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Storage Study of Intermediate Moisture Aonla Shreds Varieties

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The study was undertaken to evaluate five varieities of aonla *viz.*, Kanchan, Krishna, Chakaiya, GA-1 (GujaratAonla-1) and NA-7 (Narendra Aonla -7) were prepared intermediate moisture aonla shreds. Shreds were prepared by blanching of anola fruits in boiling water at 10 mins followed by cooling in cold water to separate the segments and then converted into shreds using manual shreder. The shreds were dipped in 70 ^{0}Brix hot sugar solution of 85^{0}C for 5min followed by soaking overnight in the same solution. The shreds after osmotic dip were drained and dried in cabinet dryer at 60^{0}C and packed in polyethylene bags. The result of storage of intermediate moisture shreds for 6 months at room temperature indicated the increase in TSS (°Brix), total sugar (%), acidity (%), moisture (%) and decrease in ascorbic acid (mg/100 g), tannin (%) and overall acceptability. The result of the study revealed that variety NA-7 possesses higher TSS, total sugars and ascorbic acid and overall acceptability score. It was also found more shelf stable during 6 months storage.

Introduction

Aonla (*Emblica officinalis* Gaertn) known as Indian gooseberry is one of the important fruit of Indian origin has wide popularity all over the world, recognized as 'Amritphal' because of its great medicinal, nutritional and therapeutic value as mentioned both in Ayurvedic and Unani system of medicines from the ancient times in India. The aonla fruit is one of the richest sources of vitamin-C after Barbados cherry (*Malpighia glabra* L.). Fruit contains 500 to 1500 mg/100 g ascorbic acid and is high valued indigenous medicines in India (Lal *et al.*, 2006). The composition of aonla fruits comprised of moisture 77.1 - 82.20 %, protein 0.50 %, fat 0.10 %, minerals 0.50 - 0.70%, Iron 1.20 mg/100g, vitamin-C 200 - 1814 mg/100g, fibre 1.9 - 3.40 % and lysine 17.00 mg/100g (Sant Ram, 1990). Aonla fruits are highly in perishable in nature and therefore, suffer heavy losses after their harvest over

long distance transportation and the growers are compelled to sell their produce at distress prices during glut season. Aonla fruits are not consumed as fresh form because of its astringency, acrid and acidic taste. Therefore, it is not popular as a table fruit. However, excellent nutritive and therapeutic values of the fruits have great potentiality for processing into several quality products. Processing not only reduce the post harvest losses but also provides higher return to the growers.

The fruits are made into various processed products i.e. *murabba*, squash, dried chips, tablets, jam, jelly, pickle, toffees, powder, juice, pulp, *mukhwas*, chocolate, candy (Ray and Kikani 1999), mouthwash, *Chawanprash*, mouth freshner, Supari, capsules and *aonla pak* (Sharma, 2006; Garg and Goel, 2006; Singh *et al.*, 2006). Among the all product, dehydrated shreds are more popular and are being prepared on commercial scale in our country. Dehydration of aonla is one of effective method to increase the shelf life of anola fruits. The dehydrated aonla is further converted into aonla powder which is used for preparation of various kinds of medicines on commercial scale and acts an important antioxidant that creates immunity in our body against diseases. Blanching with hot water is used before drying to check the enzyme spoilage and improve colour and texture of the shreds (Prajapati *et al.*, 2011). Cabinet drying is a convenient method of lowering moisture content from the products (Singh *et al.*, 2006). Keeping these points in view, the present investigation was carried out to evaluate the suitable varieties for value added intermediate moisture aonla shreds and to study the shelf life on nutritional as well as organoleptic quality during storage.

