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Review Article

A Systematic Review of The Pharmacological Potentials and Phytoprofile of Benincasa Hispida

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ABSTRACT

Benincasa hispida, popularly referred to as ash gourd and winter melon. It is a yearly climbing plant which belong to the Cucurbitaceae family that plays a vital role in traditional practices. It has traditionally been used to treat various ailments including epilepsy, diabetes, urinary tract disorders, and psychological illnesses. Phytochemical investigations have identified diverse bioactive compounds, including sterols, flavonoids, triterpenes, and essential oils, responsible for its therapeutic activities. Modern pharmacological research supports its anti-inflammatory, antidiabetic, neuroprotective, nephroprotective, antimicrobial, and anti-osteoporotic effects through multiple mechanisms such as neurotransmitter regulation, antioxidative stress modulation, and enzyme stabilization. Despite its historical safety in traditional use, recent toxicological studies emphasize the need for standardized evaluations of dosage and formulation to ensure safety and efficacy. This review consolidates the ethnopharmacological, phytochemical, botanical, and pharmacological data available for *B. hispida*, underlining its potential as a source of novel therapeutics while advocating for more rigorous clinical and toxicological studies.

INTRODUCTION

Benincasa hispida, also known as white pumpkin, winter melon, ash gourd, wax gourd or Chinese watermelon. It is a yearly climbing plant which belongs to Cucurbitaceae family. It plays a pivotal role in traditional practices and has broad spectrum

of medicinal uses. The wax gourd is traditionally used in managing various diseases such as cardiovascular conditions, gastrointestinal disturbances, diabetes, respiratory disorders and urinary tract infections. The fruit of *Benincasa hispida* is used for medicinal properties such as diuretic, laxative and general tonic. It has also

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shown therapeutic effects against schizophrenia, epilepsy, menstrual disorders, jaundice and certain psychological conditions.¹ *Benincasa hispida* has been found to contain four distinct triterpenes and two types of sterols, in addition to benzyl glycoside, C-glycoside flavonoid and an acylated sugar compound.² The fruit of *Benincasa hispida* contains various bioactive constituents, including sugars, proteins, flavonoids, essential oils, carotenes, glycosides, along with various minerals, vitamins and uronic acid. Extensive pharmacological studies have investigated its broad spectrum of therapeutic effects, which encompass neuroprotective, nephroprotective, antidiabetic, antioxidant and hypolipidemic.^{3,4} Although *Benincasa hispida* has rich history of traditional use, a widespread and concerning misconception persists that herbal medicines are inherently safe. This notion frequently supported by cultural traditions and observation evidence tends to disregard essential factors such as proper purity, dosage and the risk of toxicity. Recent toxicological research underscores the importance of conducting comprehensive safety assessments, even for well established herbal remedies like *Benincasa hispida*.⁵

1. Plant Profile

Ash gourd, scientifically known as *Benincasa hispida*, is also known as winter melon and wax gourd. The name “ash gourd” is derived from the fruit’s ash coloured skin, while the term “wax gourd” refers to the waxy coating often found on its surface in certain regions. The name “winter gourd” reflects its ability to produce fruit even during the rainy season.⁶ *Benincasa hispida* is a monoecious climbing plant characterized by hairy stems, leaves, petals, petioles, and immature fruits, along with distinctive yellow flowers.⁷ The leaves of *Benincasa hispida* are simple and alternate, characterized by dense hairiness on both surfaces. They typically exhibit a palmate or ovate shape in younger specimens and possess a cordate base. The immature fruits range from 30 to 45 cm in length, are succulent, and covered with dense trichomes, eventually developing a thick, waxy layer as they mature. The mature fruit is finely textured, yellowish-white in colour, mildly acidic, and faintly aromatic, though generally lacking a distinct odour. The plant itself may attain a height of up to 80 cm and is distinguished by its broad foliage and bright yellow flowers.⁸



Fig. *Benincasa Hispida*

Taxonomy⁹

Kingdom	Plantae (Angiosperms)
Family	Cucurbitaceae
Sub family	Cucurbitoideae
Genus	<i>Benincasa savi</i>

