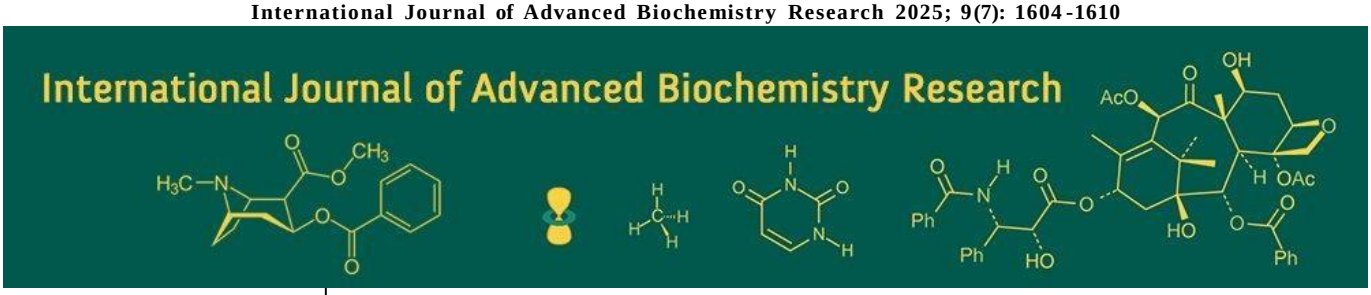


ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; 9(7): 1604-1610
www.biochemjournal.com
Received: 04-05-2025
Accepted: 07-06-2025

Akershit Srivastava
M.Sc. Research Scholar, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Samir E Topno
Assistant Professor, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Dr Shilpa Rana
Assistant Professor, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Dr. Deepak Lall
Assistant Professor, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj

Prof (Dr) Vijay Bahadur
Professor And HOD Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj

Corresponding Author:
Samir E Topno
Assistant Professor, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Effect of different edible colour and natural flavouring agents on value: Added products of ash gourd

Akershit Srivastava, Samir E Topno Shilpa Rana, Deepak Lall and Vijay Bahadur

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i7t.5001

Abstract
The present study focused on evaluating the physiological changes in the value-added ash gourd product (Petha) under different treatment conditions. Specific gravity varied significantly across treatments, with T_1 showing the highest value (1.56) and T_7 the lowest (1.23). For hardness, T_1 (9.43) performed the best, followed by T_5 (9.26), while T_8 (7.60) recorded the lowest value. Shelf life was longest in T_1 (12 months), followed by T_5 and T_{10} (10 months each), with T_4 showing the shortest (7 months). T_1 also recorded the highest total soluble solids (TSS) at 87.66°Brix, followed by T_7 (83°Brix), while T_2 had the lowest (73°Brix). In terms of ascorbic acid content, T_1 (5.16 mg) ranked highest, closely followed by T_3 (5.1 mg), with T_6 (4.5 mg) being the lowest. Total reducing sugar was also highest in T_1, followed by T_8, with T_5 showing the least. Regarding colour, T_1 received the highest score among all treatments. Sensory evaluations over the storage period showed that T_1 consistently outperformed other treatments (T_0 to T_8) in texture, flavour, aroma, and overall acceptability. Its superior specific gravity contributed to better firmness and mouthfeel, making it the most preferred option.

Keywords: Petha, hardness, TSS, quality attributes, shelf life, specific gravity, total reducing sugar

