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Studies on process standardization and storage behaviour of squash beverage prepared from aonla cultivars

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ABSTRACT : Aonla is an important fruit crop grows in tropical and subtropical regions of India. The Uttar Pradesh is leading state in production and acreage under aonla cultivation in the country. Generally aonla is considered as "Wonder Fruit for the Health" because aonla fruits are highly nutritious and having good medicinal value but fruits is not consumed freely in fresh form because of its astringent taste due to fruit tannins. Therefore, various cultivars of aonla were screened for their suitability into squash beverage preparation, which may become a popular beverage in comparison with modern synthetic beverages. Accordingly eight aonla cultivars viz - Banarasi, Chakaiya, Kanchan, Krishna, NA–6, NA–7, NA–8, NA–9 were evaluated. Fruits segments and water ratio of 1:1 was found ideal for pulp extraction. Composition of squash with 25 per cent aonla pulp, 50 per cent Total soluble solids (TSS) and 1 per cent acidity were found ideal. During the storage Vitamin 'C' (ascorbic acid) content decreased while Total soluble solids increased in squash beverage and acidity increased towards the end of storage whereas browning increased continuously during storage. But organoleptic score of the squash reduced gradually during storage. Thereby, acceptable quality of squash were maintained up to four months. Thus fruits of Chakaiya cultivar were found most suitable for making quality squash, which may helpful in making aonla production a profitable enterprise in India.

Key Words : Indian Gooseberry squash, Aonla (*Emblica officinalis* Gaertn.), medicinal products, organoleptic quality, qualitative changes during storage.

Aonla (*Emblica officinalis* Gaertn.) which is also called Indian Gooseberry, a versatile fruit tree, belongs to the family Euphorbiaceae. It occupies an important place among the indigenous fruits and have a special place in India as it has got tremendous medicinal value as well as high nutritional value also. Aonla fruit is one of the richest known sources of ascorbic acid (300-1000mg/100g edible portion) depending upon the cultivar and location (Manny and Shadakshara Swamy, 1997) and fresh fruit of aonla is also appreciable source of total sugar (7.53mg/100g), calcium (14.91mg/100g), iron (0.62 mg/100g), phosphorus (11.81 mg/100g) as reported by Khan (2009). Thereby, only a few fruits can meet the daily requirement of vitamin 'C' (Shankar, 1969). The fruit also contains polyphenols, which have antioxidant property and thus has good free radical scavenging activity. Tannin found in fruits containing gallic acid, ellagic acid and glucose in its molecule, which is naturally present in the fruit, prevents and/or retards the oxidation of the vitamin 'C'. Therefore, even after processing it retains major part of ascorbic acid.

Aonla fruits are not generally consumed fresh because fruits are highly acidic and astringent; therefore fruits are not popular as table fruit. Nayak *et al*. (2011) reported that high medicinal properties of aonla fruits can be processed in to value added Squash beverage.

Keeping in view this fact, in present investigation an attempt has been made to evaluate squash, prepared from fruits of different aonla cultivars.

Materials and Methods

The study was carried out at Department of Horticulture, Janta College, Bakewar, Etawah (U.P.). Matured, uniform sized and disease free aonla fruits of each variety of eight cultivars viz. Banarasi, Chakaiya, Kanchan, Krishna, NA–6, NA–7, NA–8, NA–9 were selected and procured for Sqaush preparation from the experimental farm of Janta College, Bakwar, Etawah. The technique used for extraction of aonla fruit pulp is depicted in Flow chart-1.

Organoleptic quality of the Sqaush was evaluated by panel of 10 judges who scored on a 9-point Hedonic scale (Amerine *et al*., 1965). The recipe which has been found ideal for squash preparation was used for screening of cultivars.

Recipe: 25 per cent aonla pulp, 50 per cent T.S.S. and 1 per cent acidity.

Process: Squash was prepared by mixing calculated amount of pulp, sugar, water, and citric acid followed by preservative. For formulation of recipe, the total soluble solids and acidity present in the pulp were first determined and remaining amount of sugar and citric acid was added after making adjustments for the ingredients already present. Sugar syrup was prepared by heating

Flow Chart-1 : Extraction of aonla fruit pulp.

AONLA FRUITS

⇩

Lye Treatment
(2% NaOH at 100°C For 5 minutes)

⇩

Washing with Water

⇩

Dipping in 0.5% Citric Acid Solution for 5 Minutes

⇩

Seed Removal and Conversion into Segments

⇩

Addition of Water

⇩

Passing through the Pulper

⇩

AONLA PULP

Flow Chart-2: Preparation of aonla squash.

AONLA PULP

⇩

Mixing with Syrup Solution
(Sugar + Water + Citric acid
according to recipe)

⇩

Addition of Preservative
(0.6 g kms/ litre product)

⇩

Bottling

⇩

Capping

⇩

STORAGE

the mixture of water, sugar and citric acid. Syrup strained with the help of muslin cloth and finally fruit pulp was blended with sugar syrup then bottled, capped and stored for further studies. The technique used for preparation of squash is given in Flow chart- 2.

