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Review Article

Clinical Significance of Drinking Ash Gourd Juice: A Review Article

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ABSTRACT

Fruit and vegetable juices are important in human diets because of their pleasant, satisfying, aesthetic, refreshing therapeutic qualities. The Ash gourd (*Benincasa hispida*), a unique melon that belongs to the cucurbit family, includes significant nutritional values with a long storage life and good transport qualities. This fruit contains medicinal and functional characteristics and is used to treat a variety of clinical conditions in Ayurveda, naturopathy and Chinese systems of medicine. The ash gourd is valuable for its nutritional significance and contains characteristics such as triterpenoids, flavonoids, glycosides, saccharides, proteins, carotene, vitamins, minerals, β-sitosterin, uronic acids and sterols. The fruit includes a high quantity of moisture and the mature fruit is predominantly rich in vitamins B1 and C. It contains a high quantity of dietary fibers. Pharmacological studies have revealed that *Benincasa hispida* plays important roles in central nervous system (as anxiolytic, muscle relaxant and antidepressant agent, in Alzheimer's disease and for decreasing opiate withdrawal symptoms) with antioxidant, anti-inflammatory, anti-asthmatic, diuretic, nephroprotective, antidiabetic, hypolipidemic and antimicrobial effects. In addition, ash gourd juice improves gut health by changing the intestinal microbiota, which plays important roles in the health benefits. Thus, consumption of ash gourd juice can be adopted as a part of healthy diets.

Keywords: Ash gourd, Flavonoids, Antioxidant, Naturopathy, Microbiota

1. Introduction

Ash gourd (*Benincasa hispida*) is commonly known as hairy melon, wax gourd, winter melon, ash pumpkin or white pumpkin and it is the only species found in *Benincasa* genus. It is widely cultured through the old-world tropics and cultivated in India, Burma and Sri Lanka up to 1500 m of altitude (1). It is a fruit native to regions of southern Asia. Based on the region of origin, ash gourd can be called Petha (Hindi), Kundur (Malay), Bhuru Kolu or safed Kolu (Gujarti), Kushmanda (Sanskrit), Donggua (Chinese) and Beligo (Indonesian) (2,3). It is a member of the cucumber family, which grows in warm seasons. Cucurbitaceae is a genetically diverse group of plants in plant kingdom. From cucurbit, ash gourd is addressed as a gifted vegetable due to its significant nutritional values with its long storage life and good transport qualities. Various usable parts of gourd include young leaves, flowers and matureand immature fruits. Mature fleshy fruits can be consumed raw, sliced and boiled. Due to its unique medicinal and functional characteristics, the fruit is used to treat a variety of clinical conditions and in Ayurveda, naturopathy and Chinese systems of medicine (4, 5).

2. Characteristics of ash gourd

Benincasa is a monotypic genus with a single species. It needs long periods of warm dry weather for their optimal growth because the species is indigenous to arid and temperate regions of the earth. It includes a chromosome number of 2n = 24 and four cultivators based on its size, shape, fuzziness, waxiness and presence or absence of a dusty or ashy layer (6). The herbal size may vary from medium to large and the weight ranges 8.5–9 kg, depending on the genotype and production system. It is seen in shapes such as oblong, cylindrical and elongated (7).



Figure 1. A piece of ash gourd

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Since the plant is an annual growing one as a trailing vine, it reaches up to 40 cm in length and is often covered by a white chalky wax that deters microorganisms. This helps impart longevity to the gourd. Mature fruit is green and contains flat white seeds with nearly 1-cm length. Taste of the fruit is bland (9).