Introduction
Ash gourd (*Benincasa hispida*), also known as winter melon, is some tropical fruit rich in water, low in calories, and packed with nutrients like vitamins A and C, calcium, iron, and fiber, making it a valuable dietary component (Sultana). It is widely cultivated in India - particularly in Tamil Nadu, Karnataka, Andhra Pradesh, Odisha, and Uttar Pradesh - during the summer and monsoon seasons due to its preference for warm tropical climates (Singh *et al*., 2020) [4]. Traditionally consumed fresh or in simple recipes, its economic utilization remains limited (Gupta *et al*., 2019) [6]. However, growing interest in healthy, value-added products has spurred efforts to develop ash gourd-based items like juices, jams, soups, and powders (Goswami), which offer better shelf life and economic potential (Akinmoladun *et al*., 2022). A key challenge remains improving its sensory appeal due to its bland flavor. To overcome the challenge of ash gourd's bland flavour, incorporating edible colourants and natural flavouring agents has shown great potential. Colourants sourced from fruits, vegetables, and spices - such as turmeric, beetroot, and spinach - can enhance visual appeal, while flavouring agents like ginger, cardamom, and citrus extracts improve taste and aroma. These natural additives not only elevate the sensory qualities of ash gourd-based products but also add nutritional and bioactive value, appealing to health-conscious consumers (Poonam; Nath).

This study investigates the impact of natural edible colourants and flavouring agents - such as paan and elaichi (cardamom) paired with green, red, orange, and yellow hues - on the sensory quality, nutritional value, and consumer appeal of ash gourd-based value-added products. These additives aim to enhance taste, colour, texture, and aroma, transforming ash gourd's typically bland profile into more attractive, functional foods. Sugar plays a critical role in this process, not only by preserving texture and flavour but also by lowering water activity, improving shelf life, aiding gel formation, and supporting fermentation, especially in products like jams and beverages (Feliziani *et al*., 2015). By improving both sensory and nutritional aspects, the research supports the creation of innovative, health-focused products

while promoting the sustainable and economic utilization of ash gourd in India's food industry.

Materials and Methods

The present study, "Effect of Different Edible Colour and Natural Flavouring Agents on Value-Added Products of Ash Gourd," was conducted in March 2023 at the Post-Harvest Laboratory, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The objective was finding the quality and storage of petha as affected by different edible colours and natural flavouring agents. The detail of various material used and the method employed in carrying out the experiment and described in the detailed in this chapter under appropriate heading.

Treatment	Combinations
T_0	Sugar (without colour) 100%
T_1	Paan flavour 5% (of the total weight) + Green colour 10% (of the total weight)
T_2	Paan flavour 5% (of the total weight) + Red colour 10% (of the total weight)
T_3	Paan flavour 5% (of the total weight) + Orange colour 10% (of the total weight)
T_4	Paan flavour 5% (of the total weight) + Yellow colour 10% (of the total weight)
T_5	Elaichi flavour 5% (of the total weight) + Red colour 10% (of the total weight)
T_6	Elaichi flavour 5% (of the total weight) + Green colour 10% (of the total weight)
T_7	Elaichi flavour 5% (of the total weight) + Orange colour 10% (of the total weight)
T_8	Elaichi flavour 5% (of the total weight) + Yellow colour 10% (of the total weight)

Fresh, mature ash gourd (*Benincasa hispida*) fruits were procured locally, thoroughly cleaned, peeled, deseeded, and cut into uniform cubes. Natural edible colourants - turmeric (yellow), beetroot (red), spinach (green), and carrot (orange) powders - along with flavouring agents like freshly ground cardamom (elaichi) and paan extract were used. Other key ingredients included refined sugar, purified water, and citric acid. The ash gourd cubes were blanched briefly in boiling water and cooled. For product development, jams were prepared by blending the cubes into a puree, boiling with sugar, and incorporating colourants and flavours. Candy was made by soaking the cubes in 50% sugar syrup, then boiling to desired consistency with added flavours. Beverages were prepared by blending and straining the fruit, sweetened with sugar, and enhanced with ginger or lemon extract.

Observations on sensory parameters

Flavour: By the above experiment I concluded that the treatment T_1 (Paan (%) + Green Colour) shows the best result followed by T_6 (Elaichi flavour (%) + Green Colour)

Original weight

subsequent weight
Original weight

$$PLW = \frac{\text{Original weight} - \text{subsequent weight}}{\text{Original weight}} \times 100$$

Firmness: The fruits firmness is measured by penetrometer by driving the probe into the fruit. The fruit was held steady on a firm surface and the probe was pushed into the fruit to a depth of 8mm, corresponding to a mark inscribed on the shaft of the probe (Watkins and Harman, 1981). Early hand-held penetrometers were developed by Magness and Taylor.

