizontally

before branching out vertically to produce new plants. Rhizomes develop a corm at the end of their downward growth in environments with limited daylight. How quickly the corms grow is also greatly affected by the photoperiod. When the photoperiod is longer than 12 hours, the development of corms slows significantly. The corms are used for both propagation and storage. Another option is to utilize transplants. For planting, you may utilize machinery like vegetable planters that are attached to tractors.

### **Global description [19-22]**

*Eleocharis dulcis* is a vivacious plant that grows in marshes as dense clumps, from short, thick rhizomes. The many stems are green, leafless and cylindrical, transversely partitioned, 4 to 10 mm in diameter, 80 cm high. The leaves are reduced to sheaths without lamina. The inflorescence is made of a single dense spikelet extensively sub conical, located at the end of the stem, straw color, 2 to 5 cm long and 4 to 7 mm wide. The Chinese water chestnut belongs to the sedge family Cyperaceae, and it should not be confused with the more common water chestnut, *Trapa natans*. *Eleocharis dulcis* is the scientific name for this plant, and it belongs to a large family of plants called spikerushes or spikesedges. Parts of Australia, tropical Africa, a number of Asian nations, and islands in the Indian and Pacific seas are all part of its vast range. It is often grown as a novelty crop in places where it is not native, such as North America. In tropical and subtropical regions, you may find the aquatic perennial *Eleocharis dulcis* growing in bogs, marshes, and along the edges of other wetlands and riparian zones. Clumps of tall, rigid, erect stems without leaves that may reach a height of more than a metre constitute an individual plant. An inflorescence is a cluster of tiny, cylindrical florets that are yellow-brown in colour and are carried at the very top of stems.

Rhizomes link clusters of stems, allowing for the formation of dense colonies. Corms, the edible section of *E. dulcis* and the part of the plant that we call water chestnuts, are where rhizomes also end.

### **Nutrients And Phytochemicals [23-28]-**

The edible portion of Evergreen dulcis is the fleshy corm, which makes up 78% of the plant 26. As far as nutrients go, *E. dulcis* corm is low in calories and mostly carbs, with protein coming in a distant second. Dietary fibres (DF) are linked to the regulation of gut microbiota and metabolic profile, total soluble sugar (TSS) is a type of carbohydrate that has a wide range of industrial and food processing uses, and non-starch polysaccharides (NSPs) are typically reserved for specific bioactivities. Of the six vitamins found in *E. dulcis* corm, vitamin C has the greatest concentration at 70.0 mg.kg<sup>-1</sup>, surpassing even certain popular fruits as pear (50.0 mg.kg<sup>-1</sup>), apple (30.0 mg.kg<sup>-1</sup>), and grape (40.0 mg.kg<sup>-1</sup>).

*E. dulcis* corm contains eleven minerals, the most abundant of which is potassium (3.06 g.kg<sup>-1</sup>). Since potassium is known to play a key role in maintaining homeostasis in the cardiovascular system, it follows that a diet rich in *E. dulcis* corm would be beneficial to the cardiovascular system. At the same time, there are eleven amino acids found in *E. dulcis* corm, with aspartate having the greatest concentration at 1.95 g.kg<sup>-1</sup>. Only twenty-five percent of these amino acids are needed for adults, suggesting that the proteins found in *E. dulcis* corm are not very nutritious. In addition, the peel wastes of *E. dulcis* plants included bioactive phytochemicals such as phytosterols, quinones, ketones, puchiin, saponins, and total flavonoids (TF). One such chemical is puchiin, which is antibacterial and found mostly in the pulp of *E. dulcis* corms.