Materials and Methods

Fully matured (yellowish green), uniform sized of aonla fruits of different varieties were harvested from orchard of Anand Agricultural University, Anand, Gujarat. The diseased, mechanical injuries, spotted and blemished fruit were sorted out and then thoroughly washed in running tap water to remove dust and other extraneous materials form the surface of the fruits. The fruits of five aonla varieties viz. (Kanchan, Krishna, Chakaiya, GA-1 (Gujarat Aonla-1) and NA-7 (Narendra Aonla -7)) were used in experiment for preparation of IMF i.e. shreds. Aonla fruits were blanched for 10 min in boiling water (1:2 :: fruits : water) followed by immediate cooling in cold water. After cooling, the segments were converted into shreds using a shredding machine. These shreds were dipped into 70 ^{0}Brix solution (1:1: sugar: shred) heated at 85 ºC for 5 min and left for overnight in the same solution for the osmosis process (Sagar and Kumar, 2006; Tondon and Kumar, 2005). Next day, these shreds were drained and uniformly loaded in stainless steel trays and dried in cabinet dryer at 60±2 ^{0}C of 6-7 hours to intermediate moisture level upto 20%. Then, shreds were packed in 200 gauge polyethylene bags with heat sealed and followed by labeling and storage at room temperature for storage studies. The samples were taken at monthly interval for analysis during 6 months of storage. The dried aonla shreds were evaluated for TSS (ºBrix), total Sugar (%), acidity (%), ascorbic acid (mg/100g), moisture (%) and tannin (%) as per Ranganna (1986) methods.

Organoleptic parameter like overall acceptability of aonla shreds were analyzed using (9 -Point Hedonic Scale) as per Ranganna (1986). The moisture content of fresh aonla as well as prepared shreds were estimated at 70^{0}C for 24 hours as per the method of AOAC (1984) and expressed as per cent. The total soluble solids of fresh as well as dried shreds of sample were recorded by using Erma made hand refractometer as per (Ranganna, 1986). The acidity and ascorbic acid of the sample was determined by titration as per Ranganna (1986) method and expressed on per cent and mg / 100 g basis, respectively. The volumetric method described by Ranganna (1986) was adopted for estimation of tannin content and expressed as per cent.

Organoleptic Attributes was assessed for overall acceptability by a panel of 10 judges using 9 -point

Hedonic Rating scale (Ranganna, 1986). The experimental data were statistically analyzed by variance techniques as described by Panse and Sukhatme (1967). The design of experiment was CRD and each treatment was repeated trice.

Results and Discussion

The quality parameters like moisture, TSS, Total sugars, acidity, ascorbic acid, tannin content and overall acceptability among different aonla varieties were illustrated in details below.

Moisture

The moisture content showed significant variation during storage period (Table 1). The lowest moisture content was found in treatment V_5 (NA-7) and moisture content was increased during 6 months of storage of aonla shreds. It may be due to genetical character and status of the variety. The variation among the treatments may be due to uneven layering of the shred in to tray and also variation in heat exposure. Increasing trend in moisture level during storage can be seen mainly because of absorption of moisture from atmosphere and fluctuation in temperature due to seasonal variation. Similar observations were recorded by Naik and Chundawat (1996 a & b) and Singh *et al.,* (2006) in study of aonla dehydrated product, Mehta and Tomar (1980 a & b) in study of dehydrated guava and papaya, Rai *et al.,* (2007) in pineapple osmodried slices.

Total soluble solids

TSS in shreds of different aonla varieties was found significant up to 6 months of storage (Table 1) and value of TSS was found maximum in treatment V_5 (NA-7) which was at par with V_2 (Krishna) and V_4 (GA-1).TSS was increased with increase in storage period which may be influenced by metabolic changes especially utilization in oxidative metabolism. It might be due to interactive chemical reaction of solids and acids in shred during storage for responsible of increase in total soluble solids of shreds. Similar findings were also recorded by Singh *et al.,* (2008) for aonla candy, Naik and Chundawat (1996 a & b) and Singh *et al.,* (2006) for aonla dehydrated product, Singh *et al.,* (2005) in processing of aonla fruits, Rani and Bhatia (1985) for osmodehydrated pear candy and Rai *et al.,* (2007) in pineapple osmodried slices.

Total sugar

The total sugar content of intermediate moisture aonla shreds was significantly higher in V_5 (NA-7) at initial stage (Table 1). It might be due to higher value of sugars in the aonla shreds. The total sugar followed on increasing trend in intermediate moisture aonla shred during storage period which might be due to the degradation of polysaccharides with respect to time. These kinds of observations were also recorded by Mehta and Tomar (1980 a & b) in study of dehydrated guava and papaya, Naik and Chundawat (1996 a & b) and Singh *et al.,* (2006) in dehydrated aonla product, Rai *et al.,* (2007) in pineapple osmodried slices and Tripathi *et al.,* (1988) in aonla preserve.

