

Comparative study of varieties, honey coating and storage durations on *aonla* candy

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ABSTRACT

The investigation was carried out under laboratory conditions to assess impact of varieties, honey coating and storage durations on *aonla* candy. The parameters like TSS, acidity, pH, ascorbic acid and optical density were analyzed before the segment impregnation into sugar, so that after product preparation the values may be evaluated as the impact of variety, honey and storage duration. Cultivars yielded significant results with the parameters studied. This was further influenced when prepared *aonla* candy were coated with honey. Amongst varieties NA-6 proved much better with respect quality parameter studied. There was increase in the level of total soluble solids, acidity and browning and decrease in pH, ascorbic acid, and organoleptic taste during storage. The highest TSS was recorded in NA-6 (76.7%) and the lowest value was (75.9%) in Kanchan at 90 days of storage. Acidity was recorded highest in Kanchan (0.68%) and the lowest (0.58%) in NA-6 after 90 days of candy storage. The maximum pH (4.28) was observed in Krishna, while the minimum (4.23) was NA-6. The highest ascorbic acid (102.15 mg /100 g) was recorded in NA-6 and the lowest was (90.10 mg /100 g) with Kanchan. The highest browning was found (0.14 OD) in Kanchan and the same OD value (0.13 OD) was recorded in NA-6, NA-7 and Krishna. The organoleptic quality was best (7.19 score) in NA-6 at 90 days of storage. All the qualitative parameters were significantly superior with honey coated candy as compared to cane sugar prepared candy.

Key Words: *Aonla* candy, honey, TSS, organoleptic quality, storability.

INTRODUCTION

Aonla (*Embllica officinalis* Gartn.), the miracle of waste land fruit plant has planned for massive planting in Northern India especially in Uttar Pradesh. Besides its medicinal, nutritional and religious significance, it occupies a sacred place in India mythology. The edible fruit tissue of *aonla* contains about three times as much protein and 160 times as much vitamin 'C' compared to apple (Barthakur and Arnold, 3). The fruit contains a chemical substance called leucanthocyanin which retards the oxidation of ascorbic acid. Antioxidant effect of gallic acid, present in *aonla* fruit is being well acknowledged.

Aonla preserve has the beneficial effect on blood purifying. This also helps in reducing the cholesterol level in blood and in improving eyesight. However, the use of preserve is often disliked by majority of people due to unease in handling during consumption. As fruit is preserved in sugar syrup, there is always a chance of spillage of syrup on clothes and hands become sticky too. During journey preserve become always unfit due to these difficulties. Its transportation and storage is also troublesome. Moreover, stone

has to be separated while eating the fruits. In order to avoid these difficulties and to popularize the consumption of *aonla* products, *aonla* fruit candies are being popularised now a days. Candy is an intermediate moist food which is prepared after shade drying of drained fruits impregnated with cane sugar. According to Pathak *et al.* (10), cultivar Krishna is moderate in keeping quality, hence an ideal variety for preparing candy and juice. NA-6 is reported as an excellent variety for making preserve, candy and jam. Contrary to this, *aonla* candy has no such limitations and judiciously may be fortified with differed maturity range of fruits. Candies are becoming more and more popular because of high acceptability, minimum volume, higher nutritional value and longer storage life. These have additional advantage of being least thirst provoking and ready-to-eat snacks.

Among the unique products of *aonla*, the candy has much demand in domestic as well as export point of view. To strengthen market, storability and superior quality of *aonla* candy is of prime importance. It needs to fortify with nutrition rich sweeteners. It is also a matter of great interest to notice the influence of such sweeteners on different cultivars to reach on top quality parameters with high degree of acceptance by the commoners and elite both and economically remain

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on the limits of purchasers. Therefore, natural honey was used for coating the candy to enhance nutritive value and maintaining the TSS. Keeping above facts in view, a laboratory trial was conducted.