Fruit Colour: The surface colour of the fruit was assessed using a colour analyzer (version 2.0.1). The parameters L*, a*, and b* represent the three axes of the CIELAB colour space - L* for lightness, a* for the red-green spectrum, and b* for the yellow-blue spectrum. These values are used to objectively quantify and compare colour differences. The Hunter Lab colour space, introduced by Richard S. Hunter in 1948, was an earlier system derived from the CIEXYZ model, aiming for perceptual uniformity using coordinates labeled L, a, and b. Later, in 1976, the International Commission on Illumination (CIE) developed the CIELAB model with refined coordinates (L*, a*, b*) to distinguish it from Hunter's system.

Observation on quality parameters

A. Determination of Total soluble solids: The total soluble solids (TSS) content of the fruits was measured using a hand refractometer (Erma, Japan). Randomly selected fruits from each treatment were cut into pieces, mashed using a mortar and pestle, and the juice was extracted by filtering through a muslin cloth. A drop of the filtered juice was then placed on the refractometer to record the TSS value.

B. Determination of Ascorbic acid: The ascorbic acid was determined by 2, 6 dichlorophenol indophenol dye indicator method (Dung *et al.* (2020).

C. Determination of pH: The pH of juice was determined with the help of an electronic pH meter (Elica, model 110) Electronics and industrial co. Pvt. Ltd., Hyderabad. pH meter was standardized using standard buffers of pH 4.2 and pH 9.0. The juice whose pH was to determined was taken in a beaker. The electrode of the pH meter was dipped into it for 1 minute and pH was recorded. The electrode of the pH meter was washed with distilled water after each determination.

Economics

As per the existing market prices, the input and output costs were computed treatment-wise and different economic parameters *viz*., cost of treatment, gross return, net return and benefit cost ratio were calculated.

Cost of treatment (Rs. / kg): The cost for each treatment was calculated, taking into account all the inputs required for the treatment and storage of fruits.

Gross return (Rs. / kg): The gross return from each treatment was calculated deducting physiological loss of weight of fruits, cost of treatment and sale price of the fruits.

Net profit (Rs. / kg): The net profit from each treatment was calculated using the following formula:

Net profit (Rs. / kg) = Gross return - cost of treatment.

Benefit cost ratio (BCR): The benefit cost ratio from each treatment was calculated using the following formula:
Benefit Cost Ratio = Gross return / (Cost of treatments)

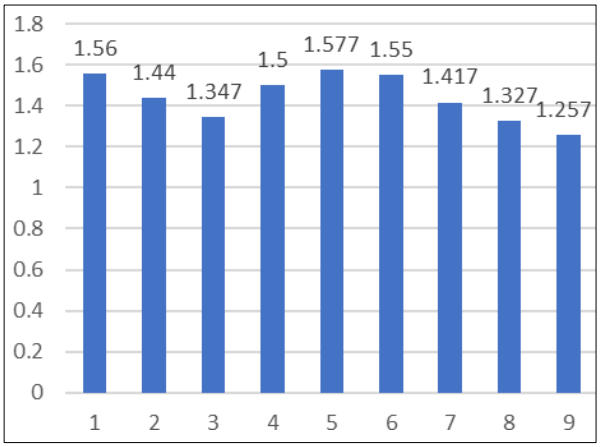
Results and Discussion

The study titled "Effect of Different Edible Colour and Natural Flavouring Agents on Value-Added Products of Ash Gourd" was carried out during the winter season of 2023-24 at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh). All required resources and manpower for the experiment were provided by the department.

Quality Parameters

Specific gravity: Results show that the choice of edible colour and natural flavouring agents significantly influenced the specific gravity of ash gourd products. The highest specific gravity (1.58) was observed in T_4 (5% paan flavour + 10% yellow colour), closely followed by the control (T_0; sugar only) at 1.56. All treatments differed significantly from one another, except T_7 and T_8, with the lowest value (1.256) recorded for T_8 (5% elaichi flavour + 10% yellow colour).

