



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(6): 1843-1846
© 2022 TPI

www.thepharmajournal.com

Received: 16-03-2022

Accepted: 19-04-2022

Gursimran Kaur

Student, Food and Nutrition
Department, School of
Agriculture, Lovely Professional
University, Phagwara, Punjab,
India

Review based study on bioactive compounds and properties of water chestnut

Gursimran Kaur

Abstract

Water Chestnut is an aquatic plant and used as a medicinal herb. Water chestnut is delicious to eat and contains many beneficial properties such as antimicrobial, antidiabetic, anti-inflammation and antiulcer having minerals (potassium, iron and calcium), carbohydrates and proteins. It is used in Ayurveda preparation as appetizer, astringent, coolant and tonic. Many food products are made from water chestnut kernel and its flour to enhance their nutritional properties. This paper reviews the bioactive compounds and properties of water chestnut.

Keywords: Water chestnut, health benefits, bioactive compounds

Introduction

Water chestnut is considered as one of the most popular food in Asia. Due to its unique taste and properties it is something which grows in marshy places, ponds and paddy fields and different kind of shallow lakes which has numerous numbers of benefits.

Water chestnut can be defined as free floating plants which grows in marshy places and shallow ponds which consist of pH range of 6.7 to 8.2 an alkalinity of 12 to 128 mg/l of calcium carbonate which basically grows in the rainy season and has certain kind of edible values but is considered as minor crop due to its low cultivation techniques since there is scarcity of the performance. It is basically know to be alternative crop as it has potential for cultivation in the wastelands. It can be known as that fruit where the seeds are basically roasted or boiled. Dried fruits are basically grounded into fine flour and used as component for the substitute of cereals. There are different kind of religious ceremonies which are held in India where chestnut is used to make colors, powder and dye. It is of two type one is of green color and another is of red color, in which they have two dull spines and further divided into three categories: completely red, completely green and mixture of red (Singh *et al.*, 2017) ^[8].

Water chestnuts are known to be the native of different areas such as islands of Indian and Pacific oceans, Southeast Asia, Southern China, Taiwan and Australia and further they are harvested with corn so they change their color to dark brown. In Asia, they are used in different kind of dishes, chopsuey, curries and salads and sometimes are enjoyed in raw or cooked manner (Jana *et al.*, 2019) ^[5].

Water chestnut basically is type of fruit which belongs to sedge family which is found in marshy places and it consists of different kind of health benefits such as antimicrobial effects on bacteria, treatment of pharyngitis and laryngitis, antioxidants. Water chestnuts are used by washing them effectively and then they are peeled and then packaged and then used for restaurants, homes and hotels.

II. Benefits of water chestnuts

One of the major benefits of water chestnuts is that they are full of nutrients. Water chestnuts basically are considered to be high source of fiber as it consists of 12% of fiber which is recommended for women and 8% which is recommended for men. Eating foods which are rich of fiber basically helps in keeping gut healthy, reducing blood cholesterol levels, helps in bowel movements and helps in regulating blood sugar levels. Water chestnuts are basically made up of 74% of water, which is the reason they are rich in carbs and low in calories (Singh, 2017) ^[8].

Corresponding Author:

Gursimran Kaur

Student, Food and Nutrition
Department, School of
agriculture, Lovely Professional
University, Phagwara, Punjab,
India

High in antioxidants

Water chestnuts are considered to be as those of the fruits which have good amount of antioxidants. Antioxidants here refer to those kind of energy which helps to protect the body against different kind of harmful molecules which are known as free radicals. Those free radicals are such kind of radicals which mixes up in the body and protect the body against various kinds of diseases and they release a state which is known as oxidative stress. Such kind of risk is further related to high chances of chronic diseases such as heart diseases, type 2 diabetes and different kind of cancers.

Water chestnuts is basically that kind of fruit which is great source of catechingallate, ferulic acid, gallo catechingallate and epicatechingallate, such kind of antioxidants are basically those kind of antioxidants which combined with oxidative stress, which is linked to chronic diseases.

Water chestnuts are further rich in such kind of antioxidants which further are present in the peel of that particular fruit and flesh of that particular fruit can be helpful in the reduction of different kind of chronic diseases such as heart diseases and cancer. Antioxidants in water chestnuts consist of fluid which is known as ferulic acid which is basically helpful in making it crunchy and crisp even after cooking (Jana, 2020) [4].

Lower Blood Pressure and reduce the risk of Heart Disease

With the changes in the modern times, there has been increase in the risk of chronic diseases like heart disease which is one of the major causes of deaths all around the globe. There are different kind of factors which contribute to the heart diseases such as high blood pressure, high blood cholesterol levels and high blood triglycerides. One of the major importance of the water chestnut as a fruit is that it helps to maintain blood pressure as it is great source of potassium.

There are different other studies which have mentioned that if there are reduced risk of stroke and blood pressure, they can reduce the risk of heart diseases.