MATERIALS AND METHODS

The investigation on varietal evaluation of honey coated *aonla* candy at ambient storage conditions was carried out in P.G. Laboratory, Department of Horticulture, SHIAT, Allahabad. Honey was procured from the Department of Horticulture, K.A.P.G. Collage, Allahabad. The four cultivars, viz., NA-6, NA-7, Krishna, and Kanchan were selected for candy preparation. Two kilogram healthy, uniform size, disease, pest and bruise-free fruits were taken randomly from each genotype for the processing of *aonla* candy. Fruits were then washed properly in running water to clean the fruit. After surface drying, fruits were pricked and dipped in 2% salt solution for 24 h., then washed with clean water and kept pricked fruits in 2% CaCO₃ solution for 24 h and washed. Fruits were blanched in boiling water for 10 min. (Geetha *et al.*, 5). Then seeds were removed and segments were separated as suggested by Kumar *et al.* (8). Honey was used at the end of complete impregnation of sugar in fruit segments. One kg of *aonla* segments were coated with 100 g honey. While, for remaining one kg similar procedure was adopted without honey just to have comparison the effect of honey. The candy was filled in glass jar and stored at ambient temperature. Various physico-chemical parameters of candy, viz. TSS, acidity, pH, ascorbic acid and organoleptic score were recorded at 0, 30, 60 and 90 days of storage. The method of preparation of candy is given below in form of flow chart. Total soluble solids (TSS) were determined by hand refracto-meter. Ascorbic acid was determined according to the method, as described by Ranganna (11). The pH values were recorded in *aonla* candy with the help of an electronic pH meter. Then the sensory evaluation of the product was done at monthly interval starting from zero day to eight months of storage by a panel of five judges. Data were statistically analyzed and the significance of variance calculated.

RESULTS AND DISCUSSION

The chemical composition of tender *aonla* segment just after boiling is given in Table 1. It is evident from the data that maximum TSS (11.34%) was recorded in NA-6 followed by NA-7 (11.09%), Kanchan (10.34%) and minimum Krishna. However, the acidity was maximum is Kanchan (1.93) followed by Krishna (1.87%), NA-7 (1.74%) and minimum in NA-6 (1.63%). The trend of value was same as acidity. The ascorbic acid value was maximum in NA-6 (493 mg/ 100 g) followed by Krishna (430 mg/ 100 g), and minimum in Kanchan (397 mg/ 100 g). Though, browning did not show significant difference. These differences in chemical composition were genetically characters of individual cultivation grown under some agro-climatic and management conditions.

The data presented in Tables 2(a) & (b) indicate that the total soluble solids (TSS), acidity and browning increased significantly with increasing storage period irrespective of varieties in both non-honey coated and honey coated candies. Whereas, pH and ascorbic acid decreased, though the differences among varieties were non-significant. The TSS of honey coated *aonla* candy was maximum in variety NA-6 (76.7%) followed by NA-7 (76.2%), Krishna (76.1%), while minimum in Kanchan (76.0%). This might be due to loss of moisture during storage and the conversion of polysaccharides into sugars during hydrolysis process. Increase in TSS with storage was also reported by Kumar and Singh (8) and Daisy and Gehlot (3) in *aonla* products.

The total acidity of honey coated *aonla* candy was increased with the advancement of storage period. Maximum acidity (0.68%) was recorded in Kanchan, while minimum were associated with NA-7 (0.58%) at 90 days after storage. Retention of pH was found to be highest in the honey coated *aonla* candy prepared from variety NA-7 (4.33) followed by Krishna (4.28), while minimum retention was recorded in NA-6 (4.25) and Kanchan (4.23). Results showed that the most desirable candy prepared from NA-6 had the least pH reduction.

Table 1. Chemical composition of tender *aonla* segments just after boiling.

Treatment	TSS (%)	Acidity (%)	pH	Ascorbic acid (mg/100 g)	Browning (OD)
NA-6	11.34	1.63	1.63	493	0.03
NA-7	11.09	1.74	1.69	418	0.03
Krishna	10.49	1.87	1.88	438	0.04
Kanchan	10.74	1.93	1.93	397	0.04
CD at 5%	0.06	0.02	0.02	8.12	NS

The ascorbic acid retention was found highest at 0 day in honey coated *aonla* candy prepared from variety NA-6 (112.80 mg/ 100 g) followed by Krishna-(110.01 mg/ 100 g), whereas minimum was noted with Kanchan (104.27 mg/ 100 g). Ascorbic acid was found minimum in NA-6 (10.65 mg/ 100 g) followed by Krishna (12.56 mg/ 100 g), after 90 days. The observations are in conformity with Damame *et al.* (4), and Agrawal and Chopra (1) with regard to changes occurring in ascorbic acid and total phenols during storage in different *aonla* products. They observed that the shreds registered greater loss in ascorbic acid followed by jam, candy and squash respectively. However, the candy showed greater loss in total phenols followed by shreds and squash, while in jam slight increase in total phenols content was recorded.

