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Sensory Evaluation of Value Added Products and Quantification of Ascorbic Acid of Ash Gourd (*Benincasa hispida*, Thumb.) Cong. Germplasm by Volumetric Method

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ABSTRACT

Ash gourd is an important, under-exploited vegetable that is immensely used in ayurvedic medicine preparations. It has a long storage life and good scope for value addition. Petha (Candy) and Badi (Nugget) prepared from ash gourd are much preferred in India. But ash gourd varieties differ significantly as regards the taste, acceptability and nutritive value of petha and badi prepared from them. Ideal varieties for badi and petha preparation have not been identified yet. Therefore, sensory and quality evaluation of petha and badi made from ash gourd pulp was done by taking fruits of eight promising ash gourd genotypes grown during the rainy season. Sensory quality attributes were evaluated in nine points Hedonic scale by 10 trained panelists for petha and badi. On the basis of scores given by the panel, BAGS-11 (7.54) was found to be the best for petha with a TSS of 2.03 0 Brix closely followed by Pusa Sabji Petha (6.27). In the case of badi, the local line BAGS-6 scored the highest overall acceptability (7.2) followed by BAGS-1(6.7). The range of ascorbic acid contents of eight parents was from 14.67 to 40 mg 100g⁻¹.

KEY WORDS: ASH GOURD, ASCORBIC ACID, CANDY, NUGGET. SENSORY EVALUATION, VALUE ADDITION.

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INTRODUCTION

The Indian subcontinent has a rich diversity of cucurbits and is believed to be the primary and secondary center of origin of several gourds and melons (Choudhury 2017). Ash gourd (*Benincasa hispida*) belonging to the Cucurbitaceae family, is a single species of tender annual vines. Indo-China region being a center of diversity is endowed with great variability in terms of morphological characters especially, growth habit, maturity including shape, size and flesh thickness of fruits (Rubatzky and Yamaguchi 1997 Flores et al. 2019).

Ash gourd (Benincasa hispida; syn. white gourd, wax gourd, white pumpkin, Chinese preserving melon, tallow gourd and Chinese water melon (Tindall 1986; Pandey et al. 2015) is an important vegetable mainly valued for its long storage life and having good scope for value addition. The fruits are consumed as baked, fried, boiled, pickled or candied/preserved (Robinson and Decker-Walters 1999). World-famous confectionery known as Petha (Candy) is prepared using ripe flesh of ash gourd in sugar syrup. Apart from fresh and processed produce, the fruits are immensely used in ayurvedic medicine preparations (Nagaraju et al.2016). The famous Ayurvedic preparation 'Kusumanda rasayanam' used as a nerve tonic and health rejuvenator, is prepared using well matured ash gourd fruit. The methanolic extract of the fruit is reported to possess anti-ulcer (Grover et al., 2001), antihistaminic and antidepressant activities (Anil and Ramu, 2002). Fruits of Benincasa hispida are used in folk medicine for the treatment of weak nervousness and debility (Nadhiya et al. 2014).

Ash gourd is composed a of higher amount of moisture (96.50 %), low calories 10 K cal, protein 0.40g, fat 0.1g, carbohydrates 1.9 g, ascorbic acid 1mg, fiber 0.80g, ash 0.39, iron 0.8 mg and 30 mg of calcium (Gopalan et al. 1989). Its mature fruits are mostly used by confectionaries for sweet making and in villages it is used for 'Badi' making, which is a popular ingredient of vegetable curry. Petha is a very popular sweet dish of western parts of Uttar Pradesh. The delicacy of sweet can be judged that it can be prepared and served in many forms depending upon the choice of consumers. On the compositional basis, petha based sweets contain on an average basis of total fat 0.4%, total carbohydrate 65%, dietary fibre 3%, protein 0.6% and sugar 40% (Pandey et al. 2015).