3. Nutritional significance

Ash gourd is valuable for its significant nutrition and contains characteristic compounds such as triterpenoids, flavonoids, glycosides, saccharides, proteins, carotene, vitamins, minerals, β-sitosterin, uronic acids and sterols (10) (Table 1). It is composed of high quantities of moisture (96.50 %), low calories (10 Kcal), 0.40 g of proteins, 0.1 g of fats, 1.9 g of carbohydrates, 1 mg of ascorbic acid, 0.80 g of fibers, 0.39 g of ash, 0.8 mg of iron and 30 mg of calcium (11). The mature fruit is predominantly rich in vitamins B1 and C and contains a high quantity of dietaryfibers. Concentration of dietary fibers is almost 27.5% of the dry weight, which contributes to its important functional characteristics. Moreover, ash gourd includes relatively high levels of organic amino acids of phenolic amino acids, minerals and nucleosides, providing antioxidant and anti-inflammatory characteristics (12, 13). From the index of nutritional quality values, the fruit includes a high quantity of potassium and a low quantity of sodium (14).

Table 1. Nutritional composition of the ash gourd (15)

Nutrient	Amount (100 gm.)	Unit
Water	96.1	Gm.
Energy	13	Kcal
Ash	0.3	Gm
Carbohydrate,	3	Gm
Protein	0.4	Gm
Total lipid (fat)	0.2	Gm
Fiber, total dietary	2.9	Gm
Calcium, Ca	19	Mg
Iron, Fe	0.4	Mg
Magnesium, Mg	10	Mg
Phosphorus, P	19	Mg
Potassium, K	6	Mg
Sodium, Na	111	Mg
Zinc, Zn	0.61	Mg
Copper, Cu	0.023	Mg
Manganese, Mn	0.058	Mg
Selenium, Se	0.2	µg
Vitamin C, total ascorbic acid	13	Mg
Thiamine	0.04	Mg
Riboflavin	0.11	Mg
Niacin	0.4	Mg
Pantothenic acid	0.133	Mg
Vitamin B-6	0.035	Mg
Folate, total	5	µg
Lysine	0.009	Gm.
Methionine	0.003	Gm

4. Preparation and consumption of the juice

Ash gourd must be washed, peeled and cut into pieces before extracting the juice using juice extractor (17). A total of 220 ml of fresh juice can be mixed with 30 ml of water and consumed on empty stomach (16).

5. Clinical importance

Fruit and vegetable juices are important in human diets because of their pleasant, satisfying,aesthetic, refreshing and therapeutic qualities. Ash gourd includes mild taste and pale color; however, it includes excellent values, providing great potentially vital health benefits. Despite including good health benefits, ash gourd is not consumed by large populations (19).

Pharmacological studies have revealed that *B. hispida* includes important roles in central nervous system (CNS) (as anxiolytic, muscle relaxant and antidepressant agent, in Alzheimer's disease and for decreasing opiate withdrawal symptoms) with antioxidant, anti-inflammatory, anti-asthmatic, diuretic, nephroprotective, antidiabetic, hypolipidemic and antimicrobial effects (20). Traditionally, the fruit is used as antibiotic and purgative in treatment of cough, fever, heart diseases and liver disorders (21).

5.1 Improvement of digestion

Digestion is a complex multiple-scale physiological process in the human gastrointestinalsystem that involves steering the food intake, catabolism it to appropriate forms, absorption of the basic units, transportation to associated tissues and removal of remaining wastes (22). Presence of food components and structure affect nutritional and functional performances during the digestion process (23). Ash gourd is low in calories and rich in water, which may help promote digestion and improve a healthy body weight. Presence of high soluble fiber content slows down digestion and promotes feeling of fullness (24).

5.2 Prevention of ulcers

Peptic ulcers are acid-induced lesions commonly seen in the stomach as well as duodenum. They are characterized by denuded mucosa with defect extending into the submucosa or muscularis propria (25). Medicinal and therapeutic characteristics of the ash gourd include capacity to increase basal volume of the gastric juice and decrease the pH levelof the gastric juice by increasing free acidity and chloride secretion in the gastric juice (26).A study by Mandal et al. reported that administration of aqueous extracts of *B. hispida* resulted in significant corrections of ranitidine-induced hypochlorhydria in rats.

Significant increases were reported in vitamin C, pepsin and chloride concentrations in the gastric juice with antioxidant activity (27).