Acidity

The acidity level showed significant variation during storage of intermediate moisture aonla shreds. The maximum acidity (%) was found in treatment V_2 (Krishna) which was at par with V_1 (Kanchan) initially and remained the maximum during storage of product for 6 months with increasing trend (Table 2). It might be due to the genetical character and status of the variety.

The increase in acidity might be due to chemical interaction between the organic constituents of the fruits, induced by the temperature as well as acidity level of fruit itself and due to formation of acids from sugar. Shred of V_5 (NA-7) treatment showed lowest acidity due to the lower level of acidity in fruit pulp. These findings were in conformity with the earlier findings of Singh *et al.,* (2008) for aonla candy, Naik and Chundawat (1996 a & b) and Singh *et al.,* (2006) in study of aonla dehydrated product, Singh *et al.,* (2005) in study of processing of aonla

fruits, Rai *et al.,* (2007) in pineapple osmodried slices, Mishra *et al.,* (2009) in Physico-chemical properties of Chakiya variety of amla.

Ascorbic acid

Significantly higher ascorbic acid content in intermediate moisture aonla shreds was found in V_5 (NA-7) and T_2 (Krishna) ranked 2nd at initial stage (Table 2). During 6 months of storage, highest value recorded in V_3 (Chakaiya) while V_5 (NA-7) was ranked 2nd, which may be due to the variations of respected varieties. The ascorbic acid was observed in decreasing trend during storage which may be due to increase in average temperature as the advancement of storage period. Since ascorbic acid is heat sensitive vitamin, the highest temperature might have caused its destruction during the storage period. Similar results were also observed by Singh *et al.,* (2008) for candy, Tripathi *et al.,* (1988) in different preserve product of aonla, Naik and Chundawat (1996 a & b) and Singh *et al.,* (2006) in study of aonla dehydrated product, Rai *et al.,* (2007) in pineapple osmodried slices, Mishra *et al.,* (2009) in Physico-chemical properties of Chakiya variety of amla.

Tannin

Significantly lower tannin content in intermediate moisture aonla shreds was found in V_1 (Kanchan) which was at par with V_5 (NA-7) which may be due to the varietal characters of respected varieties (Table 2).

The tannin content was observed decreasing trend during storage which may be due to increase in temperature level as the nature of tannin that was destroyed with temperature during storage period.

Similar results were also observed by Anand (1970) in aonla preserve, Prajapati *et al.,* (2011) in aonla shreds, Naik and Chundawat (1996 a & b) in various processed products of aonla, Pant *et al.,* (2004); Daizy and Gehlot (2006) in aonla fresh fruits and preserve and Tripathi (1988) in aonla preserve.

The effect of varieties of aonla on organoleptic quality attributes during storage

Overall acceptability

Overall acceptability of processed aonla shreds was varied significantly (Table 3). In overall acceptability of shred product with respect to colour, texture, flavour and taste, the shreds of treatment V_5 (NA-7) was found highly acceptable and showed decreasing trend during 6 months of storage which may be due to the effect of atmospheric as well as changes in biochemical constituents of shreds as well as the physical characteristics of varieties reflect on the product qualities viz., colour, texture, flavour and Taste score. The result of the present study were conformity with those of Singh *et al.,* (2008) for aonla candy, Naik and Chundawat (1996 a & b) and Singh *et al.,* (2006) for aonla osmodehydrated product and Tripathi *et al.,* (1988) in aonla preserve.

From the study, it indicated the intermediate moisture aonla shreds was found significantly higher in V_5(NA-7) in TSS, reducing sugar, total sugar, and ascorbic acid., Significantly higher acidity and lower tannin was found in V_2 (Krishna), V_4 (GA-1 and V_3 (Chakaiya), respectively of aonla shreds. Significantly lower moisture content was found in V_5 (NA-7) which was at par with V_4 (GA-1) showed higher shelf life of intermediate moisture shreds.