Candy prepared from all the four varieties were acceptable. However, at 0 and 30, 60 and 90 days of storage period, the variety NA-6 organoleptically scored 8.11 and 7.98, 7.70, and 7.19 followed by Kanchan 7.78 and 7.66, 7.37 and 6.85, respectively. At 90 days of storage both varieties were statistically at par. Organoleptic evaluation revealed that the acceptability of honey coated *aonla* candy decreased with the storage period. Honey coated *aonla* candy packed in glass jars maintained their acceptability up to 3 months at ambient temperature. These findings were in line with the findings of Mishra *et al.* (9) and Tandon *et al.* (15). It is evident from the data presented in Tables 3 (a) & (b) that the acceptability in terms organoleptic evaluation was found better with the candy prepared from NA-6, followed by Krishna and Kanchan at 90 days storage. Honey coated *aonla* candy showed decreasing trend in overall acceptability in all the treatments during storage period, which might be due to the changes in colour as indicated by increase in browning and changes in texture also indicated by the texture scores awarded by judges (Relekar *et al.*, 12). Based on the above facts, it may be concluded that TSS, acidity, pH, ascorbic acid, browning and organoleptic scoring, the cultivar NA-6 was the most suitable variety for preparing honey coated *aonla* candy with good storage upto 90 days at ambient conditions.

REFERENCES

1. Agrawal, S. and Chopra, C.S. 2004. Changes in ascorbic acid and total phenols in making *aonla* products. *Bev. Fd. World*, **31**: 32-34.
2. Dahiya, S.P. and Dhawan, S.S. 2001. Physico-Chemical characteristics of *aonla* (*Embllica officinalis* Gaertn.) Chakaiya. *Indian Fd. Pack.* **55**: 133.

3. Daisy and Gehlot, Rakesh. 2006. Physical and bio-chemical differences in fresh *aonla* fruits and preserve of cvs. Banarasi and Chakaiya. *Haryana J. Hort. Sci.* **35**: 57-59.