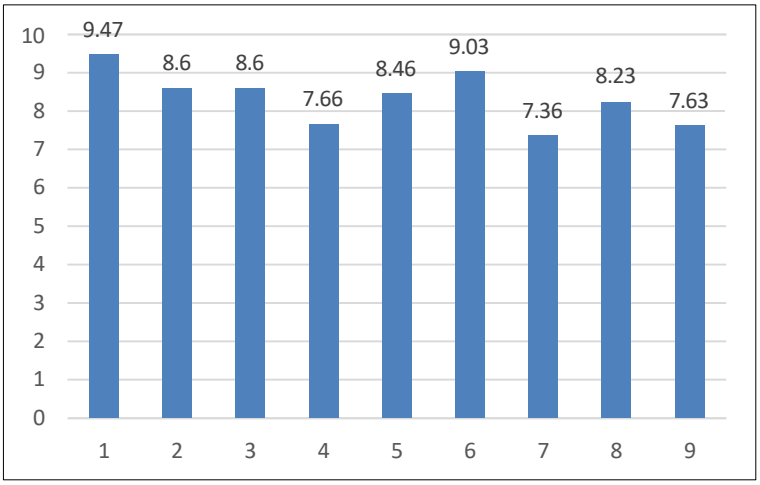
Treatment	Specific Gravity
T_0	1.56
T_1	1.44
T_2	1.347
T_3	1.5
T_4	1.577
T_5	1.55
T_6	1.417
T_7	1.327
T_8	1.257
F-Test	S
SE(d)	0.071
C.D. at 0.5%	0.152
CV	6.02



Effect of Specific gravity on value added product of Ash gourd

Hardness (Kg/inch): Result show that the hardness (kg/inch) of ash gourd value-added products was significantly influenced by different edible colours and natural flavouring agents. The highest hardness was observed in T_0 (100% sugar without colour) at 9.47 kg/inch (very firm), followed by T_5 (5% elaichi flavour + 10% red colour) at 9.03 kg/inch (firm, slightly softer). Treatments T_6 and T_8 were statistically similar, while the remaining treatments showed significant differences. The lowest hardness was recorded in T_6 (7.36 kg/inch - firm, slightly softer) with 5% elaichi flavour + 10% green colour.

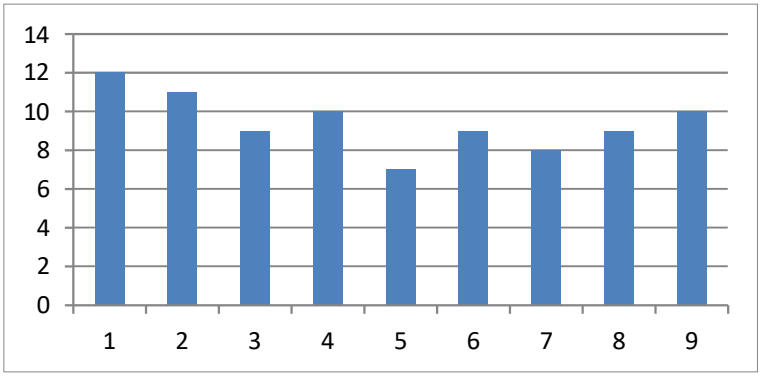
Treatment	Hardness (1-10)
T_0	9.47 (Very firm)
T_1	8.6 (Firm, slightly softer)
T_2	8.6 (Firm, slightly softer)
T_3	7.66 (Firm, slightly softer)
T_4	8.46 (Firm, slightly softer)
T_5	9.03 (Firm, slightly softer)
T_6	7.36 (Firm, slightly softer)
T_7	8.23 (Firm, slightly softer)
T_8	7.63 (Firm, slightly softer)
F-Test	S
SE(d)	0.253
C.D. at 0.5%	0.54
CV	3.7



Hardness of value-added product of ash gourd

Shelf Life: The result shows the shelf life of ash gourd value-added products was significantly influenced by the use of different edible colours and natural flavouring agents. The longest shelf life was observed in T_0 (100% sugar without colour) at 12 months, followed by T_8 (5% elaichi flavour + 10% yellow colour), T_2, and T_5, each with 10 months. Treatments T_3 and T_4 were statistically at par, while the rest showed significant differences. The shortest shelf life was recorded in T_4 (7 months), treated with 5% paan flavour + 10% yellow colour.