**Table no- The ability of some plants to accumulate heavy metals [18-26].**

Plants	Classification	Accumulation Heavy Metals
<i>Limnocharis Flava</i>	Emergent plant	Fe & Mn
<i>Cyperus alternifolius</i>	Emergent plant	Cu, Fe, and Zn
<i>Zizania latifolia</i>	Emergent plant	Pb, Cd, and Zn
<i>Echinochloa crus-galli</i>	Emergent plant	Pb, Cd, and Zn
<i>Polygonum hydropiper</i>	Emergent plant	Pb, Cd, and Zn
<i>Monochoria vaginalis</i>	Emergent plant	Pb and Cd
<i>Digitaria sanguinalis</i>	Emergent plant	Zn
<i>Fimbristylis miliacea</i>	Emergent plant	Zn
<i>Eichhornia crassipes</i>	Floating leaved plant	Cd, Cu, Cr, Ni, and Pb
<i>Type domingensis</i>	Emergent plant	Ni, Cd, and Pb
<i>Lemna minor</i>	Free-floating plant	Cu, Cr, Pb, Ni, and Cd

## PHARMACOLOGICAL USE-

### Antioxidants [25-32]-

Research has shown that water chestnut peel is rich in antioxidants. The phenolic content of various cereals, veggies, and fruits varies. A close relationship exists between phenols and antioxidants. The phenolic compounds in food undergo structural and content changes during digestion that impact their biological function. The phenolic components in chestnuts are responsible for their antioxidant properties. The oligosaccharides extracted from Chinese water chestnut exhibited strong antioxidant activity at a concentration of 100ug/ml, according to the research. Oligosaccharides extracted from Chinese water chestnuts have antioxidant and functional dietary potential, according to the research and experiments.

### Anti-Diabetic [33-38]-

Crushed, raw chestnut kernels are very low-glycemic, with a GI of 54. Gluten is also not present in chestnuts. Those who suffer from coeliac disease or diabetes may appreciate its low GI. Cereals are a mainstay in many people's diets, which may be problematic for those with food allergies or those with diabetes who need to purchase specific items. For those who suffer from coeliac disease or diabetes due to its low GI and high fibre content, chestnut flour is a great option. While lowering insulin resistance, low-GI meals

have a mild effect on blood sugar levels. The effects of cultivating chestnut trees on individuals with diabetes and coeliac disease were studied by researchers from three different countries. In one research, the chestnut was included in the diet of diabetes patients. Crushed, freshly peeled chestnuts were used for this experiment. Six people with diabetes, spanning the ages of 25 to 60, were selected for this study. Blood glucose levels were measured before and after consuming chestnut flour in this 12-day research. Thirty grammes of chestnuts were provided to participants after they took a glucose test at 7 o'clock in the evening before dining for the first four days. On day two, they received honeycomb with jam, and on days three and four, they received chestnut flour products. A blood sample was then taken two hours later. For the next four days, they were provided chestnut products to compare before and after meals, and a diet of 30g of rye bread with a resistant starch content of 0.055g for two days. For the next four days, they went back to their usual eating habits.

### Anti-tumor Effects [39-42]

Research has focused on the anti-proliferative and anti-tumor properties of water chest nuts. An experimental study indicated that water chest nut extracts showed anti-proliferative properties when tested against human colon cancer, breast adenocarcinoma cell line, and human ductal



epithelial cell line. However, further research and studies are necessary to confirm their potential as a cancer treatment. A different set of experiments showed that flavonoids extracted from water chestnut peel might scavenge nitrite and limit cell growth. Their ability to induce cell death or necrosis and to inhibit A549 cell activity during G1 phase suggested that they may have anti-proliferative therapeutic potential. A novel approach was taken to the problem of using water chestnut nut extracts as an inhibitor of activity and cancer prevention. Subjects' cancer metastasis was suppressed in the colon, lungs, liver, kidneys, breast, and cervical areas by this newly created way of giving the extracted material. Reportedly, water chestnut kernals and peels contain many compounds with antioxidant and anticancer properties. Both the food and nonfood businesses may benefit from their abundant availability and distinctive traits. Using silver nanoparticles as an anticancer therapy has been done. The experimental effort included removing these silver nanoparticles, which are helpful to the environment, from the water chestnut leaves. Could be used for cancer treatment down the road, since this shown their promise.

