



Study and Quality Evaluation of Candy Prepared by Using Ash Gourd (*Benincasa hispida*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was carried out at the post-Harvest laboratory, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during the session 2021-22 with a view to study the shelf life of products and to find out the best product based on organoleptic test. The treatments were dried in sun and observations were recorded at 4 various days of storage viz. 10 days, 30 days, 45 days, 60 days as 4 replications in Randomized Completely Block Design (RCBD). Ash gourd were picked from the local market of Prayagraj. The fruits which were uniform in size, unblemished, free from diseases and pests were chosen for the study along with honey, sugar, lemon and jaggery. Under this experiment, overall, 9 treatments were taken viz., T₁ (Ash gourd in 64° Brix Sugar syrup), T₂ (Ash gourd in 68° Brix Sugar syrup), T₃ (Ash gourd in 72° Brix Sugar syrup), T₄ (Ash gourd in 64°

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Brix honey), T₅ (Ash gourd in 68° Brix honey), T₆ (Ash gourd in 72° Brix honey), T₇ (Ash gourd in 64° Brix Jaggery), T₈ (Ash gourd in 68° Brix Jaggery) and T₉ (Ash gourd in 72° Brix Jaggery). Based on results obtained during the present investigation on ash gourd candy, treatment combination T₆ (Ash gourd in 72° Brix Honey) had maximum value for colour and appearance score (7.80), flavour and taste score (9.50), overall acceptability score (7.50), shelf life (41.00). Therefore, T₆ (Ash gourd in 72° Brix Honey) is found to be the best treatment combination in overall parameters and best for preparation of candy using ash gourd.

Keywords: Overall acceptability; organoleptic; shelf life.

1. INTRODUCTION

By leveraging its diverse agro-climatic conditions, India produces more than 90 different types of fruits and vegetables. India has just supplanted Brazil as the world's top fruit grower, and it is currently the world's second-largest producer of veggies behind China. In 2019, the country produced 177.18 million tonnes of vegetables and 93.64 million tonnes of fruits, which represents a proportion of the global vegetable production of 15.8%. It was one among the top five producers of more than 80% of agricultural products worldwide, but it also experiences close to 25% of its production going to waste [1]. Processing accounts for 2.2% of all horticultural products. Amounting to around U.S. \$ 86.17 (≈7000 @ ≈81.24 = U.S. \$ 1, 2022) yearly in monetary values, 20 to 30% of horticultural produce is lost each year because of insufficient post-harvest processing. A significant portion of the farmer's profit has also been lost because of this enormous loss, which also deprives the nation and the farmer of labour and resources. The management of post-harvest losses is crucial. One strategy for reducing post-harvest losses is to preserve the produce. Typically, objective criteria including the commodity's general look, taste, and texture are used to determine the post-harvest shelf life. These procedures often combine observations from the senses, biochemistry, mechanics, and colorimetry (optical). A technique for prolonged storage is preservation. Botanically known as *Benincasa hispida* is one of the well-known plants belonging Cucurbitaceae family. It is the only member of the genus *Benincasa*. The fruit is covered in a fuzzy coating of fine hairs when young. The immature melon has thick white flesh that tastes sweet. By maturity, the fruit loses its hairs and develops a waxy coating, giving rise to the name wax gourd. The wax coating helps to give the fruit a long shelf life of up to a year. The wax gourd can be stored for many months, much like winter squash. Ash gourds of the Indian

subcontinent have a white coating with a rough texture (hence the name ash gourd). Southeast Asian varieties have a smooth waxy texture. In India, the wax gourd is recognized for its medicinal properties in the ayurvedic system of medicine [2]. It also has significance in spiritual traditions of India and Yoga, where it is identified as a great source of prana. In northern India it is used to prepare a candy called petha. In South Indian cuisine, it is traditionally used to make a variety of curries, including a stew made with a yogurt base. Ash gourd production in India is around 108.96 million tons in year 2019, Uttar Pradesh ranks first in production followed by Bihar, Jharkhand, and Rajasthan [3]. Ash gourd comprises 96% water and is very low in calories, fat, protein, and carbs. One 3.5-ounce (100-gram) portion of raw ash gourd offers low calories: 13 calories, Protein: less than 1 gram, Carbohydrates 3 grams, Fiber 3 grams, Fat less than 1 gram, Vitamin C 14% of the Daily Value (DV), Riboflavin 8% DV, Zinc 6% DV [4]. It also contains smaller amounts of iron, magnesium, phosphorus, copper, and manganese, as well as various other B vitamins. Still, these amounts typically don't exceed 3% of the nutrients' DVs. In addition to vitamin C, ash gourd is a good source of flavonoids and carotenes, two antioxidants believed to help protect your body against cell damage and certain conditions like type 2 diabetes and heart disease [5]. Currently, ash gourd's antioxidant content is thought to be the main reason behind most of its purported benefits [6].