Flores et al. (2019) confirmed that there are genuine differences among vegetable varieties as regards sensory parameters. There are several varieties of ash gourd which are yet to be evaluated. Under the present scenario, it is believed that the future of agriculture is safe in increasing the productivity, diversification and value addition to horticultural crops. The value addition to ash gourd products fetches higher prices, extends the shelf life and can be made available throughout the year (Singh and Singh, 2015). Petha (candy) is a popular sweet dish made from ash gourd pulp in Uttar Pradesh in India. Badi (nugget) prepared from ash gourd is much preferred in several Indian states. Research involving varietal differences in sensory parameters of petha and badi is very limited. Therefore, the present investigation was undertaken for a comparative analysis on physic-chemical and sensory quality was carried out on a different variety of ash gourd to determine overall acceptability.

MATERIAL AND METHODS

The research work was carried out at the All India Coordinated Research Project on Vegetable Crops, Orissa University of Agriculture and Technology, Bhubaneswar and Department of Food and Nutrition, College of Community Science, Orissa University of Agriculture and Technology, Bhubaneswar, India.

Selection of suitable ash gourd variety: During the rainy season of 2015-16, eight genotypes of ash gourd (BAGS-1, BAGS-2, BAGS-6, BAGS-7, BAGS-11, Kashi Dhawal, Kashi Surbhi and Pusa Sabji petha) were grown in the randomized block design with 3 replications. The BAGS lines have been developed from local landraces of ash gourd collected from different parts of Odisha state and the rest of the genotypes are Nationally released varieties of India. The soil of the experimental plot was sandy loam having pH 5.1. The chemical analysis of soil indicated, the nitrogen content of 100 kg/ha, phosphorous content of 35.7 kg/ha and potassium content of 413.9 kg/ha. The organic carbon content of soil was 0.31%. The sowing was done on 31st July, 2015 as well as 2016 in kharif season. The crop was harvested on 20th of January. The experiment Randomized Block Design and replicated thrice. In each replication, each genotype was grown in four pits with four plants in each pit in a plot size of 3.0 m x 2.7m. The recommended package of practices was followed to raise a successful crop. Fully matured fruits of the 8 genotypes were obtained for the preparation of Petha (candy) and Badi (nugget).

Physico-chemical analysis: The Physico-chemical parameters were analyzed with fruit samples of 8 genotypes. The edible portion of ash gourd was analyzed for ascorbic acid content in triplicates by using standard procedures (Dinesh et al. 2015). Total soluble solids (TSS) were measured by using Erma hand refractometer and were expressed as degrees Brix.

Ascorbic acid analysis: The analysis was performed by taking a sample from each genotype. Ascorbic acid content in fruit was estimated by the volumetric method. Five milliliters of standard ascorbic acid (100 μ g/ml) was taken in a conical flask containing 10 ml 4% oxalic acid and was titrated against 2, 6-dichlorophenol indophenol dye. The appearance and persistence of the pink colour were taken as an end point. The amount of dye consumed (V1ml) is equivalent to the amount of ascorbic acid. 5 ml of sample (prepared by taking 5 g of fruit in 100 ml 4% oxalic acid) was taken in a conical flask having10 ml of 4% oxalic acid and titrated against the dye (V₂ ml). The amount of ascorbic acid was calculated using the formula (Ashwah et al, 1980).Ascorbic acid (mg/100 g) $= (0.5 \text{ mg/V}, \text{ml}) \times (V2/5 \text{ ml}) \times (100 \text{ ml/Wt. of sample}) \times 100$ (Ranganna, 1997)

Sensory evaluation: The sensory attributes of ash gourd petha and badi were analyzed for colour, flavor, texture, taste and overall acceptability by a trained panel of judges consisting of ten members by using a nine point hedonic scale (1 = dislike extremely; 9 = like extremely) (Amerine et al. 1965).

Procedure of preparing Badi: This is one of the most popular sun dried items. These badis are either deep fried and eaten or they can be used in many differentdishes/ curries.

