

## Nutritional Significance of *Benincasa hispida*

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### ABSTRACT

Ash gourd is sometimes known as wax gourd, and its scientific name is "*Benincasa hispida*," also known as *B. cerifera*, and it is from the family- Cucurbitaceae. *B. hispida* is said to be originated from Japan and Java, but it was widely cultivated in warm climates. It is one of the most well-known crops, farmed largely due to its fruits, and is known for its nutritional and therapeutic benefits, particularly in Asia. It's a famous vegetable crop that was used both for nutrition and medicine. Volatile oils, flavonoids, saccharides, glycosides, vitamin, proteins,  $\beta$ -sitosterin, minerals, carotenes, and uronic acid are among the major constituents of *B. hispida* fruits, according to phytochemical analysis. According to pharmacological studies, the pharmacological activities of this plant included central nervous effects (muscle relaxant, anxiolytic, antidepressant, in the Alzheimer's disease treatment and to reduce opiates withdrawal symptoms), antioxidant, analgesic, antiasthmatic, diuretic, antiinflammatory, hypolipidemic, antidiabetic, nephroprotective, and antimicrobial. *B. hispida*'s chemical constituents and pharmacological effects were highlighted in this review. This paper discusses the cultivation, nutritional and chemical content, as well as the medical and therapeutic properties of this versatile fruit as one of the potential sources of bioactives for functional foods, among other topics.

**Keywords:** Phytochemistry, Phytomedicines, *Benincasa hispida*, Functional foods

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### INTRODUCTION

Ash gourd which is also known as wax gourd and its scientific name is "*Benincasa hispida*" also known as *B. cerifera* and belongs to a cucurbitacean family which was first located on sea shore in a wild form in Java.<sup>1</sup> The Cucurbitaceae (cucurbit) family of food plants is one of the most genetically diverse in the plant kingdom. This family of plants is drought-tolerant, frost-sensitive and intolerant of moist, badly drained soils. It is also widely grown in South Asia and Japan. Ash Gourd is rich in iron and calcium but contains less protein and fats than other gourds.<sup>2</sup> It protects against bronchospasm induced by histamine.<sup>3</sup> The term "Ash Gourd" comes from the fruit's skin color: ash. In some areas, the ash gourd's skin has a waxy sheen, earning

it the nickname "Wax Gourd." Winter gourd gets its name from the fact that even during rainy seasons, it can be yield. Ash gourd comes under the *B. genus* and is covered with a coating that is frizzy in visual. Ash gourd is a vegetable that is used in many countries and apart from its taste and cooking ability, it contains many antioxidant and antiinflammatory abilities. The essential minerals Fe, Mg, Cu, Zn, Ca and Se are present. Nutritive value of ash gourd 100 gm of ash gourd contains total of 13 calories and its nutritive value is further divided as protein- less than 1-gm and carbs- 3 gms and fiber- less than 1-gm and vitamin C 14% of daily value and riboflavin 8% of daily value and zinc 6% of daily value. Ash gourd is very popular in Asian dishes, contains much less calories, is rich in water, fibres, and other benefits and nutritional value.<sup>4,5</sup>

Health benefits of ash gourd helps in digestion in many ways as it is high in water content. It is rich in soluble fibre and helps increase energy levels and immunity. The nutritional composition of ash gourd is made of 92% of edible water weight and rich in moisture and low in fat and major in micronutrients and vitamins and minerals. *B. hispida* is also used as laxative, Tonic and other psychological disorders etc. The cultivation of ash gourd is very simple and it is cultivated at 3-5/pit at 1-2 cm dept in the soil. It is grown slower than pumpkin. Fruit that is exacted from *B. hispida* helps majorly in the healing effects of ulcers in rats.<sup>6</sup>

This fruit shows the phytochemical screening of various fruit extracts, resulting in major concentrations of triterpenoids, vitamins, saccharides, carotenes, flavonoids, glycosides, and uronic acid. Substances extracted from ash gourd fruit are rich in antioxidants and are also natural drug for ulcer. It contains many antioxidants like terpenes, flavonoids etc. *B. hispida* shows really good results in Alzheimer's disease too. It works perfectly in inducing colchicine in rats. The aqueous extract from the stems of *B. hispida* helps in hypoglycemic effect in diabetic-induced rats. Total soluble solids make up almost 96% of the edible fraction of ash gourd juice, including the pulp and peel. 100 gm of ash gourd includes 12 gm of protein, 2.9 gm of fibre, 3.96 gm of carbs, 0.6 mg of zinc, 11.8 mg of iron, and 30 mg of calcium. The juice of the ash gourd contains no fat.