Treatment	Shelf life
T_0	12 months
T_1	9 months
T_2	10 months
T_3	8 months
T_4	7 months
T_5	10 months
T_6	8 months
T_7	9 months
T_8	10 months

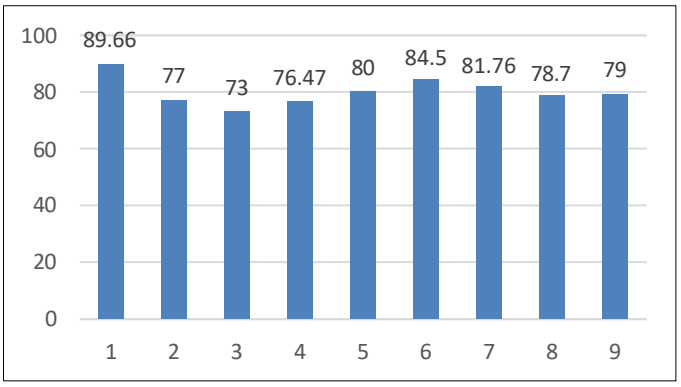


Shelf life of value-added product of ash gourd

T.S.S.: Result show that the Total Soluble Solids (TSS in °Brix) of ash gourd value-added products were significantly influenced by different edible colours and natural flavouring agents. The highest TSS was recorded in T_0 (100% sugar without colour) at 89.66°Brix, followed by T_8 (5% elaichi flavour + 10% red colour) with 84.5°Brix. Treatments T_2 and T_3 were statistically similar, while the remaining treatments differed significantly. The lowest TSS was observed in T_2 (73°Brix), treated with 5% paan flavour + 10% red colour.

Treatment	TSS
T_0	89.66° Brix
T_1	77° Brix
T_2	73° Brix
T_3	76.47° Brix
T_4	80° Brix
T_5	84.5° Brix
T_6	81.76° Brix
T_7	78.7° Brix
T_8	79° Brix

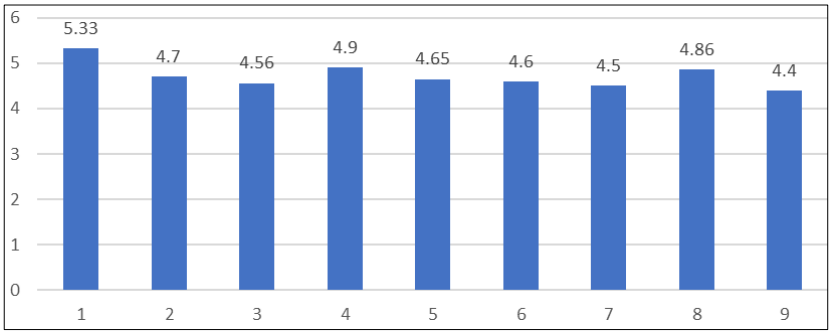
F-Test	S
SE(d)	1.486
C.D. at 0.5%	3.178
CV	2.275



TSS of value-added product of ash gourd

Ascorbic acid: The results indicate that the ascorbic acid content (mg/100g) in ash gourd value-added products was significantly influenced by different edible colours and natural flavouring agents. All treatments had a positive effect, with significant differences observed among them. The highest ascorbic acid content was found in T_0 (100% sugar without colour) at 5.33 mg, followed by T_3 (5% paan flavour + 10% orange colour) with 4.90 mg. Treatments T_6 and T_8 were statistically similar, while the rest showed significant variation. The lowest ascorbic acid content was recorded in T_8 (4.40 mg), treated with 5% elaichi flavour + 10% yellow colour.