The chemical constituents of intermediate moisture shreds viz., TSS, total sugar, acidity and moisture was found increasing trend, while ascorbic acid and tannin content was found decreasing trend during 6 months storage.

Significantly maximum overall acceptability were found in V_5 (NA-7) which was at par with with V_2 (Krishna) in respect of taste, flavour and texture except colour and the organoleptic quality attributes was found in decreasing trend during 6 months of storage. From above result, it can be concluded that treatment V_5 (NA-7) is the best aonla variety for preparation of intermediate moisture shreds.

Table.1 Changes in total soluble solids, total sugar and moisture during six months storage of intermediate moisture aonla shreds

Different varieties of aonla		Total soluble solids (TSS °B)				Total sugar (%)				Moisture (%)			
		0 Month	3 Months	6 Months	Mean	0 Month	3 Months	6 Months	Mean	0 Month	3 Months	6 Months	Mean
V_1	Kanchan	72.14	73.62	75.14	73.63	44.32	45.3	45.57	45.57	16.92	19.1	23.33	**19.78**
V_2	Krishna	72.74	77.84	79.59	76.72	44.73	45.8	45.79	45.79	17.5	19.54	24.4	**20.48**
V_3	Chakaiya	72.36	73.6	75.26	73.74	45.14	46.44	46.58	46.58	17.35	19.24	22.51	**20.33**
V_4	GA-1	72.4	74.68	76.63	74.57	46.5	47.55	47.77	47.77	16.5	18.92	21.41	**18.94**
V_5	NA-7	73.74	77.88	80.41	77.34	48	49.41	49.40	49.40	16.21	18.22	21.82	**18.75**
S. Em. ±		0.361	1.025	0.347		0.307	0.191	0.299		0.105	0.192	0.241	
CD at 5%		1.088	3.088	1.04		0.926	0.575	0.902		0.317	0.580	0.728	
CV %		**0.99**	**2.71**	**0.90**		**1.34**	**0.81**	**1.23**		**1.25**	**2.03**	**2.13**	

Table.2 Changes in acidity, ascorbic acid and tannin during six months storage of intermediate moisture aonla shreds

Different varieties of aonla		Acidity (%)				Ascorbic acid (mg/100 g)				Tannin (%)			
		0 Month	3 Months	6 Months	Mean	0 Month	3 Months	6 Months	Mean	0 Month	3 Months	6 Months	Mean
V_1	Kanchan	0.695	0.700	0.725	0.706	206.21	175.96	145.21	175.79	3.3	2.53	1.81	**2.54**
V_2	Krishna	0.705	0.713	0.728	0.715	210.06	181.2	156.24	182.5	3.71	2.88	1.63	**2.78**
V_3	Chakaiya	0.655	0.685	0.708	0.682	209.81	196.86	184.72	197.13	2.9	1.89	1.01	**1.93**
V_4	GA-1	0.650	0.668	0.698	0.672	205.53	173.23	156.81	178.52	3.24	2.32	1.75	**2.43**
V_5	NA-7	0.645	0.663	0.695	0.667	212.8	190.67	181.66	195.04	3.93	2.63	1.59	**2.78**
S. Em. ±		0.005	0.005	0.006		0.288	0.320	0.339		0.105	0.040	0.035	
CD at 5%		0.017	0.015	0.020		0.869	0.966	1.022		0.317	0.122	0.106	
CV %		**1.67**	**1.50**	**1.84**		**0.28**	**0.35**	**0.41**		**1.25**	**2.38**	**2.88**	

Table.3 Changes in taste score, colour score, texture score and overall acceptability score during six months storage of intermediate moisture aonla shreds

Different varieties of aonla		Overall acceptability score			
		0 Month	3 Months	6 Months	Mean
V_1	Kanchan	7.81	7.35	6.56	**7.24**
V_2	Krishna	8.43	7.93	7.50	**7.95**
V_3	Chakaiya	8.18	7.87	7.50	**7.85**
V_4	GA-1	7.56	7.18	6.50	**7.08**
V_5	NA-7	8.93	8.93	8.62	**8.82**
S. Em. ±		0.181	0.195	0.195	
CD at 5%		0.540	0.605	0.596	
CV %		**4.44**	**5.07**	**5.40**	

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