#### Nutritional Benefits of *B. hispida*

Vitamins and minerals are vital components that the body needs to function properly. Vitamins and minerals can be gained through everyday dietary consumption. In comparison to the other countries, Malaysia's Kundur fruit has the greatest riboflavin content and vitamin C content, with 68.00 and 0.31 mg/100 g of edible portion of food, respectively. Thiamin is the least prominent of the vitamins, ranging from 0.02 to 0.04 mg/100 g of edible part. When compared to other fruits, potassium (K) and calcium (Ca) are the most abundant minerals, with concentrations ranging from 77–131 mg/100 g and 5–23 mg/100 g of edible fruit, respectively, while iron (Fe) is the least abundant. Both of these minerals (K and Ca) play an important function in maintaining the electrolytic equilibrium of body fluids and in alkalinizing the body.

#### Antioxidant Effects of Ash Gourd "*B. hispida*"

The antioxidant activity and total phenolic content of *B. hispida* seeds were determined using the traditional soxhlet extraction method and DPPH and ABTS.<sup>11</sup> *B. hispida* leads to sudden increase of superoxide dismutase in erythrocytes of plasma level in rats.<sup>7</sup> The antioxidation limit of *B. hispida* takes off peels, seeds and mush. Decrease in activity of Fe changes color of assays.<sup>8</sup> 250–500 mg of dose in rats decreases sugar content insulin and cholesterol of plasma level in rats.

#### Antibacterial Effects Ash Gourd "*B. hispida*"

*B. hispida* stops the antimicrobial actions. It shows more antibacterial activities than immature fruit. Antioxidant activity of several *B. hispida* extracts was determined by their ability to scavenge hydrogen peroxide. The preliminary

antibacterial activity screening was carried out according to Hegazi's instructions. The approach is based on the diffusion of an antibacterial principle in a vertical whole extract into a petridish's solidified seed nutrient agar layer to the point where development of the introduced microorganism is completely stopped in a circular zone. The antibacterial activity of 20 extracts from diverse propolis samples was tested using the disc plate diffusion method. Two gramme positive and two gramme negative species, *Staphylococcus aureus* and *E. coli*, were chosen for this study.<sup>24</sup>

#### Effects on Central Nervous system by *B. hispida*

Anxiolytic effect of alcohol which is extracted from *B. hispida* was tested on mice while present in elevated plus maze and spontaneous motor activity.<sup>4</sup> *B. hispida* methanolic extract has a strong anti-compulsive effect. It aids in the improvement of serotonin activity.<sup>12</sup> Maximal electroshock Test (MEST) technique is used to observe the anticonvulsant properties of ash gourd (*B. hispida*). Due to fruit of *B. hispida* and its methanolic extract. It shows instant motor activity with no muscle relaxation. The antidepressant activity was tested on Swiss make albino mice for 14 continuous days and also tested with classical antidepressant drugs like fluoxetine 20 mg/kg, Imipramine mg/kg, and phenelzine 20 mg/kg. Methanolic extract shows their activity by inhibition of MAO-A and shows interactions with  $\alpha$ 1- adrenergic, dopaminergic, serotonergic and GABAergic system.<sup>10</sup> Juice of ash gourd shows major reaction against symptoms of morphine withdrawal. Therefore it helps in preventing morphine addiction and its suppression against other addictive substances like opioid and other drugs. some very serious treatments were being appeared manageable due to the liquified dose of *Benincasa hispida* according to Alzheimer's diseased rat model by colchicines. There was also an increase in antioxidants in various central nervous system, as well as the accuracy of decision making was improved.

#### Effect of *B. hispida* Fruit Extract as a Gastroprotective

The ethanolic and methanolic fruit extract injected orally to rat model in 300 mg/kg bodyweight shows gastroprotective effect by reducing gastric mucosal damage, gastric ulcer affected by pylorus bacteria.<sup>13</sup> *B. hispida* inhibits the destruction of mucosal lining known as gastric ulcers by lowering the gastric volume and acid content. The accurate dose of 300 mg/kgP. A methanol extract of *B. hispida* seeds inhibited ulcers in pyloric ligations, indomethacin-induced ulcer and Water immersion stress models by 25.7, 67.4 and 61.2%, respectively.<sup>15</sup> *B. hispida* fruit peel ethanolic extracts showed considerable anthelmintic action (p0.05) in a dose-dependent manner.