Results and Discussion

(A) Pulp extraction technique

Certain amount of water is required for the extraction of pulp in some fruits. In present finding, aonla pulp was successfully extracted by addition of water equal to the weight of segments. In other words, fruits segment and water ratio of 1:1 was found to be the optimum for easy extraction and better recovery of pulp with moderate total soluble solids, vitamin 'C' and acidity (Table-1). Addition of water for easy extraction of pulp has been also recommended in ber (Khurdiya and Singh, 1975) and in bael (Roy and Singh, 1979).

(B) Evaluation of recipe

(i) The pulp of Chakaiya cultivar was used for preparation of squash. The recipe containing 25 per cent pulp, 50 per cent total soluble solids, 1.0 per cent acidity, and 600 ppm potassium metabisulphite was used as preservative for 1 kg product. Prepared squash was filled in sterilized bottles of 750 ml capacity, sealed immediately and kept at ambient temperature for storage studies. Observation on vitamin 'C' (ascorbic acid), T.S.S. acidity, and browning and organoleptic quality were recorded at monthly interval.

(i) Qualitative changes during storage of squash

The squash was analysed for its vitamin 'C', TSS, acidity and browning content at an interval of one month and findings are given in Table 2. It is clear from Table-2 that in squash vitamin 'C' (ascorbic acid) content decrease with increasing storage period. When squash was prepared maximum vitamin 'C' contend was noted it was 175.30 mg per 100g, gradually it came down to 39.10 mg per 100g after nine months of storage and the retention was lowest (22.30 per cent). TSS content in squash was also observed increase with increasing storage period. In beginning it was 50.0 mg per 100g, which reached 52.3 mg/100g after 9 months of storage. This increase was 104.6 per cent. Acidity content of the squash did not change up to one month thereafter changes were recorded after each storage period slab. At the beginning of storage of squash acidity was 1.00%, which become 1.50% after nine months. This increase was continuously and showed 150 per cent increase. The observation of Browning in all samples of squash was measured at 440 nm (nanometer) using 60 per cent alcohol as blank. Browning in terms of O.D. increased continuously during storage of squash and highest increase was recorded 1600 per cent. In the beginning of squash storage Organoleptic score was 8 in first month, which decreased continuously and reached 3.5 in ninth months.

(ii) Organoleptic evaluation

The organoleptic quality of squash was judged by a

Table-1: Determination of fruit segment and water ratio for pulp extraction.

Fruit segment /water ratio	Recovery of Pulp (%)	T.S.S. (%)	Vitamin C (mg/100g)	Acidity (%)	Organoleptic score
1:0.5	133.8	7.0	242.3	1.3	6.2
1:1.0	178.0	6.0	181.9	1.0	6.7
1:1.15	222.5	4.5	145.2	0.8	6.0
1:1.20	266.6	3.4	88.9	0.7	5.8
C.D. 5%	5.8	0.9	12.5	0.1	0.6

panel of judges and the product was assessed on the basis of color, appearance, texture and taste and the overall average (Table 3). It is clear that organoleptic score of squash decreased with the storage period up to four months of storage.

The data presented in Table -3 is evident that organoleptic quality of squash prepared from Chakaiya cultivar was best (8.0) among squash prepared from other cultivars. The difference was in squash score was non-significant among Banarasi (7.1), Kanchan (7.0), Krishna (7.2), NA-6 (7.3), and NA-9 (7.4) cultivars. The squash prepared from NA-7 (6.5) and NA-8 (6.3) cultivars did not show the acceptable score.

The variability studies indicated the possibility of selecting an ideal cultivar for processing industries. Chakaiya cultivars show better suitability for becoming popular cultivars for processing industry. In present study Chakaiya cultivar was adjudged best for making squash. Results of present studies indicate that the vitamin 'C" content of squash decreased continuously with the increasing storage period. The result corroborate with findings of Singh *et al*. (1993) who also recorded loss of ascorbic acid during storage of aonla. Reduction in vitamin 'C' may be due to oxidation by trapped oxygen in container, which results in formation of dehydro ascorbic acid. Loss of ascorbic acid was also observed in aonla squash (Ram, 1984) and in tomato (Srivastava *et al*., 2014).

Total soluble solids of squash increased slightly during storage. Hydrolysis of polysaccharides during storage of beverage squash may be the possible reason for little increase in total soluble solids. An increase in total soluble solids in aonla beverage squash was also reported by Ram (1984). Similarly increase in total soluble solids during storage of guava squash (Singh, 1985), jamun squash (Ashraf, 1987), papaya beverages (Kumar, 1990) and pine apple value added jam (Dubey and Prasad, 2012) were also noticed. This finding is also supported by Ram (1984). Similar results have also been observed phalsa beverages (Khurdiya, 1979) and (Sabahuddin *et al*., 2017).

Acidity content has been observed increase in beverage squash continuously. This finding is also supported by Ram (1984). Similar results have also been observed in bael squash (Dube, 1984) and phalsa beverages (Khurdiya, 1979).