Tribe	Benincaseae
Subtribe	Benincasinae
Order	Cucurbitales

2. Ethnopharmacology



As according to Raja Nirghantu (an ancient Ayurvedic text on therapeutics), medicinal preparations from *Benincasa hispida* were traditionally made using mature, fully ripened fruits. The pulp was finely shredded into thin strips, allowing the abundant watery extract to be collected and stored. In Ayurvedic practice, *Benincasa hispida* is proposed as the treatment for internal haemorrhages, epilepsy, gastric ulcer and various nervous system disorders.¹⁰⁻¹¹ In traditional Indian medicine, *Benincasa hispida*, known as *Kushmanda*, used as a remedy for diuretic conditions, urinary system infections, diabetes as well as chronic inflammatory disorders, in accordance with Ayurvedic principles. Within the framework of traditional Chinese medicine, *Benincasa hispida* is considered to have a slightly cooling nature and a sweet taste, with its therapeutic effects associated primarily with the energetic pathway associated with gastrointestinal processing and fluid balance. Historically, it has also been widely used in traditional treatments to manage conditions such as painful urination, lumbago, heat syndrome, and hives.¹² Traditionally, its fruit is described as sweet and is valued for its cooling properties. It is also recognized for its functions as a styptic, Renal stimulant, Adaptogen, Reproductive tonic, antiperiodic, laxative, as well as Cardiac stimulant. Additionally, it is utilized in the management of jaundice, indigestion, asthma, menstrual irregularities, fever, urinary calculi, blood-related disorders, conditions associated with aggravated *pitta*, and for regulating body heat.¹³

3. Chemical Constituents Found in The Whole Plant of The *Benincasa Hispida* Plant¹⁴

Plant parts	Chemical constituents
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Fruits	β -sitosterol, cucurbitin, rhamnose, mannitol, triacontenol, fat, vitamin, glucose, alkali, histidine, hexanal, and pyrazine components and lupeol.
Seeds	24-ethylidene, 24- β -ethyl cholesterol, and cholesterol -7 enol.
Root	Bryonolic acid, Pentacyclic triterpene

4. Pharmacological Activities

5.1 Neuroprotective Effect

In the study, a D galactose induced mice model was used where aqueous extract and methanolic extract of *Benincasa hispida* significantly reduced oxidative stress and lipid peroxidation whereas, there was increase of anti-oxidant enzyme like glutathione peroxidase. These biochemical improvements were accompanied by reduction in autofluorescence and lipofuscin in the cerebral cortex which indicated a reversal of age associated neurochemical damage.¹⁵ In addition, a study using hydroalcoholic extract revealed significant improvements in levodopa induced aggression, pentobarbital induced sleep, and serotonin mediated responses in mice, indicating to a modulatory effect on dopaminergic and serotonergic neurotransmission.¹⁶ Similarly, the ethanolic seed extract of *Benincasa hispida* has shown anticonvulsant properties in both pentylenetetrazol induced seizure models and maximal electroshock. The observed effects suggest mechanisms involving stabilization of neurotransmitters and membrane protection. Notably, in an aluminium chloride induced Alzheimer's disease model, there was significant improvement in learning and memory by the use of *Benincasa hispida* extract which was evaluated using the Y-maze tests and Morris's water maze. There was also increase in the level of neurotransmitters such as acetylcholine, dopamine, and serotonin, in the cortex and

hippocampus and reduction in the proinflammatory cytokines and oxidative stress markers. These neuroprotective effects were associated with the upregulation of the Keap1/Nrf2/HO-1 signaling pathway, suggesting that *B. hispida* promotes antioxidative and anti-inflammatory defenses at the molecular level.^{18,19}

5.2 Anti-Inflammatory Effect

According to Parida et al. (2010), the methanolic extract of *Benincasa hispida* fruit peel has shown potent anti-inflammatory activity among rodents. The extract effectively diminished acute inflammatory reaction induced by protein fraction of egg white among rodents. The maximum suppression of paw oedema was observed within the first hour of administration, and the activity was comparable to that of acetylsalicylic acid. This effect was statistically significant and was attributed to tannins, flavonoids, steroids as well as saponins. They are purported to interfere with inflammatory mediator pathways. Moreover, the infusion demonstrated antinociceptive activity in mice by significantly reducing formalin induced paw licking, acetic acid induced writhing and thermally induced pain responses.²⁰ Another study conducted by Kadam and Lele (2014), the extracts of methanol and petroleum ether of *Benincasa hispida* fruit were assessed for anti-inflammatory effects. The methanolic extract exhibited significant membrane stabilization effects which suggests that the ability of *Benincasa hispida* extract to prevent erythrocyte membrane lysis under hypotonic stress, a mechanism similar to lysosomal membrane stabilization observed during inflammation. In vivo studies further validated its anti-inflammatory effect, with the delivery of the methanolic extract (250–350 mg/kg) via the oral route leading to a marked reduction of paw oedema over a 4-hour period in rats ($p < 0.05$), in comparison to the standard anti-