Because of its morphological and physiological similarities to human intestinal roundworm parasites P(22)P, the testing was carried out in vitro employing mature earthworms (*Pheretima posthuma*) The anti-diarrheal property of the *B. hispida*' methanolic fruit extract also - BHF Ewas tested in rats using several different diarrhea models. In rats, BHFE treatment inhibited PGER 2 R-induced enter pooling and significantly inhibited castor oil-induced diarrhea. It showed

a vital decrease in gastrointestinal motility after a charcoal meal<sup>P</sup> in rats too.

#### Anti Asthmatic Effects

*B. hispida* methanolic extract provides powerful protection against histamine induces bronchospasm in pigs even at 50 gm/kg which is considered as very low dose. After high dose not much of a protection was observed.<sup>14,15</sup>

#### Effects over kidneys and Renal Functioning

*B. hispida* fruit extract shows diuretic activity which increases urine volume, Sodium volume and chloride volume and also shows major lowering of potassium excretion in rats with average daily dose of 100 mg/kg bw.<sup>16</sup> Some histological observations revealed that treatment using a hydro-alcoholic whole fruit extract of *B. hispida* reversed the degenerative alterations caused by paracetamol.<sup>17</sup> It also helps in production of nephroprotective activity against mercury in poisoned rat models.<sup>18</sup>

#### Nanoparticles Synthesis by Using Peel Extract from *B. hispida*

The use of silver (Ag) in the category of inorganic metals may be dated back to the Neolithic era. During the eighth century, Moyer was the first to record the use of Ag for therapeutic purposes.<sup>19</sup> AgNPs are well-known for their antibacterial capabilities as well as their toxic effects on G bacteria, fungus, viral infection and protozoa. Drug resistance persistence in microorganisms has shown the antibacterial effects of Ag, AgNPs and compounds which are Ag based.<sup>20</sup> Ag is not toxic to human cells in small amounts, but its catalytic oxidation and reaction with dissolved monovalent Ag<sup>+</sup> ion likely amplifies toxicity.<sup>21</sup> The mechanism of action of metallic nanoparticles (NPs) against pathogenic bacteria is crucial for achieving synergistic effects with natural compounds. Nanoparticles display cytotoxicity by generating reactive oxygen species cross a broad spectrum.<sup>22,23</sup>

#### Ayurvedic Effect of *B. hispida*

*B. hispida* have major effect as Ayurveda. According to Ayurveda, *B. hispida* is known as Kushmanda and can be used in ripped or unripe form. It's plant includes flowers, leaves, barks, roots, stems and fruits. Kushmanda offers many benefits like:

- Antioxidant activity
- Antiinflammatory analgesic activity
- Antimicrobial activity
- Antipyretic
- Anti-convulsion activity
- Antiulcer activity
- Antidepressant activity
- Anorectic activity
- Histamine activity

It can also be used for cooking purposes in vegetables, salad, chips and sweets. In the form of juice, paste, powder, and other forms, it is used to treat piles, internal bleeding, anemia, cough, and heart disease. Kushmanda consumption is useful in both

therapeutic and prophylactic ways. For the dissemination of traditional knowledge of this plant, systemic study is required for the assessment of nutritional characteristics. More research is required in Ayurveda for better understanding of this Kushmanda known as *B. hispida*.

Gulkand is a tonic used in Ayurvedic medicine. It aids in reducing heat and pitta in the body, as well as reducing eye inflammation and redness, tooth and gum strengthening, and acidity treatment. Gulkand has a cooling effect on the body. It relieves lethargy, fatigue, itching, pain and aches. It also helps to relieve burning sensations in the hands' soles and palms. Gulkand is a powerful antioxidant and revitalizer.<sup>29</sup>

#### Physicochemical Study of *B. hispida*

##### Organoleptic character

It has a fine texture, a yellowish-white appearance, a slightly acidic flavor, a mildly aromatic scent, and a generic odor.

##### Physicochemical parameters

It has a foreign matter content of less than 1%, a total ash value of less than 12%, and acid insoluble ash of less than 1%, respectively. At the same time, alcohol-soluble extractives and water-soluble extractives must be at least 10 and 24%, respectively.