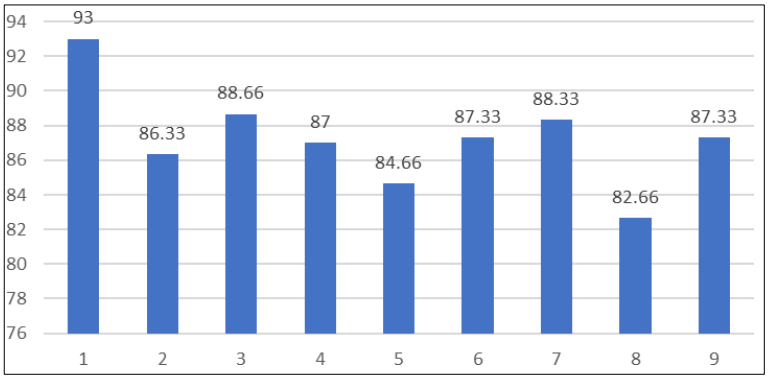
Treatment	Ascorbic acid (mg/100gm)
T_0	5.33 mg
T_1	4.7 mg
T_2	4.5 mg
T_3	4.9 mg
T_4	4.65 mg
T_5	4.6 mg
T_6	4.5 mg
T_7	4.8 mg
T_8	4.4mg
F-Test	S
SE(d)	0.186
C.D. at 0.5%	0.398
CV	4.824



Ascorbic acid of value-added product of ash gourd

Total Reducing Sugar: - The results show that the total reducing sugar content in ash gourd value-added products was significantly influenced by the use of different edible colours and natural flavouring agents. All treatments had a positive effect, with significant differences among them. The highest reducing sugar content was observed in T_0 (100% sugar without colour) at 93% (pure sucrose), followed by T_2 (1% paan flavour + 4% red colour) with 88.66%. Treatments T_4 and T_7 were statistically similar, while the others differed significantly. The lowest reducing sugar content was recorded in T_7 (82.66%), treated with 1% elaichi flavour + 4% orange colour.

Treatment	Total reducing sugar
T_0	93% (pure sucrose)
T_1	86.33%
T_2	88.66%
T_3	87%
T_4	84.60%
T_5	87.33%
T_6	88.33%
T_7	82.66%
T_8	87.33%
F-Test	S
SE(d)	1.84
C.D. at 0.5%	1.84
CV	2.583



Total reducing sugar of value-added product of ash gourd

Economics: The economic analysis of different treatments, as shown in Table 4.7 and Fig. 4.7, revealed that the highest gross return (Rs. 1410.00), net return (Rs. 840.00), cost of cultivation (Rs. 570.00), and benefit-cost ratio (1.47) were achieved with treatments T_4 and T_7 - Paan flavour 1% + yellow colour 4% and Elaichi flavour 1% + orange colour 4%, respectively. Among all treatments, T_4 (Paan flavour + yellow colour) proved to be significantly superior in terms of economic returns from the storage of value-added ash gourd product (Petha).

Treatment	Cost of treatment	Selling rate (Rs)	Gross return (Rs)	Net return (Rs)	Benefit cost ratio
T_0	540	210	1260	720	1.33
T_1	570	225	1350	780	1.37
T_2	570	220	1320	750	1.32
T_3	570	230	1380	810	1.42
T_4	570	235	1410	840	1.47
T_5	570	225	1350	780	1.37
T_6	570	215	1290	720	1.26
T_7	570	235	1410	840	1.47
T_8	570	230	1380	810	1.42

Conclusion

From this current investigation, it is concluded that Treatment T_1 (Sugar (without colour)) performed best in terms of quality parameters such as TSS (87.66ºBrix), ascorbic acid (5.16mg), specific gravity (1.56), hardness (9.43), shelf life (12 months), Total Reducing Sugar (93.66) followed by the other treatments according to the consumer preferences.

The highest B: C ratio was found in the Treatment T_4 (Paan flavour 1% (of the total weight) + Yellow colour 4% (of the total weight) with 1.47.