inflammatory agent, acetylsalicylic acid. The anti-inflammatory effects were attributed to phytochemical constituents such as glycosides, flavonoids, polyphenols as well as triterpenoids which likely act through mechanisms that inhibit stabilize cellular membranes and prostaglandin synthesis.²¹

5.3 Anti-Diabetic Effect

Mahatma et al. (2015) conducted an investigation in which methanolic extracts of *B. hispida* fruit were given orally at doses of 200 mg/kg and 400 mg/kg to streptozotocin induced diabetic rats for 15 days. The treatment led to a significant reduction in blood glucose fasting level, with statistical relevance. Moreover, *Benincasa hispida* extract positively influenced the lipid profile by decreasing level of serum triglycerides and VLDL levels, while increasing HDL levels. The higher dose also resulted in enhanced body weight and a significant reduction in total cholesterol, effects similar to those observed with the standard anti-diabetic drug, glibenclamide.²² Similarly, Zakaria et al. (2022) conducted an investigation in which *Benincasa hispida* has led to decrease in the blood glucose level. Treated rats showed lower HbA1c levels, improved weight maintenance, and enhanced lipid profiles compared to untreated diabetic controls. Importantly, liver and kidney function tests showed biochemical and histological improvements, suggesting organ-protective effects superior to metformin in certain aspects. The study attributed the therapeutic benefits to bioactive components such as gallic acid and polysaccharides with antioxidant properties.²³ Another study conducted by Ravi Kumar et al. (2021), *Benincasa hispida* petroleum ether and methanolic extracts showed significantly reduced sugar levels. The extracts also increased HDL level and decreased VLDL, cholesterol, triglycerides and LDL, thus improving lipid

profile modulation alongside glycaemic control. The antioxidant properties were characterised by lower MDA levels and increased SOD and catalase activity. As such, it's likely that the antidiabetic activity of the *Benincasa hispida* is due to antioxidant action and improved insulin sensitivity.²⁴ Similarly, Mishra and Barik (2009) conducted an investigation in which the *Benincasa hispida* fruit peel extract showed significant hypoglycaemic activity. The extract effectively normalized blood glucose levels and demonstrated a restorative effect on pancreatic cells. Additionally, it contributed to improved lipid metabolism, underscoring its potential as a therapeutic candidate for diabetes management.²⁵

5.4 Nephroprotective Effect

Benincasa hispida has exhibited significant nephroprotective properties involving drug induced renal injury. In the investigation, *Benincasa hispida* significantly reduced blood urea nitrogen, urinary glucose levels and serum creatinine. It also increased antioxidant enzyme glutathione while decreasing lipid peroxidation. Histological examination further showed the preservation of normal renal architecture in treated groups indication strong protective effects against oxidative damage and tubular degeneration.²⁶ In another study, the *Benincasa hispida* derived silver nanoparticles showed superior nephroprotective activity. This formulation exhibited notable reduction of uric acid, serum creatinine and electrolyte disturbances alongside improved histopathological profiles distinguished by tubular necrosis and reduced inflammation. The enhanced efficacy was associated with improved antioxidant and anti-inflammatory effect, also increased in bioavailability and stability of the nanoparticle formulation.²⁷ Additionally, a study assessing the nephroprotective role of *Benincasa hispida* against paracetamol induced

nephrotoxicity underlined similar reports. Increase in GSH levels and reduction of lipid peroxidation verified its antioxidant role. Histopathological analysis supported these findings, indicating restoration of renal tissue architecture following treatment.²⁸