##### Biochemicals

Volatile oils, flavonoids, saccharides, glycosides, carotenes, vitamins, proteins, uronic acid minerals and  $\beta$ -sitosterin were found in abundance in *B. hispida* fruits. In the fruit of *B. hispida* main sugar content are the galactose, xylose, sorbose and glucose. Total dietary fibre (58.43%), crude protein (11.63%), and crude fat (11.63%) were discovered in the chemical analysis of seeds (20.70%). Linoleic acid (67.37%), oleic (10.21%), stearic acids (4.83%), palmitic (17.11%) were found in the seed oil [Sew *et al.*, 2010] Carbs, sugars and lipids were found to be lacking in the roots aqueous extract, but glycosides, alkaloids and tannins were found. The intensity of color or the production of precipitate has been employed as analytical responses in the investigations.

##### Anti Inflammatory effects

According to early research, the aqueous extract of *B. hispida* revealed antiinflammatory effects. In a rat model, methanolic and petroleum ether extract of *B. hispida* fruit at 300 mg/kg bw inhibited carrageenan-induced paw edema, histamine-induced paw edema, and cotton pellet-induced granuloma in a dose-dependent and substantial manner. Petroleum ether and methanolic extracts inhibited inflammation the most inwv a carrageenan-induced paw edema model when compared to the control group and conventional valdecoxib. Both extracts inhibited histamine-induced paw edema as compared to the control. The effects it had were equivalent to those of the commonly prescribed medication cetirizine (95.24%). The use of petroleum ether and methanolic extracts resulted in a small but statistically significant reduction in granuloma tissue formation in cotton-implanted rats.<sup>25</sup>

### Hypolipidemic and Hypoglycemic Effects

In normal male wistar rats, the stem's chloroform extract of *B. hispida* displays low sugar content in blood. At a dose of 200 mg/kg bw, the stem extract of *B. hispida* produced the greatest downfall of sugar-glucose levels in blood. In normal males, the stem chloroform extract of *B. hispida* exhibits substantial hypoglycemic action. Wistar rats are a type of rat. The stem extract of *B. hispida* resulted in the greatest reduction in blood glucose levels. When given the dose of 200 mg/kg bw, the results were recorded.<sup>26</sup>

Salad was produced with 100 gm of ash gourd (*B. hispida*), 10 curry leaves or 1-g of curry leaves, and 5 gm of skimmed milk powder (formed into curd), adding pepper and salt seasonings. The therapeutic efficacy of ash gourd and curry leaves supplementation was determined by giving this salad to hyperlipidemic diabetic patients in the middle of the morning for three months. Within three months, ash gourd and curry leaves supplementation demonstrated a substantial hypoglycemic and hypolipidemic impact, lowering blood glucose levels (both fasting and postprandial).<sup>27</sup> In mice, *B. hispida* when given at doses of 250 and 500 mg/kg reduced plasma glucose, triglyceride, and insulin levels in a dose-dependent manner. The glucose uptake from the hemidiaphragm was also increased.<sup>28</sup>

### Diabetic Benefits of Ash Gourd *B. hispida*

The medicinal and healing properties of ash gourd are well-known. It's ideal for diabetics and those trying to lose weight because it's low in calories. The cooling purgative herb promotes urine secretion and elimination. As a result, it also serves as a good detoxifying agent.

### Nutraceutical Product using *B. hispida*

Gulkand is well-known for its calming effects as well as its antioxidant and rejuvenating capabilities. It has long been known that gulkand is made up of a variety of active and significant phytochemicals that work together to provide the product its medicinal properties.<sup>29,30</sup> Gulkand is prepared from ash gourd or *B. hispida* base and it was noticed that, gulkand is rich in calcium and vitamin C with multiple properties, including antacid and antioxidant properties. Vitamin C, a powerful antioxidant, was discovered higher in winter melon gulkand than in marketed Gulkand, implying that it has greater antioxidant properties than market gulkand.

### Post-harvest Technology of *B. hispida*

The ash gourd can be kept for a long time, even up to 6 months, without spoiling. As long as it's stored in a clean, well-ventilated environment. Because the fruits are heavy, they must be kept away from one another to avoid damage to the outside of the fruits, such as bruising or cutting marks. The ash gourd has a variety of uses and can be processed to make a juice that is beneficial to persons suffering from lung disorders such as asthma and bronchitis. It's also used to make halwa and the famed 'Petha', sweet cubes that originated in Agra and

can be sold as ash gourd processed products. A little kind of ash gourd grown in Kerala is employed in making this dish.