The best time to harvest fruits, vegetables, and ornamentals depends on whether they are good for eating or looking at. However, after harvest, they will degrade because they are live, organic things. Depending on the products' overall rate of metabolism, the rate of deterioration varies widely among them, but for many it can be quick. The pace of post-harvest deterioration, for instance, has little impact in marketing chains where fruit is moved quickly from the farm to the

consumer. However, the distance between farm and market is growing as production areas are farther away from population centers. By extending the marketing periods into fewer windows of time, the intentional storage of some produce to increase return on investment prolongs the time between farm and end consumer. Keeping these above point the present investigation was undertaken with objectives to study the shelf life of products and to find out the best product based on organoleptic test of ash gourd candy.

2. MATERIALS AND METHODS

2.1 Experimental Site

The present investigation entitled was done to understand the effect of different treatment combination of ash gourd for making candy and its effect on organoleptic quality and shelf life. The details of the materials used, and the procedures adopted in the investigation, which was carried out at Post-Harvest Laboratory, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the session 2021-22 are described under the following heads.

2.2 Materials Used

Ash gourd (*B. hispida*) fruit were collected from local market of Prayagraj, which was first cleaned properly from tap water and seeds were separated manually, fruits were cut into pieces and prepared for different treatments. The fruit pulp was extracted and soaked in lime. In the present investigation the design used for analysis of variables were Randomized Completely Block Design (RCBD) comprising 4 replications in terms of days of storage viz. 10 day (initial day), 30 days, 45 days, 60 days and nine treatment combinations was prepared by the ingredients given in Table 1.

2.3 Methods Incorporated

Candy is affected by several independent variables, viz., sample solution ratio, solution concentration, duration of osmosis, solution temperature, sample shape and size as well as dependent variables such as solute gain, mass reduction, water loss, etc. Fig. 1 depicts the flowchart of preparation of candy. The washed

fruits are peeled and sliced into pieces, by various treatment combination followed by drying and after different storage period evaluated for organoleptic analysis and shelf life.

2.4 Organoleptic Evaluation and Statistical Analysis

Prepared fruit candy was evaluated for appearance and color, overall acceptability was rated on 9-point Hedonic Scale and shelf life was measured in days. The data were statistically analysed by the method suggested by Fisher and Yates, [7]. Hedonic Scores were placed. Defects were observed in the product and expressed critically in the column of remarked as per guidelines below.

2.4.1 Guidelines

- Examine the body of the sample
- Examine the texture of the sample
- Examine the flavor of the sample
- Examine the color and appearance of the sample

Rating was done as per scale below:

Hedonic ratings	Scores
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

3. RESULTS AND DISCUSSION

The organoleptic analysis deals with evaluation of color and appearance, flavor and taste score and overall acceptability of ash gourd candy present among the different treatment at different days of storage. The data recorded showed significant differences and is shown in Table 2.

At 10 days of storage of ash gourd candy, color and appearance score was significantly maximum recorded in treatment T₆, while minimum score was recorded in T₁. After 30 days of storage of ash gourd candy, color and appearance score was significantly maximum recorded in treatment T₆, while minimum score was recorded T₁. After 45 days of storage of ash gourd candy, color and appearance score was

Table 1. Treatment details

Treatment notion	Treatment combination	Treatment notion	Treatment combination
T ₁	Ash gourd in 64° Brix Sugar syrup	T ₆	Ash gourd in 72° Brix honey
T ₂	Ash gourd in 68° Brix Sugar syrup	T ₇	Ash gourd in 64° Brix Jaggery
T ₃	Ash gourd in 72° Brix Sugar syrup	T ₈	Ash gourd in 68° Brix Jaggery
T ₄	Ash gourd in 64° Brix honey	T ₉	Ash gourd in 72° Brix Jaggery
T ₅	Ash gourd in 68° Brix honey		