Ingredients: 1 cup black gram, 1 cup grated ash gourd, salt. To prepare badi, black gram was first soaked in water overnight. Ash gourd was grated and the gratings were kept in colander to remove any water from it. This water was reserved as it would be used later for grinding. The soaked black gram was then grinded with reserved water to a very smooth paste. The mixture should not be too watery and therefore, ash gourd gratings should be squeezed to drain out excess water. These gratings were added to the paste of black gram. Salt was mixed in this paste and then small balls of paste were made which were kept under sun on a plastic paper which should be oiled so that badis can be taken out easily. Enough space was kept between two badis. After drying for 2-3 days, badis came off the paper easily. They were dried till they became crispy. Then the badis were cooled at room temperature and stored in air tight containers.

Petha preparation: Petha is a popular Indian sweet. It is soft, chewy and candy-like, eaten dry or dipped in sugar syrup (*Chashni*). It is known to have originated in Agra, India.

Ingredients of petha: 1 kg white ash gourd fruit, 2 tsp chemical lime, 3/4 kg (3 cups) sugar and 3 cups of water, 2 tbsp milk mixed with 2 tbsp water, 1 tbsp lemon juice, 3-4 green cardamoms (peeled and crushed) and 1 tsp rose water.

Procedure for making petha: The ash gourd fruit was peeled and the seeds and the soft fibrous portions were removed. Then fruits were cut into large thick slices and pricked well with a fork. 1 tsp of chemical lime was dissolved in enough water to cover the ash gourd pieces, soaked and washed well. Lime water solution was made with the remaining tsp of chemical lime and the pieces were again soaked for 2 hours. The cubes were then drained and washed thoroughly, squeezing out water and rinsing again so that no trace of lime remained. The cubes were cooked in boiling water until they became soft and transparent. Meanwhile, 3 cups of water and the sugar were filled in a pan; place over low heat, stirring till sugar was dissolved and brought to boil. The lemon juice and the cardamoms were added and cooked till it reached 'one thread' consistency. Foam, that might get collected along the sides of the pan, was skimmed off, Cooked pieces were drained with a slotted spoon and transferred into the warm syrup. After simmering for a couple of minutes, rose water was added and mixed well

on the cooked ash gourd pieces. Then the pieces were cooled and served (Pandey et al. 2009).

Statistical analysis: Analysis of variance and critical difference for triplicate data of each observation (n=3) was performed after logarithmic transformation of all values (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSION

Sensory quality attributes of fresh ash gourd for TSS and petha were evaluated in nine point Hedonic scale (Peryam and Pilgrim, 1957) by 10 trained panelists (Table 1). The overall acceptability scores for petha showed a wide range from 4.81 to 7.54. The highest overall acceptability score for petha was obtained in the line BAGS-11 (7.54) closely followed by Pusa Sabji Petha (6.27) and Kashi Surbhi (5.72). As evaluated by 10 trained panelists, overall acceptability scores for badi had a wide range from 4.3 to 7.2. The local line BAGS-6 had the highest overall acceptability score of 7.2 for badi followed by BAGS-1(6.7). BAGS-7 and Kashi Dhawal had the same score (6.1). It is noteworthy that the highest acceptability scores for both petha and badi were obtained by selections from local landraces which were superior to even the released varieties of ash gourd in this regard. This indicates that there are very valuable attributes in our local landraces that are yet to be thoroughly explored. Hence, we should conserve our local germplasm and evaluate them in the best possible way.

Table 1. Overall acceptability scores of Badi (nugget) andPetha (candy) based on genotypes of Ash Gourd (Benincasahispida)

Genotypes	Badi	Petha
BAGS-1	6.7	5.27
BAGS-2	5.1	4.81
BAGS-6	7.2	5.0
BAGS-7	6.1	4.81
BAGS-11	4.3	7.54
Kashi Dhawal	6.1	5.72
Kashi Surbhi	6.3	5.36
Pusa Sabji Petha	6.0	6.27