#### **Antibacterial Properties of Water Chestnut [43-50]**

Potentially harmful effects on food safety, preservation, and quality could be caused by

pathogenic and disease-causing microorganisms. The rise in cases of food poisoning is mostly caused by this. In order to reduce the frequency of food illness and food spoilage, a small number of chemical and preservative reactions were required. Therefore, hypersensitivity, immunological suppression, and allergic reactions in hosts are consequences of this element's careless usage, which leads to the evolution of bacteria resistant to several drugs. Thanks to its distinctive flavour, Chinese water chestnut (*Eleocharis dulcis*) is a beloved dish among Asian cuisine enthusiasts. This low-lying grass plant is a member of the sedg family and grows in damp agricultural areas.

Some of the health advantages of this plant include its ability to cure pharyngitis and laryngitis, reduce inflammation, and function as an antioxidant. It is also believed to have an antibacterial impact on germs. Typically, Chinese water chestnuts are washed well, sliced, and stuffed before being sold in restaurants, homes, and hotels. The peel accounts for around 20% of the weight of water chestnuts when processed into food. The water chestnut plant, or *Trapa bispinosa roxb*, is mostly found in wetter regions of the globe and produces fruits. An uncommon starchy fruit with no practical use in Bangladesh. This fruit plant, which is not harmful and has no dangers, is now the main ingredient in most medicines.

**Table no- Distinctive characters of several species of *Eleocharis* [40-52]**

Habit	Height	Underground system	Stem	Spikelet	Species
small size, dense tuft	10-25 cm	fasciculate roots from +/- visible rhizome	flattened, ridged stem, 1 to 1.5 mm thick, glabrous	small terminal single spikelet, without bracts at the base. Its end is not pointed. It is approximately 5 mm long. It is pale or purplish.	<i>E. complanata</i>
small size, small tuft	1-10 cm	slender stolons with closely spaced stems	filiform, slender, solid stem, about 1 mm in diameter, erect or often arching	single spikelet 1.5 to 4.5 mm long and 1 to 1.5 mm wide, greenish or straw colored	<i>E. minuta</i>

almost robust, dense tuft	30-60 cm	thick rhizomes with closely spaced stems	cylindrical stem more or less compressed, 2 to 4 mm in diameter	single spikelet, base slightly wider than the top of the stem, attenuate-acute, 20 to 30 mm long and 3 to 5 mm wide, straw-colored	<i>E. limosa</i>
dense tuft	30-70 cm	short rhizomes and long stolons	triangular section stem with very sharp angles, with smooth faces 2.5 to 4 mm wide.	single terminal spikelet, pointed end, without bract at the base, 20 to 60 mm long, 3 to 6 mm in diameter, base slightly wider than the stem.	<i>E. acutangula</i>

## CONCLUSION-

A thorough examination of Unani and Ayurveda literature suggests that *Trapa natans* may provide relief for a variety of diseases. These include dysuria, polyuria, sexual weakness, general weakness, lumbago, sore throat, and the runs. Ongoing pharmacological studies are revealing its significant immunomodulatory, anti-inflammatory, anti-bacterial, and anti-glucose properties. Because of its record of accomplishment of successfully treating patients with few adverse consequences, conventional medicine is rapidly expanding its global appeal. The results of this study support the classification of *Trapa natans* as a nutraceutical plant that has a number of beneficial health effects. The phenolic content of the peel wastes of *E. dulcis* corm is often much greater than that of the edible pulp. The key to extending the shelf life of fresh-cut *E. dulcis* corm is anti-browning processing, which may be done either as a ready-to-eat meal or as juice for beverage manufacture. The current crop of *E. dulcis* corm foods is underdeveloped and categorised, with a focus on fruit and vegetable drinks. To sum up, the nutritious and healthful corm of the underappreciated *E. dulcis* plant has enormous untapped potential as a novel food source.

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**HOW TO CITE:** Sachin Gursale\*, Yash Vikhankar, Kaushal Patil, Amol Chandekar, Atul Tripathi, Eleocharis Dulcis An Overview, *Int. J. of Pharm. Sci.*, 2024, Vol 2, Issue 11, 400-409. <https://doi.org/10.5281/zenodo.14052423>