One of the study made stated in the reports that people suffering from high blood pressure consumed intake of more potassium and there systolic and diastolic blood pressure reduced by 3.49 mmHg and 1.96 mmHg and such kind of people have low risk of developing heart stroke. Another analysis of 11 studies stated that people who focused on intake of more potassium has 21% risk of lower heart attack and heart diseases (Rani *et al.*, 2016) [7].

Thus, it can be stated that water chestnuts are those kinds of fruits which are great source of potassium and which contribute to reduction in blood pressure and strokes.

Promote Weight Loss

Despite being in the category of low calories, water chestnuts are considered as high volume food as they consists lot of air and water and are used to curb hunger.

They are the best fruits which are used for weight loss as they consist of 74% of water and further helps in staying fuller when a particular person consume less calories.

Thus, it can be further stated that the water chestnuts are made up of 74% of water which makes them high volume food and further helps them in the reduction of weight.

Reduction in the risk of oxidative stress and helps in fighting cancer

Due to the presence of high level of ferulic acid, water

chestnuts stays crunchy after they are cooked. The ferulic acid present in the water chestnuts helps in the less growth of cancerous cells in the body.

In one of the study it has been stated that the ferulic acid help to treat the cancerous cells and helps in suppressing the growth of skin, lung and bone cancer cells.

Water chestnuts can be considered as one of the other fruit which consist of such kind of antioxidants which consists of anti-cancer effects which means consisting of such kind of antioxidants which are free of radicals and which might compromise the growth of cells of cancer (Hossain and Rahmatullah, 2020) [3].

Thus the property of water chestnut consisting of high ferulic acid is linked to reduced risk of stress and cancer.

III. Bioactive compounds in water chestnut

Protein

Protein plays an important role in all the biological processes. The protein constituents of fruits and vegetables, although occurring in low concentration, are of primary importance not only as component of nuclear and cytoplasmic structures, but also including, as they must the full complement of enzymes involved in metabolism during growth, development, maturation of fruit and vegetables (Hansen, 1970). Water chestnuts contained 0.275 mg and 0.251 mg (per 100 g) of water soluble protein in green and red varieties, respectively (Razvy, *et al.*, 2011).

Lipid

Lipid is more useful in animal body. Fats serve as efficient source of energy and insoluble material. Dietary fat helps in the absorption of fat soluble vitamins, lipoproteins are important cellular constituents. Lipids are also essential components of cell membrane, source of metabolic energy for cell maintenance, reproduction and embryogenesis in insects. As lipid is very important for the body, water chestnuts contain a very low amount of lipid i.e., 0.84 and 0.83% in green and red varieties, respectively (Alfasane *et al.*, 2011) [2].

Sugar

Water chestnuts contained low amount of reducing sugar and the content of reducing sugar is estimated to be 0.33 and 0.30% in green and red varieties, respectively.

Starch

Starch is the most important source of carbohydrate in human diet. As water chest nut has been consuming by a large number of people for its rich nutrient contents as well as low price, it is very important to determine the amount of starch contents to the different varieties of water chest nuts. Both the varieties of water chestnuts contained a significant amount of starch, i.e., 8.7 and 8.2% in green and red varieties respectively (Malviya *et al.*, 2010) [6].

Vitamin-C

Vitamin-C takes part in the formation of tissue collagen. Recent research has established the role of ascorbic acid in the conversion of folic acid to a physiologically active form tetrahydrofolic acid. Vitamin-C also involves in oxidation reduction reaction in cells. Vitamin-C content of water chestnuts is higher (1.1 mg/100 g) in green variety compared to red variety (0.9 mg/100 g). Thus, water chestnuts are a good source of vitamin-C (Adkar *et al.*, 2014) [1].

β- Carotenes

β- Carotenes are precursors of vitamin A. Animal cannot synthesize it but can convert it to vitamin A through enzymatic reaction. In plants, it is very necessary for growth and development of soft tissues through its effect upon protein synthesis. Vitamin A also plays a role in the maintenance of normal epithelial structure. β- Carotene content is higher in red variety (92 µg) and lower in green variety (60 µg)

Phenolic Compounds

Phenolic compounds enjoy a distribution in the plant kingdom and they are particularly prominent in fruits and vegetables where they are important in determining color and flavor (Lee and Jaworski, 1987). Water chestnuts contains low amount of phenol. In green variety the amount of phenol is 0.5 mg (per 100 g) and in red varieties the amount of phenol is 0.6 mg (per 100 g). It may be concluded that the phenol content of water chestnuts was slightly higher in red variety.

Minerals

Minerals are inorganic elements exist in the body and in food as organic and inorganic combination. In foods mineral elements are present as salt. They combined with organic compound, e.g., iron in hemoglobin. Minerals are required for the teeth and bone formation. Minute amount of mineral elements are constituents of various regulatory compounds such as vitamins, enzymes and hormones. For example, some enzymes require calcium for their activities as lipases and succinate dehydrogenase. Iron requiring enzymes are ferredoxin, catalase, indophenol oxidase, aldehyde oxidase etc. The mineral elements present in the intra and extra cellular fluid maintained water and acid-base balance. They regulate transmission of impulses and contraction of muscles. The deficiencies of minerals cause many disease in human being. The amount of potassium is slightly lower in green variety. Potassium content of water chestnuts are 5.22 and 5.32% in green and red varieties, respectively. The sodium content of water chestnuts is higher in green variety (0.64%) as compared to red variety (0.59%).