5.3 Anti-inflammatory characteristics

A properly functioning immune system is important for the activation of acute inflammatory responses, which are needed in times of acute infections and injuries. These acute responses play significant roles in attraction of leucocytes and other immunemediators to the sites of infections and injuries (28). When the inflammatory stimulus is chronic in nature, the individual enters the state of chronic inflammation. Chronic inflammation is responsible for increasing risks of several chronic diseases such as cancers, cardiovascular diseases (CVDs), diabetes and hypertension (29) Ash gourd is one of the strongest food affecters of chronic systemic inflammation (30,). A study by Moon et al. reported that the ash gourd extract significantly decreased the following events in cultured endothelial cells, including adhesion of high glucose-induced intracellular reactive oxygen species (ROS) formation, adhesion activation of the redox sensitive transcription factor (NF-kB) via the suppression of IkB degradation and phosphorylation and adhesion of monocytes and CAM expression. These results showed that ash gourd could inhibit vascular inflammation in diabetic patients and prevent atherosclerosis by inhibiting oxidative stress. Thus, ash gourd includes significant potentials for decreasing inflammation by increasing pro-inflammatory cytokines (31, 32, 33).

5.4 Anti-bacterial and anti-microbial effects

Ash gourd includes protective functions against certain bacteria and fungi. Pulps and seedsof ash gourd have shown antimicrobial efficacy against certain Gram-positive and Gram- negative bacteria (34). A study by Wadikar et al. reported that aqueous extracts of pulp and seeds included antibacterial characteristics, especially better efficacy against *A. actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotellaintermedia* and *Fusobacterium nucleatum*, compared to other microorganisms. Fruit components with antibacterial characteristics include triterpenoids, flavonoids, glycosides, saccharides, carotenes, vitamins and sitosterin uronic acid (35, 36). Bioactive peptide of hispidalin in *B. hispida* includes considerable medical importance such as antimicrobial compounds. These peptides are active against human and plant pathogenic bacteria and fungi (37).

5.5 Prebiotic characteristics

Prebiotics are non-digestible carbohydrates that provide fermentable carbon sources forthe growth of probiotic microorganisms in the intestine. These microorganisms help with the production of specific immune regulators and stimulate antibody responses, which suppresses growth and development of pathogenic microorganisms and improves the mucosal gut barrier (38, 39, 40). A study by Sreenivas et al. showed that ash gourd as a prebiotic was able to absorb bile and played significant roles in production of short chain fatty acids (SCFAs) (e.g., acetate, propionate and butyrate) in the large intestine, resulting in important health benefits such as anticancer effects (39).

5.6 Antioxidant characteristics

Several epidemiological studies have revealed that consumption of dietary-rich antioxidants is effective for the potentially positive health, decreasing risks of dangerous diseases as well as premature aging. In addition to proteins, fats, carbohydrates, vitamins and trace elements, natural antioxidants are recognized as important components or nutrients in healthy diets (41, 42). Spices, fruits, vegetables, berries, chocolates and nuts contain a majority of the antioxidants. Ash gourd is rich in vitamin C and a good source of flavonoids and carotenes, which acts as antioxidants in the body and provides protective effects (42).

5.7 Decrease of blood lipids

Hyperlipidemia is a lipid metabolism disorder that increases risks of developing diabetes mellitus and CVDs (43). Numerous food-medicines have been shown to help dyslipidemia, including bitter melon, ginger, celery, citrus maxima and hawthorn (44). In China and other East Asian countries, ash gourd is used to treat conditions such as hyperlipidemia (45). Ash gourd peel acts as a modulator of PPARs, which block intracellular lipid accumulation and lipogenesis and thus improve insulin resistance and decrease expression ofits downstream genes (45). It has been verified that four triterpenes, two sterols, one flavonoid c-glycoside and one benzyl glycoside are included in ash gourd. Triterpenes can decrease serum cholesterol, β-lipoproteins and triglycerides in hyperlipidemic mice (46, 47).