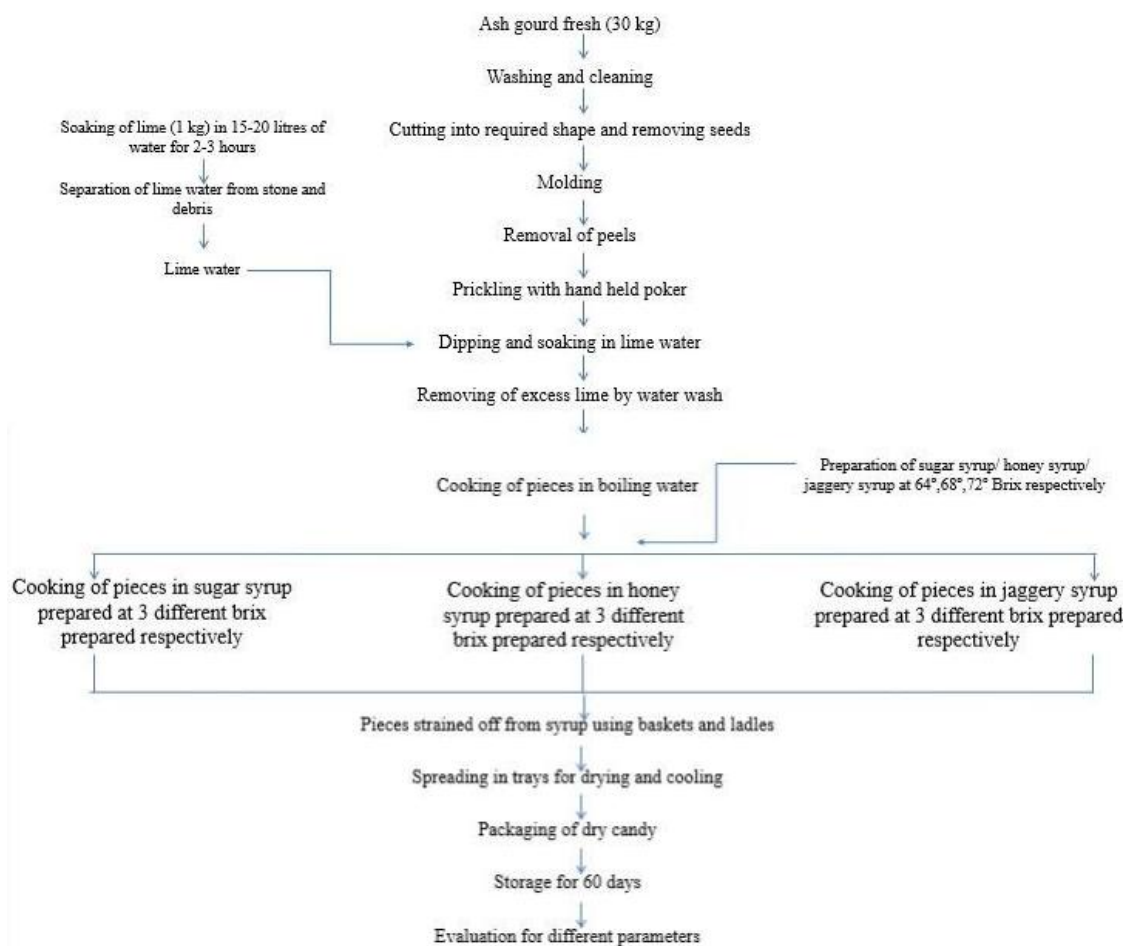


Fig. 1. Method of preparation of candy

significantly maximum recorded in treatment T₆ followed by T₉, while minimum score was recorded T₁. After 60 days of storage of ash gourd candy, color and appearance score was significantly maximum recorded in treatment T₆ followed by T₉, while minimum score was recorded T₁.

At 10 days of storage of ash gourd candy, flavor and taste score was significantly maximum recorded in treatment T₆ followed by T₄, however minimum score was recorded T₂. After 30 days

of storage of ash gourd candy, flavor and taste score was significantly maximum recorded in treatment T₆ followed by T₄, however minimum score was recorded T₁. After 45 days of storage of ash gourd candy, flavor and taste score was significantly maximum recorded in treatment T₆ followed by T₄, however minimum score was recorded T₂. After 60 days of storage of ash gourd candy, flavor and taste score was significantly maximum recorded in treatment T₆ followed by T₄, however minimum score was recorded T₂.

Table 2. Effect of various treatment combinations on Colour and Appearance score; Flavor and taste, Overall acceptability score of ashgourd candy at different days of storage