Calcium

Calcium is an important nutrient element for human body. It plays an important role in formation of bone and teeth. It plays an important role as second messenger for some hormone action. Calcium acts through calmodulin component of phosphorylase kinase and activates phosphorylase. Ca⁺⁺ activates some enzymes e.g., lipase, ATP-ase, succinate dehydrogenase etc. A similar amount of calcium is observed in both of the varieties of water chestnuts i.e., 0.25 and 0.26% in green and red varieties, respectively.

Phosphorus

Phosphorus is also used in the form of phosphate (as high energy compounds e.g., ATP, UTP, CTP, creatinine phosphate, GTP etc.) in the synthesis of phospholipids, constituents of cell membranes and nerve tissues etc. Phosphorus content is same in both varieties. In both varieties phosphorus content is 6.77%. Like calcium phosphorus is also essential for bone and teeth formation, as well as acid base regulation.

Sulphur

Sulphur content in water chestnuts is higher in green variety. Sulphur content of water chestnuts is 0.38 and 0.32% in green and red varieties, respectively.

Iron

Iron is important mineral for human being. The primary function of iron is to form hemoglobin and for the formation and maturation of red blood cells. It carries oxygen in the blood in the form of oxyhemoglobin myoglobin is an iron containing chromoprotein. There is some iron requiring enzymes, such as xanthine oxidase, cytochrome C reductase, aconitase, Acyl CoA dehydrogenase, succinate dehydrogenase etc. Iron content of water chestnut is same in both varieties. The amount of iron is 200 ppm in both varieties. Copper content of water chestnut is 430 and 450 ppm in green and red varieties, respectively indicating that red variety contains a higher amount of Cu (Jana, 2020) [4].

Manganese and Zinc

Manganese and zinc content of water chestnut is significantly higher in red variety as compared to green variety. Manganese content is 90 and 110 ppm whereas zinc content is 600 and 650 ppm in green and red varieties, respectively.

Free Amino Acids

Nine amino acids are present in the green variety whereas, eight amino acids are present in the red variety. The amino acids, glutamic acid, tryptophan, tyrosine, alanine, lysine and leucine are present in both of the varieties. Moreover, cysteine, arginine and proline are present only in the green variety. Furthermore, the red variety but not the green variety contains free amino acids, glutamine and asparagines (Singh, 2017) [8].

VI. Conclusion

It appears that there are very few differences in bioactive compounds and properties between the two varieties of water chestnuts. However, only a significant difference was observed in the case of the β-carotene, some minerals especially sodium, manganese, zinc, copper and some amino acids contents in the both of the varieties of water chestnuts. Water chestnuts are consumed by lot of people and may be an important source of carbohydrate, protein, lipids, vitamins and minerals and thus, suggesting its suitability for incorporation in human diet.

References

- Adkar P, Dongare A, Ambavade S, Bhaskar VH. *Trapabis pinosa* Roxb.: A review on nutritional and pharmacological aspects. 2014. Retrieved from <https://www.hindawi.com/journals/aps/2014/959830/>
- Alfasane MA, Khondker M, Rahman MM. Biochemical composition of the fruits of water chestnut. *Dhaka University Journal of Biological Sciences*. 2011;20(1):95-98.
- Hossain K, Rahmatullah S. Potentiality of water chestnut (*Trapa natans*). *International Journal of Management and Social Sciences*. 2020;7(2):77-87.
- Jana BR. Agronomic Management of Water Chestnut (*Trapa natans* L.): A Review. *International Journal of Current Microbiology and Applied Sciences*. 2020;9(8):2773-2777.

5. Jana BR, Bhatt BP, Singh IS, MD Idris. A study on commercial cultivation and storage of water chestnut (*Trapa natans* L.) under wetland ecosystem of North Bihar, India. Journal of Applied and Natural Science. 2019;11(2):528-533.
6. Malviya N, Jain S, Jain A, Gurjar R. Evaluation of *in vitro* antioxidant potential of aqueous extract of *Trapa natans* L. fruits. Acta Pol. Pharm. 2010;67:391-396.
7. Rani B, Verma D, Bhati I, Chharang H, Maheshwa RK. Health benefits of Sbscrumptious water chestnuts /water caltrop (*Trapa natans* L.). International Archive of Applied Sciences and Technology. 2016;7(3):32.
8. Singh H, Thakur SN, Wilson I, Kishor K, Rai BS. Studies on quality parameters of bun incorporated with wheat flour water chestnut flour and soya flour. The Pharma Innovation Journal. 2017;6(8):119-124.
9. Singh S. Efficacy of water chestnut (*Trapa bispinosa*) powder for development of functional Pudding with Honey as sweetening agent; Ph. D. Thesis, Warner College of Dairy Technology Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, 2017, 1-218.