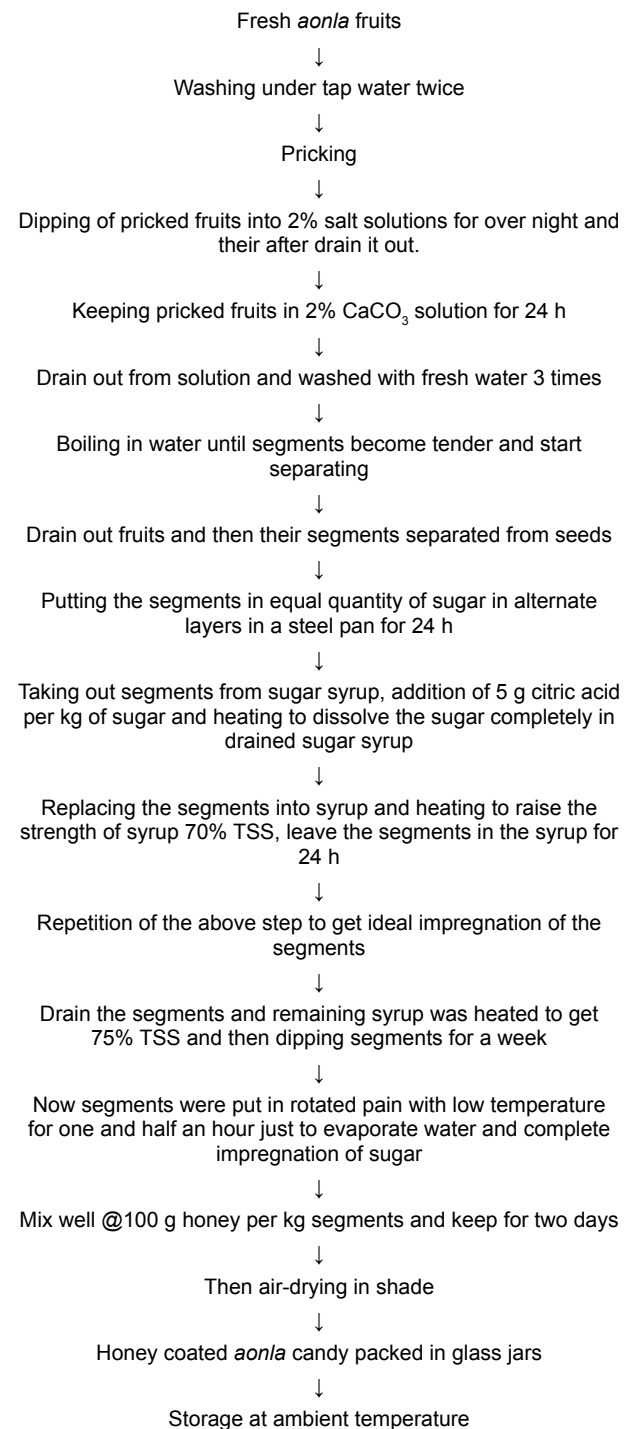


Fig. 1. Flow chart for preparation of *aonla* candy with honey coating.

Table 2 (a). Changes in chemical composition in non-coated *aonla* candy during storage.

Treatment	TSS (%)			Acidity (%)			pH			Ascorbic acid (mg/100 g)			Browning (OD)							
	Days																			
	0	30	60	90	0	30	60	90	0	30	60	90	0	30	60	90				
NA-6	75.0	75.3	75.9	76.3	0.52	0.54	0.56	0.58	4.41	4.38	4.33	4.27	112.70	108.95	105.96	101.75	0.05	0.08	0.11	0.15
NA-7	74.8	75.2	75.5	75.9	0.47	0.49	0.52	0.55	4.49	4.46	4.42	4.35	106.30	102.64	97.15	92.55	0.05	0.08	0.11	0.15
Krishna	74.9	75.1	75.4	75.8	0.53	0.55	0.58	0.62	4.44	4.42	4.37	4.31	109.90	108.00	103.03	97.07	0.06	0.08	0.12	0.16
Kanchan	74.9	75.1	75.2	75.7	0.56	0.58	0.62	0.65	4.39	4.36	4.32	4.25	104.13	100.40	96.13	89.75	0.06	0.08	0.12	0.16
CD at 5%	NS	NS	0.07	0.14	0.14	0.14	0.15	0.16	NS	NS	NS	NS	0.637	0.647	2.673	5.438	NS	NS	NS	NS

Table 2 (b). Changes in chemical composition in honey coated *aonla* candy during storage.

Treatment	TSS (%)			Acidity (%)			pH			Ascorbic acid (mg/100 g)			Browning (OD)							
	Days																			
	0	30	60	90	0	30	60	90	0	30	60	90	0	30	60	90				
NA-6	75.2	75.6	76.3	76.7	0.54	0.56	0.58	0.60	4.40	4.37	4.32	4.25	112.80	109.10	106.21	102.15	0.04	0.07	0.11	0.13
NA-7	75.0	75.5	75.9	76.2	0.49	0.51	0.54	0.58	4.48	4.45	4.40	4.33	106.41	102.61	97.38	92.95	0.04	0.07	0.10	0.13
Krishna	75.1	75.4	75.9	76.1	0.55	0.57	0.60	0.65	4.43	4.40	4.35	4.28	110.01	108.15	103.25	97.45	0.05	0.07	0.11	0.13
Kanchan	75.2	75.4	75.7	76.0	0.58	0.60	0.64	0.68	4.38	4.35	4.30	4.23	104.27	100.55	96.38	90.10	0.05	0.07	0.11	0.14
CD at 5%	NS	NS	0.07	0.14	0.14	0.14	0.15	0.16	NS	NS	NS	NS	0.637	0.647	2.673	5.438	NS	NS	NS	NS

Table 3 (a). Changes in organoleptic parameters in non-coated *aonla* candy during storage.

Treatment	Colour and appearance			Flavour			Texture			Taste			Overall acceptability							
	Days																			
	0	30	60	90	0	30	60	90	0	30	60	90	0	30	60	90				
NA-6	7.04	6.89	6.62	6.21	6.39	6.23	5.78	5.00	7.39	7.29	7.04	6.51	7.23	7.15	6.97	6.67	7.01	6.89	6.61	6.10
NA-7	6.38	6.16	5.88	5.46	5.97	5.79	5.36	4.56	6.60	6.49	6.24	5.75	7.00	6.92	6.74	6.44	6.49	6.34	6.06	5.55
Krishna	6.87	6.73	6.44	6.05	6.16	5.98	5.55	4.72	6.99	6.84	6.59	6.10	6.75	6.67	6.49	6.19	6.69	6.56	6.27	5.77
Kanchan	6.60	6.55	6.25	5.88	6.21	6.03	5.61	4.70	7.22	7.10	6.88	6.35	6.30	6.22	6.04	5.75	6.58	6.48	6.20	5.67
CD at 5%	0.07	0.07	0.09	0.09	0.06	0.04	0.04	0.05	0.07	0.06	0.06	0.09	0.07	0.06	0.06	0.09	0.07	0.06	0.04	0.03