A progressive increase in browning of aonla squash was observed with the storage period in present findings. This could be mainly due to the non-enzymatic reaction such as ascorbic acid with sugar or oxidation of phenols, which leads to the formation of brown pigments. A significant difference in intensity of browning was noticed variability in browning among different fruit products is caused by three types of general reaction, i.e., (i) nitrogenous compound and sugar, (ii) organic acids and sugar, (iii) nitrogenous compound and organic acid. Factor accounted for browning of fruit products are ascorbic acid, temperature, oxygen, moisture, and sulphur dioxide treatment and these factors are interrelated. Stadman (1948) reported that decline in ascorbic acid content of fruit products may be one of the possible reasons for browning of the products. The present findings get support with work on aonla beverages (Ram, 1984). Diemair and Jury (1965) reported 5-hydroxymethyl, 2-furfuraldehyde is produced in fruit juice from sugar particularly ketones by heating during processing and can cause browning reaction with amino compounds and sugars. Meyer (1987) has suggested three hypotheses to explain non-enzymatic browning (i) browning reaction, which occurs between carbohydrates and amino acids, results in the formation of brown pigment known as ''Mailard reaction'' and believed by many to explain the browning found in processed fruits, (ii) oxidation of ascorbic acid leads to the formation of brown pigments, and (iii) carbohydrates or carbohydrate and acid decomposes to furfuraldehyde or related

Table-2 : Qualitative changes during storage of squash.

Storage Period (Month)	Qualitative Changes during Storage of Squash									
	vitamin 'C'*		TSS*		Acidity (%)*		Browning*		Organoleptic**	
	Quantity	Retention	Quantity (mg/100g)	Increase/ Decrease(%)	Quantity (mg/100g)	Increase/ Decrease (%)	Quantity (OD)	Increase/ Decrease (%)	Score	Rating
0	175.30	100.00	50.0	100.0	1.00	100	0.01	100	8.0	LVM
1	158.20	90.25	50.2	100.4	1.10	110	0.02	200	8.0	LVM
2	142.20	81.12	50.4	100.8	1.15	115	0.04	400	7.8	LM
3	127.70	72.85	50.8	101.6	1.21	121	0.05	500	7.7	LM
4	109.90	62.69	51.1	102.2	1.25	125	0.07	700	7.5	LM
5	98.70	56.30	51.3	102.6	1.30	130	0.09	900	6.8	LS
6	76.90	43.87	51.5	103.0	1.34	134	0.11	1100	6.5	LS
7	62.50	35.65	51.8	103.6	1.40	140	0.14	1400	6.5	LS
8	51.20	29.21	52.0	104.0	1.44	144	0.16	1600	6.2	LS
9	39.10	22.30	52.3	104.6	1.50	150	0.16	1600	3.5	LS

*= Quantity-mg/100g
Retention-%

**=Organoleptic score 7 and above acceptable
LE = Like extremely. LVM = Like very much.
LM = Like moderately. LS = Like slightly.

Table–3: Organoleptic quality of Squash prepared from aonla cultivars.

Cultivars	Organoleptic quality	
	Score	Rating
Banarasi	7.1	Like moderately
Chakaiya	8.0	Like very much
Kanchan	7.0	Like moderately
Krishna	7.2	Like moderately
NA-6	7.3	Like moderately
NA-7	6.5	Like slightly
NA-8	6.3	Like slightly
NA-9	7.4	Like moderately
C.D. at 5%	0.5	

compounds, which then polymerise or react with nitrogen compounds to form brown pigments.

Organoleptic score of the aonla beverage squash declined continuously during storage. Singh (1999) also reported continuous decrease in organoleptic rating of squash. The acceptable quality of aonla squash was maintained up to four months. Oxygen absorbed by the product during processing may lead to darkening. Although browning may also occurred in some product under anaerobic condition. Temperature is the most single factor affecting the uptake of oxygen; the rate increases nearly 4 times for every 10°C rise in temperature. Sulphur compounds present in fruit juice mainly in three forms viz., amino acid of protein and volatile compound and sulphate preservation of fruit beverages by addition of SO_2 delayed or reduced the browning. Temperature plays an important role in inducing certain biochemical changes in the products, which leads to development of off flavour as well as discoloration and thus masking the original colour and flavour of products. Reduction in organoleptic quality has also observed in aonla beverages, phalsa beverages (Khurdiya and Anand, 1981), Gaikwad *et al*. (2013) and Jairajpuri *et al*. (2016)

On the basis of observations recorded on various qualitative changes and organoleptic quality of squash during storage. Fruits segments and water ratio of 1:1 was found ideal for pulp extraction. Squash of composition 25 per cent aonla pulp, 50 per cent Total soluble solids (TSS) and 1 per cent acidity were found ideal. During the storage in squash Vitamin 'C' (ascorbic acid) content decreased while Total soluble solids increased did not change up to one month thereafter changes were recorded after each storage period slab whereas Browning increased continuously during storage. But organoleptic score of the squash reduced gradually during storage and acceptable quality of squash were maintained up to four months. Thus fruits of Chakaiya cultivar were found most suitable for making quality squash beverage. In the beginning of squash storage Organoleptic score was 8 in first month, which decreased continuously and reached 3.5 in ninth months.

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