### Benefits of Seed Extract of *B. hispida*

Seed extract inhibited bFGF-induced endothelial cell proliferation and tube formation. The seed extract from *B. hispida* did not cause any cytotoxicity in HUVECs or regular fibroblast cells. Additionally, bFGF-induced angiogenesis *in-vivo* was significantly suppressed by a seed extract from *B. hispida*. *B. hispida* seeds mostly consist of saponin, urea, citrulline, linoleic, oleic, and fatty acids. The seed also contains trace levels of isomultiflorenol, proteins like trigonelline, coffearin, and osmotic, steroid beta-sitosterol, alkaloids like 5-methylcytosine, stigmast-5-ene-3-beta-ol, and triterpenoids such cucurbitacin B.

*B. hispida* seeds also have diuretic properties, therefore, they're utilized to treat edema caused by sclerosis of the liver and beriberi.

### Other Value Additions of Ash Gourd

Many sweets are prepared from ash gourd, also known as *B. hispida* and are majorly popular in many parts of India.

The famous value-added products of ash gourd prepared from its fruit are Bari (Nuggets) and Petha (sweet candy). One of the most popular sun-dried items is badi. These badis can be eaten or deep fried, and they can be utilized in a variety of cuisines. Petha is a popular dessert in India. It can be eaten dry or dipped in sugar syrup and is soft, chewy, and candy-like (chashni). It is thought to have started in Agra.

Petha is a popular sweet dish in Uttar Pradesh's western regions. It's a delectable dessert made from the pulp of the fruit, which is cooked in water with sugar syrup and other flavoring agents. Sweets' delicacy can be judged by the fact that they can be prepared and served in various ways, depending on consumers' preferences. The variety of petha sweets is reflected in crystallized or glazed petha, or the dipping of cooked ash gourd into concentrated sugar with flavoring and coloring resources to improve aesthetic quality.

### Side Effects of *B. hispida*

Multiple toxicological research types in rats concerned with high safety and 10 gm/kg of high dose resulted in no mortality. Extraction of *B. hispida* chloroform showed high morbidity in rats. It is said that drinking too much ash gourd juice or doing so for a long time can cause phlegm. This is due to its waxy nature, which can be harmful in general as well as to people who suffer from asthma or bronchitis. Mineral content is also high in this vegetable. As a result, drinking it for a long time can cause toxic levels of metallic substances to build up in the body.

### Future Potential

Due to the potential health benefits of Kundur fruit for humans, researchers are starting to acknowledge these benefits. The people of the Asian region, especially the elderly, consume this fruit raw and in other forms without recognizing its healing properties. Knowledge is lacking, especially regarding the nutritional value profile of other parts of the Kundur fruit

that should be investigated, like the skins, seeds, and core. Food-grade thickeners from Kundur could be produced for commercial usage because the fruit of *B. hispida* contains significant levels of chemicals that thicken liquids.

## CONCLUSION

Ash gourd consumed in the form of juice is a great detoxifier and should be consumed first thing in the morning. This juice has the ability to absorb all of the toxins, germs, and contamination that have accumulated in one's body throughout the day. It also has the capability of flushing waste from our system. Calcium, iron, phosphorous, and vitamin C are among its components. Before juicing, the ash gourd vegetable's seed, which contains a pale yellow oil, must be removed. Constipation sufferers will benefit from this juice because it soothes the digestive tract. The combination of the well-known safed petha with coconut milk, lime juice, and amla juice is equally helpful. If you have gastroenteric worms, a mixture of coconut milk and ash gourd juice will help you feel better. It also promotes tissue development. In rats, ash gourd juice was demonstrated to alleviate morphine withdrawal symptoms and also helps in opioid addiction.

It helps in many ways and plays major role as antiulcer, antidepressant, anti-inflammatory effects and antibacterial effects, major suppressor as opioid or morphine addiction which directly shows result from the central nervous system and it's fruit extract helps as a gastro-protective. It is also used as a medicine in Ayurveda major major health benefits.

It thrives in well-drained loam and sandy soils in warm, temperate areas and is resistant to frost. It's grown in riverbeds or furrows and requires continual watering during the growing season.

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