Table 3 (b). Changes in organoleptic parameters in honey coated *aonla* candy during storage.

Treatment	Colour and appearance				Flavour				Texture				Taste				Overall acceptability			
	Days				Days				Days				Days				Days			
	0	30	60	90	0	30	60	90	0	30	60	90	0	30	60	90	0	30	60	90
NA-6	8.09	7.94	7.67	7.25	7.47	7.29	6.86	6.04	8.40	8.30	8.05	7.55	8.48	8.40	8.22	7.92	8.11	7.98	7.70	7.19
NA-7	7.35	7.20	6.93	6.51	7.05	6.87	6.44	5.61	7.61	7.51	7.26	6.76	8.25	8.17	7.99	7.69	7.57	7.44	7.16	6.64
Krishna	7.92	7.77	7.50	7.08	7.24	7.06	6.63	5.77	7.97	7.87	7.62	7.12	8.00	7.92	7.74	7.44	7.78	7.66	7.37	6.85
Kanchan	7.74	7.59	7.32	6.90	7.29	7.11	6.68	5.75	8.21	8.11	7.86	7.36	7.55	7.47	7.29	6.99	7.70	7.57	7.29	6.75
CD at 5%	0.07	0.07	0.09	0.09	0.06	0.04	0.04	0.05	0.07	0.06	0.06	0.09	0.07	0.06	0.06	0.09	0.07	0.06	0.04	0.03

- Damame, S.V., Gaikwad, R.S., Patil, S.R. and Masalkar, S.D. 2002. Vitamin C content of various *aonla* products during storage. *Orissa J. Hort.* **30**: 19-22.
- Geetha, N.S., Kumar, Surinder and Rana, G.S. 2006. Effect of blanching on physico-chemical characteristics of *aonla*. *Haryana J. Hort. Sci.* **35**: 67-68.
- Goyal, R.K., Kingsly, A.R.P., Kumar, Pradeep and Walia, Himanshu. 2007. Physical and mechanical properties of *aonla* fruits. *J. Fd. Engg.* **82**: 595-99.
- Kumar, P.S. and Sagar, V.R. 2009. Effect of osmosis on chemical parameters and sensory attributes of mango, guava slices and *aonla* segments. *Indian J. Hort.* **66**: 53-57.
- Kumar, Sanjeev and Singh, I.S. 2001. Storage studies of *aonla* fruit products at ambient temperature. *Prog. Hort.* **32**: 169-73.
- Mishra, S., Verma, A., Prasad, V.M. and Sheikh, S. 2011. Development of value added *amla* candy with rose extract. *Allahabad Farmer*, **LXVI**: 20-27.
- Pathak, R.K., Pandey, D., Haseeb, M. and Tandon, D.K. 2003. *The Aonla*, Technical Bulletin, CISH, Lucknow, India.
- Ranganna, S.S. 1986. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*, Tata McGraw Hill Pub. Co. Ltd., New Delhi.
- Relekar, P.P., Niik, A.G. and Padhiar, B.V. 2011. Qualitative changes in value added herbal products of sapota cv. Kalipatti during storage. *Indian J. Hort.* **68**: 413-18.
- Singh, Virendra, Singh, Prabhakar and Singh, K.A. 2009. Physico-chemical composition and evaluation of *aonla* cultivars under Chhattisgarh conditions. *Indian J. Hort.* **66**: 267-70.
- Srilakshmi, B. 2003. *Food Science* (3rd Edn), Anna Adarsh College for Women, Chennai, 293 p.
- Tandon, D.K., Yadav, R.C., Sood, Sushma, Kumar, Sanjay and Dikshit, Abhay. 2003. Effect of blanching and peeling on the quality of *aonla* candy. *Indian Fd. Pack.* **57**: 147-52.

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