Treatment notation	Treatment combination	Color and Appearance score				Flavor and Taste score				Overall acceptability Score			
		Storage period (Days)											
		10 days	30 days	45 days	60 days	10 days	30 days	45 days	60 days	10 days	30 days	45 days	60 days
T ₁	Ash gourd in 64° Brix Sugar syrup	7.50	7.00	6.50	6.20	6.00	6.30	6.50	6.80	7.00	6.50	6.50	6.10
T ₂	Ash gourd in 68° Brix Sugar syrup	8.50	8.00	7.75	7.50	5.00	5.10	5.30	5.50	7.50	6.50	6.10	5.90
T ₃	Ash gourd in 72° Brix Sugar syrup	8.50	7.50	7.30	6.85	5.40	5.60	6.00	7.00	6.50	6.10	5.80	5.40
T ₄	Ash gourd in 64° Brix honey	7.50	7.20	7.00	6.90	7.80	8.00	8.20	8.50	8.50	8.00	7.50	7.00
T ₅	Ash gourd in 68° Brix honey	7.50	7.00	6.80	6.50	7.00	7.60	8.10	8.50	8.50	8.00	7.40	7.00
T ₆	Ash gourd in 72° Brix honey	8.50	8.20	8.00	7.80	8.50	8.80	9.20	9.50	9.00	8.50	8.00	7.50
T ₇	Ash gourd in 64° Brix Jaggery	7.50	7.00	6.80	6.30	7.00	7.30	7.50	8.00	7.00	6.80	6.40	6.00
T ₈	Ash gourd in 68° Brix Jaggery	8.00	7.80	7.50	7.20	6.90	7.30	7.60	8.00	8.00	7.60	7.10	6.80
T ₉	Ash gourd in 72° Brix Jaggery	8.50	8.10	7.80	7.50	7.30	7.70	8.10	8.50	8.00	7.50	7.30	7.00
'F' Test		S	S	S	S	S	S	S	S	S	S	S	S
S.E.(d)		0.09	0.07	0.05	0.08	0.07	0.08	0.06	0.10	0.08	0.08	0.07	0.07
C.D. at 5%		0.27	0.21	0.16	0.23	0.20	0.23	0.18	0.29	0.24	0.24	0.20	0.20
C.V.		2.32	1.96	1.51	2.25	2.00	2.28	1.64	2.54	2.10	2.23	2.02	2.07

Values in Red:	Minimum
Values in Green:	Maximum

Table 3. Effect of various treatment combinations on shelf life of ash gourd candy at different days of storage

Treatment notation	Treatment combination	Shelf life			
		Storage period (Days)			
		10 days	30 days	45 days	60 days
T ₁	Ash gourd in 64° Brix Sugar syrup	63.00	40.00	27.00	21.00
T ₂	Ash gourd in 68° Brix Sugar syrup	72.00	53.00	40.00	32.00
T ₃	Ash gourd in 72° Brix Sugar syrup	84.00	63.00	49.00	40.00
T ₄	Ash gourd in 64° Brix honey	67.00	46.00	31.00	24.00
T ₅	Ash gourd in 68° Brix honey	68.00	48.00	36.00	30.00
T ₆	Ash gourd in 72° Brix honey	88.00	62.00	49.00	41.00
T ₇	Ash gourd in 64° Brix Jaggery	69.00	47.00	30.00	22.00
T ₈	Ash gourd in 68° Brix Jaggery	76.00	53.00	39.00	30.00
T ₉	Ash gourd in 72° Brix Jaggery	85.00	61.00	48.00	40.00
'F' Test		S	S	S	S
S.E.(d)		0.82	0.45	0.41	0.36
C.D. at 5%		2.37	1.30	1.18	1.03
C.V.		2.19	1.70	2.10	2.28

Values in Red:	Minimum
Values in Green:	Maximum

At 10 days of storage of ash gourd candy, overall acceptability score was significantly maximum recorded in treatment T₆ followed by T₅. However, minimum score was recorded T₃. After 30 days of storage of ash gourd candy, overall acceptability score was significantly maximum recorded in treatment T₆ followed by T₅. However, minimum score was recorded T₃. After 45 days of storage of ash gourd candy, overall acceptability score was significantly maximum recorded in treatment T₆ followed by T₄. However, minimum score was recorded T₃. After 60 days of storage of ash gourd candy, overall acceptability score was significantly maximum recorded in treatment T₆ followed by T₅. However, minimum score was recorded T₃. All the parameters viz., color and appearance; flavor and taste and overall acceptability score of ash gourd candy is affected by its chemical composition and due to various treatment combination used. Therefore, the variation in ranges for different treatment and at different days of storage was observed. Similar results were reported for overall acceptability score in ash gourd candy was reported by [8-12].

At 10 days of storage of ash gourd candy, shelf-life value was significantly maximum recorded in treatment T₆ followed by T₉, however minimum shelf life was recorded T₁. After 30 days of storage of ash gourd candy, shelf-life value was significantly maximum recorded in treatment T₆ followed by T₉. However, minimum shelf life was recorded T₁. After 45 days of storage of ash gourd candy, shelf-life value was significantly maximum recorded in treatment T₆ followed by T₉. However, minimum shelf life was recorded T₁. After 60 days of storage of ash gourd candy, shelf-life value was significantly maximum recorded in treatment T₆ followed by T₉. However, minimum shelf life was recorded T₁. Shelf life of ash gourd candy (given in Table 3) is affected by its chemical composition and due to various treatment combination used. Similar results were reported for colour and shelf life in ash gourd candy was reported by [8-12].

4. CONCLUSION

Based on results obtained during the present investigation on ash gourd candy, treatment combination T₆ had maximum value for colour and appearance score (7.80), flavour and taste score (9.50), overall acceptability score (7.50), shelf life (41.00). Therefore, T₆ (Ash gourd in 72° Brix Honey) is found to be the best treatment

combination in overall parameters and best for preparation of candy using ash gourd.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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