5.8 Diuretic activity

Diuretics are extremely valuable in management of mild to moderate hypertension and enhancement of effects of other antihypertensive agents. Additionally, they are capable to relieve pulmonary congestion and peripheral edema. They induceforced diuresis in cases of barbiturate

poisoning and prevent occurrenceof renal calculi (48). The whole ash gourd includes diuretic activity and it has been documented that juice of the ash gourd in traditional medicine is used to decrease blood pressure and renal calculi. It has been discovered that ash gourd rind extract significantly increases urine volume and sodium and chloride excretion while decreasing potassium excretion (49).

5.9 Renal protective activity

Renal ischemia or reperfusion (I/R) induces oxidative stress, which is responsible for theimpaired kidney function that leads to significant increases in serum creatinine, urea and uric acid levels (50). Ash gourd is able to prevent renal I/R induced lipid peroxidation and protects kidneys from severe attenuation. A study on animal models has shown that the antioxidant activity of ash gourd significantly improves impaired kidney function and morphological and cytological preservations of the kidneys (51).

5.10 Help in obesity

Obesity is addressed as excessive fat deposition in the body, which damages the general health and is considered by the WHO as one of the most concerning health issues worldwide (52). Regardless of genetic predispositions, lifestyle changes, nutrition transitions and energy balances are major contributors to obesity development (53). Dietary management is a first-line treatment for obesity. Ash gourd is low in calories, which is a water-dense food that significantly decreases body weight (54). Eating low-calorie foods helps control hunger and maintain feelings of satiety and fullness, which is important for long-term satisfaction (55). Intake of these low-energy foods may help individuals regulate their energy balances for weight maintenance (56). Ash gourd is rich in dietary fibers. Dietary fibers are plant-based carbohydrates that are not digested inthe small intestine and hence reach the large intestine or colon unlike other carbohydrates (e.g., sugars and starches) (57). Several epidemiological studies have revealed that dietary fiber intake decreases risk of obesity and its associated non-communicable diseases (58). As fibers increase feeling of fullness and decreases calories ingested, this can result in decreased overall energy intake, which prevents development of obesity. (59).

5.11 Improvement of diabetes mellitus

Diabetes mellitus is a syndrome caused by a variety of etiologies that is characterized by metabolic dysfunction by changes in insulin production, secretion and/or inability to adequately perform its effects (60). It is caused by multiple factors such as genetics, nutrition, environment and physical activities (61). Ash gourd contains moisture, proteins, carbohydrates and fibers with calcium, phosphorus, iron, riboflavin, thiamine, niacin and vitamin C. Since ash gourd islow in calories it can be used in management of diabetic patients (62, 63). Phytochemical flavonoids in ash gourd stimulate lipogenesis and glucose transport of adipocytes. These decreases blood sugar levels (64). Mohan et al. discovered that ash gourd significantly decreased high blood glucose levels in rabbit models of alloxan-induced hyperglycemia. Significant action of the aqueous extract of ash gourd was seen at Hour 6 of administration. This is due to insulin release from remnant pancreatic β-cells or release from the bound forms, potentiating insulin effects of plasma. (65).

5.12 Alzheimer's disease

Alzheimer's disease is one of the most significant public health problems in elderly people. The disease was described first by Alois Alzheimer in 1906 using criteria of progressive memory loss, disorientation and pathological markers such as senile plaques and neurofibrillary tangles (66). It is a neurodegenerative disease characterized by thepresence of protein aggregation, inflammation and oxidative stress (67). An experimental study reported that fruit extract at a dose of 400 mg/kg effectively protected colchicine-induced Alzheimer's disease rats. This is possibly due to the presenceof vitamin E and β-carotene in ash gourd, which help protection against oxidative stress (68).

6. Conclusion

Ash gourd includes nutritional and medicinal characteristics. Ash gourd includes rich sources of several biologically active components that contribute to good health and decrease risks of developing chronic diseases such as CVDs. Ash gourd is a unique melon that contains rich sources of phenols, flavonoids and dietary fibers. Polyphenols include various physiological effects such as antioxidative, immunomodulatory and antimicrobial effects. Furthermore, ash gourd juice improves gut health by changing the intestinal microbiota, which plays critical roles in health of humans. Thus, consumption of ash gourd juice can be adopted as a part of healthy diets.

Financial disclosure

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