A wide range of variation was recorded among 8 genotypes of ash gourd with respect to total soluble solids (TSS) and ascorbic acid content of mature fruits (Table 2).As regards TSS of mature fruit, there was a wide range from 1.58 to 2.850 Brix. The genotype BAGS-6 (2.850 Brix) was the best followed by BAGS- 2 (2.030 Brix) and BAGS-11(2.030 Brix). In general, the TSS of fresh fruit of ash gourd juice is 2.5° Brix as reported by Kalpeshwar (2010). Significant variations were observed among the tested genotypes with respect to ascorbic acid content of 8 genotypes was from 13.33 to 40 mg 100g⁻¹. It conforms to the range of ascorbic acid reported by Gopalan et al. (1989) and Pandey et al. (2009). The released variety

Kashi Dhawal recorded maximum ascorbic acid content of 40 mg 100g-1 which was significantly superior to that of the rest of the genotypes. Pusa Sabji Petha, BAGS-6, BAGS⁻¹ and BAGS-11 were statistically at par and recorded moderately high TSS. Patil (1991) in fresh wood apple and Panesar et al. (2000) in Kinnow fruit found relatively higher amounts of ascorbic acid content i.e 44.75 mg 100g⁻¹ and 28.84 mg100g-1 respectively.

Table 2. Total soluble solids and ascorbic acid contents offruits in 8 genotypes of Ash Gourd (Benincasa hispida)				
Sl. no	Genotypes	TSS (ºBrix)	Ascorbic acid content (mg/100g)	
1.	BAGS-1	1.8	20.00	
2.	BAGS-2	2.03	14.67	
3.	BAGS-6	2.85	21.33	
4.	BAGS-7	2.0	13.33	
5.	BAGS-11	2.03	20.00	
6.	Kashi Dhawal	1.9	40.00	
7.	Kashi Surbhi	1.9	16.00	
8.	Pusa Sabji Petha	1.58	26.67	
SE(m)+		-	3.59	
CD(0.05)		-	10.13	

BAGS-7 and BAGS-2 recorded very low ascorbic acid contents of 13.33 and 14.67 mg 100g⁻¹. This is in conformity with the findings of Baber et al. (1998) in bottle gourd. The moderately high ascorbic acid content of BAGS -11(20 mg/100g) combined with moderately high TSS (2.030 Brix) may have contributed to the high acceptability score of the genotype for preparation of petha. The moderately high ascorbic acid content of BAGS-6 (21.33 mg/100g) combined with the highest TSS (2.85 0 Brix) may have contributed to the high acceptability score of the genotype for preparation of badi.

The research findings are novel. To date, there were no research findings identifying the most ideal varieties/ genotypes of ash gourd for making badi and petha with high overall acceptability. Ash gourd itself has not been much exploited earlier for meeting such objectives of value addition. Both for making badi and petha, the landraces BAGS-6 and BAGS-11 respectively, have been found to be best instead of the nationally released varieties of ash gourd. By proving that there are very promising local landraces that have not been adequately exploited for such a purpose till date, we have upheld the importance of our valuable indigenous genetic diversity which may become extinct soon if we fail to collect, evaluate and utilize them promptly. The superior genotypes which have been identified from this research work can also be used as parents in future breeding programs to transfer the desired genes and develop many potent varieties of ash gourd meant for preparing badi and petha with highly superior sensory parameters.

CONCLUSION

BAGS-11 (7.54) was found to be the best for petha followed by Pusa Sabji Petha (6.27). In the case of badi, the local line BAGS-6 scored the highest overall acceptability (7.2) followed by BAGS-1(6.7). The moderately high ascorbic acid content of BAGS -11(20 mg/100g) combined with moderately high TSS (2.030 Brix) may have contributed to the high acceptability score of the genotype for preparation of petha. The moderately high ascorbic acid content of BAGS-6 (21.33 mg/100g) combined with the highest TSS (2.85 0 Brix) may have contributed to the high acceptability score of the genotype for preparation of badi. As regards TSS of mature fruit, there was a wide range from 1.58 to 2.850 Brix. The range of ascorbic acid contents of eight genotypes was from 14.67 to 40 mg 100g⁻¹. The released variety of Kashi Dhawal recorded the maximum ascorbic acid content of 40 mg 100g⁻¹.

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