References

1. Amerthaveni M, Priya V. Hypoglycemic and hyperlipidemic effect of ash gourd (*Benincasa hispida*) and curry leaves (*Murraya koenegii*). Int Journal of Current Research. 2011;3:37-42.
2. Bhushan B, Nanda V, Jindal N. Strategies for processing and valorization of ash gourd byproducts: A comprehensive review. Food Chemistry. 2025;473:143040.
3. Das L, Sahu A. Influence of fruit maturity and additives on the quality of ash gourd candy. Journal of Postharvest Technology. 2017;5(3):45-51.
4. Devi A, Dahiya VS, Upadhyay SK, Singh R. Antimicrobial activity and phytochemical constituents present in *Syzygium cumini* (L.) seed, leaves and bark extract. Plant Arch. 2020;20:xx-xx.
5. Gill NS, Dhiman K, Sharma P, Bajwa J, Sood S, Sharma PD, Singh B, Bali M. Evaluation of free radical scavenging and antiulcer potential of methanolic extract of *Benincasa hispida* seeds. Res J Med Plants. 2011;5:596-604.
6. Gupta P, Chikkala S, Kundu P. Ash gourd and its applications in the food, pharmacological and biomedical industries. International Journal of Vegetable Science. 2019;27(1):44-53.

7. Kapaleshwar GK, Kulkarni U. Value-added ash gourd (*Benincasa hispida*) ready-to-serve beverage and its nutritional and sensory profile. Journal of Eco-friendly Agriculture. 2017;12(2):84-86.
8. Kapaleshwar GK. Standardization and characterization of value-added ash gourd (*Benincasa hispida*) ready-to-serve beverage [dissertation]. Dharwad: University of Agricultural Sciences; 2010.
9. Kumar R, Singh N. Effect of natural colorants and flavor enhancers on quality characteristics of ash gourd preserve. Journal of Food Processing and Preservation. 2020;44(5):e14421.
10. Muley B, Dhongade H, Upadhyay A, Pandey A. Phytochemical screening and anthelmintic potential of fruit peels of *Benincasa hispida* (Cucurbitaceae). Int J Herb Drug Res. 2012;11:5-9.
11. Natarajan D, Lavarasan RJ, Chandra Babu S, Sahib Thambi Refai MAC, Thameemul-Ansari LH. Antimicrobial studies on methanolic extract of *Benincasa hispida*. Anc Sci Life. 2003;22:98-100.
12. Nimbal SK, Venkatrao N, Ladde S, Pujar B. Anxiolytic evaluation of *Benincasa hispida* (Thunb) Cogn. fruit extracts. Int J Pharm Pharma Sci Res. 2011;1:93-97.
13. Nimbal SK, Venkatrao N, Pujar BS, Ladde S. Evaluation of anticonvulsant activity of alcoholic extract of *Benincasa hispida* (Thunb) Cogn. fruit extracts. Inter Res J Pharma. 2011;2:166-168.
14. Patel J, Borkar P. Natural colorants and their application in functional food development: A review. International Journal of Chemical Studies. 2021;9(2):198-204.
15. Pandey A, Kumar S, Yadav R. Studies on preparation of ready-to-serve beverage and powder from ash gourd. KrishiKosh. 2015.
16. Rani M, Devi S. Utilization of ash gourd in preparation of traditional and innovative products. Asian Journal of Dairy and Food Research. 2019;38(1):55-60.
17. Sharma A, Jain S. Development and sensory evaluation of value-added products from ash gourd (*Benincasa hispida*). International Journal of Food Science and Nutrition. 2018;3(2):12-16.
18. Sharma PV, Varg M. In the Dravya GunVijnana Vegetable Drugs. Sharma PV, editor. Varanasi: Chaukhambha Bharti Academy; 2005.
19. Singh R, Upadhyay SK, Tuli HS, Singh M, Kumar V, Yadav M, *et al*. Ethnobotany and herbal medicine: Some local plants with anticancer activity. Bulletin of Pure and Applied Sciences Sec Bot. 2020;39:57-60.