5.5 Anti-Osteoporosis Effect

In the study, 35 female ICR mice were used following either a sham operation or OVX to investigate the *Benincasa hispida* extract to show anti-osteoporotic effect. After 8 weeks of treatment and examination, blood and femur samples were obtained to analyse the effect. The result indicated high dose of *Benincasa hispida* significantly enhanced bone mineral density and increased levels of bone formation markers when compared to the untreated OVX group. Moreover, elevated bone markers observed in OVX group were reduced following treatment with high dose of *Benincasa hispida* extract. This report suggest that *Benincasa hispida* extract effectively mitigates bone loss and supports bone regeneration, indicating its therapeutic potential in managing postmenopausal osteoporosis and related skeletal disorders.²⁹

CONCLUSION

Benincasa hispida exhibits a broad range of pharmacological activities that supports traditional system of treatment in inflammatory disorders, renal as well as neurological. Its therapeutic potential is attributed to a rich phytochemical profile, including triterpenes, sterols, and flavonoids, which collectively add to its diverse bioactivities. Among its various effects, the neuroprotective and antidiabetic properties are particularly clearly established through preclinical studies. However, the widespread perception of herbal remedies as inherently safe poses a significant concern. Rigorous investigations,



encompassing standardized clinical trials and comprehensive toxicological assessments, are important to validate its efficacy and ensure safety, thereby facilitating its incorporation into evidence based therapeutic practices.

REFERENCES

- Pahari N, Mahanti B, Banerjee M, Mandal K, Bhowmick B, Roy A. A concise review on *Benincasa hispida* (Thunb.) Cogn. Plant. Int J Health Sci. 2022;6(S6):844-853. doi:10.53730/ijhs.v6nS6.9704.
- Singh S, Gohil KJ, Singh MP. Pharmacological update on *Benincasa Hispida* (Thunb.): A review. Pharmacological Research - Modern Chinese Medicine. 2024;12:100478.
- Vînătoru C, Peticilă AG, Barcanu E, Muşat B, Bratu C, Tănase B, Agapie O-L, Gherase I, Negoşanu G. The main results in acclimatization and breeding of *Benincasa hispida*. Scientific Papers. Series B, Horticulture. 2021;65(1):577-582.
- Al-Snafi AE. The Pharmacological Importance of *Benincasa hispida*: A Review. Int J Pharma Sciences and Research. 2013;4(12):165-170.
- Pahari N, Chatterjee A, Dandapat C. Safety profile determination of *Benincasa hispida* (Thunb.) cogn. Leaves extracts using toxicological and histopathological screening. Hybrid Advances. 2024;6:100266.
- Aggarwal A, Sharma L, Sharma D, Dhobale S, Deshmukh N, Barde L, Tare H. Nutritional Significance of *Benincasa hispida*. Int J Pharm Qual Assur. 2023;14(2):410-415. DOI: 10.25258/ijpqa.14.2.28.
- Singh S, Gohil KJ, Singh MP. Pharmacological update on *Benincasa hispida* (Thunb.): A review. Pharmacol Res Mod Chin Med. 2024;12:100478. doi:10.1016/j.prmcm.2024.100478.
- Mirekar N, Ananya M, Iddalagi S, Narayanachar, Danapur V. A comparative study of HPTLC fingerprint profile and standardization of *Benincasa hispida* (Thunb.) Cogn. pulp and seed. Acta Bot Plantae. 2024;3(2):08-15. doi:10.51470/ABP.2024.03.02.08.
- Manoj S. Pagare, Leena Patil, Vilasrao J. Kadam. *Benincasa hispida*: A Natural medicine. Research J. Pharm. and Tech. 4(12): Dec. 2011; Page 1941-1944.
- Sabale V, Kunjwani H, Sabale P. Formulation and in vitro evaluation of the topical anti-ageing preparation of the fruit of *Benincasa hispida*. J Ayurveda Integr Med. 2011 Jul-Sep;2(3):124-9.
- Grover JK, Adiga G, Vats V, Rathi SS. Extracts of *Benincasa hispida* prevent development of experimental ulcers. J Ethnopharmacol. 2001;78(2-3):159-164. doi:10.1016/S0378-8741(01)00334-8.
- Zhang M, Lei J, Wang Y, Zhang J, Liu D. Ethnopharmacology, phytochemistry and pharmacology of *Benincasae Exocarpium*: A review. Chin Herb Med. 2023;15:15-26. doi:10.1016/j.chmed.2022.10.001.
- Islam MT, Quispe C, El-Kersh DM, Shill MC, Bhardwaj K, Bhardwaj P, et al. A literature-based update on *Benincasa hispida* (Thunb.) Cogn.: Traditional uses, nutraceutical, and phytopharmacological profiles. Oxid Med Cell Longev. 2021;2021:6349041. doi:10.1155/2021/6349041.
- Kumar M, Upadhyay SK, Singh R, Kumari B. Pharmacognostical, physicochemical and pharmaceutical paradigm of ash gourd, *Benincasa hispida* (Thunb.) fruit. Plant Arch. 2021;21(S1):223-228. doi:10.51470/PLANTARCHIVES.2021.v21.S1.041.
- Ambikar DB, Mohanta GP. Neuroprotective effect of petroleum ether, methanolic and



- aqueous extracts of fruits of *Benincasa hispida* on lipofuscinogenesis and fluorescence product in brain of D-galactose induced aging accelerated mice. *Indian J Pharm Educ Res.* 2021;55(2 Suppl):S528–S533.
16. Shakya A, Bhat HR, Ghosh SK. Assessment of neurobehavioral properties of hydroalcoholic extract of *Benincasa hispida* fruit pulp in mice. *J Biol Act Prod Nat.* 2019;9(4):299–310.
 17. Gohain K, Kaushik S. Study of the anticonvulsant activity of ethanolic extract of seeds of *Benincasa hispida* in albino rats. *Asian J Pharm Clin Res.* 2014;7(Suppl 2):128–130.
 18. Rapaka D, Bitra VR, Ummidi R, Akula A. *Benincasa hispida* alleviates amyloid pathology by inhibition of Keap1/Nrf2-axis: Emphasis on oxidative and inflammatory stress in Alzheimer's disease model. *Neuropeptides.* 2021;88:102151.
 19. Satish PA, Dattatraya KA. Therapeutic potential of *Benincasa hispida* for the treatment of Alzheimer disease. *J Adv Zool.* 2024;45(2):533–538.
 20. Parida NK, Sahu MR, Debata PC, Panda PK. Antinociceptive and antiinflammatory effects of methanolic extract of *Benincasa hispida* fruit peel in rodents. *Asian J Chem.* 2010;22(10):7573–9.
 21. Kadam D, Lele S. Anti-inflammatory activity of the fruit extract of *Benincasa hispida*. *J Nutr Ther.* 2014;3(4):178–82.
 22. Mahatma A, Sonowal A, Kumar MS. Evaluation of antidiabetic potential of methanolic extract of *Benincasa hispida* in streptozotocin-induced diabetic rats. *Int J Pharm Sci Res.* 2015;6(8):3334–43.
 23. Zakaria F, Wan Ishak WR, Wan Ahmad WAN, Safuan S, Tengku Ismail TA. Hypoglycaemic and protective effects of *Benincasa hispida* aqueous extract in streptozotocin-induced diabetic rats. *Sains Malaysiana.* 2022;51(3):783–93.
 24. Ravi Kumar V, Alagarsamy V, Jat RK. Anti-diabetic and wound healing potential of *Benincasa hispida* in streptozotocin-induced diabetic rats. *Int J Res Pharm Sci.* 2021;12(2):1539–45.
 25. Mishra MK, Barik BB. Antidiabetic activity of *Benincasa hispida* (Thumb.) Cogn. fruit peels on alloxan-induced diabetic rats. *Indian Drugs.* 2009;46(10):767–9.
 26. Varghese HS, Raj GG. Protective role of *Benincasa hispida* fruit extract against gentamicin-induced nephrotoxicity in rats. *Indian J Exp Biol.* 2021;58:633-639.
 27. Sheikh AS, Sharma DK, Hafiza S, et al. Evaluation of nephroprotective activity of the whole plant *Benincasa hispida* silver nanoparticles against vancomycin-induced nephrotoxicity in rats. *Afr J Biomed Res.* 2024;27(4s):14032-14043.
 28. Varghese HS, Kotagiri S, Swamy BM, et al. Nephroprotective activity of *Benincasa hispida* fruit extract against paracetamol-induced nephrotoxicity in rats. *Res J Pharm Biol Chem Sci.* 2013;4(1):322-327.
 29. Choi SI, Han X, Men X, Lee SJ, Oh G, Choi YE, et al. *Benincasa hispida* extract prevents ovariectomy-induced osteoporosis in female ICR mice. *Appl Sci.* 2023;13(2):832. doi:10.3390/app13020832.

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