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COMPARATIVE STUDIES ON COMPOSITIONAL CHANGES IN AONLA *SUPARI* (*Emblica officinalis*) DURING STORAGE

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Abstract

Aonla, a highly valued among indigenous medicine, is highly acidic in nature and has an astringent taste. It cannot be consumed as raw by the consumers however, it shows a great potential for processing into various quality products which can have great demand in national as well as international market. In the present investigation, a comparative study of anola cultivars viz. Banarsi, Chakaiya, NA-7 and Desi were carried out to identify the best suited cultivar for processing into commercially acceptable aonla supari and to assess its storability. Aonla supari was prepared by treating blanched aonla segments with salts (white and black) for extracting water from fruit pieces by osmosis. The processed samples stored at ambient temperature were analysed for chemical parameters and subjected to organoleptic evaluation at 45 days storage intervals till 135 days. Acidity declined slightly during storage period. A gradual decrease in moisture content and water activity was also observed. Maximum pectin content 0.92 per cent was found in Banarsi. Ascorbic acid content significantly declined in all the four cultivars during 135 days storage. Retention of ascorbic acid in supari was highest in Banarsi cultivar (42.8%) followed by Chakaiya and NA-7 i.e. 41.07 and 40.06 per cent respectively. Highest overall mean scores for colour, texture, taste and overall acceptability was observed in supari prepared from Banarsi cultivar followed by Chakaiya and NA-7.

Keywords: cultivars, *supari*, chemical parameters, ambient, organoleptic evaluation

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1. INTRODUCTION

Aonla (*Emblica officinalis* G.) is among the plant materials that rich in many nutraceutical compounds and being used in Ayurveda and Unani system of medicines since ancient time. Being a very rich source of vitamin C and other nutrients like polyphenols, pectin, iron, calcium and phosphorus (Khopde *et.al.,* 2001). The fruit is a potent antioxidant, hypolipidemic, antibacterial, antiviral and antacid. Moreover, the fresh aonla fruit is highly acidic and astringent; it is not as popular as table fruit. However, excellent nutritive and therapeutic values of the fruit have great potentiality for processing into several quality products. It is highly perishable in nature, the fruit needs processing for increasing shelf life and value addition. Drying is an effective method to increase the shelf life of aonla fruit. Dried fruits are useful in chronic dysentery, diabetes, diarrhoea, dyspepsia, cough, anaemia and jaundice (Kirtikar and Basu, 1993). Studies have been carried out to prepare dried whole fruit and flakes (Verma and Gupta, 2004), shreds (Sagar and Kumar, 2006), slices (Alam et.al., 2010). There are several varieties of aonla grown throughout different parts of India. However, these varieties are yet to be researched in terms of physico chemical properties for value addition. The present research paper deals with the physico chemical attributes of different cultivars of aonla for the preparation of nutraceutical commercial products i.e. aonla *supari* by improved technology.

2. MATERIAL AND METHODS

Four cultivars of aonla viz. *Banarsi*, *Chakaiya*, NA-7 and *Desi* were procured from Akhnoor

and RRSS Raya station and analysed for physico chemical parameters (Table 1). The product aonla *supari* was prepared by blanching aonla fruits for 10-15 minutes in boiling water until fruit cracked. The fruits were drained, cooled and segments were separated from stone manually. Each segment was cut into 3-5 pieces depending on its size. Powdered common salt and black salt were then mixed thoroughly for extracting water from the fruit pieces by osmosis. The product was dried in tray drier at 60-70°C for 7-8hrs.The dried product was removed, cooled at room temperature and packed in polypropylene pouches/bags. The biochemical parameters viz. titrable acidity, moisture, pectin, ascorbic acid were estimated (Ranganna, 1977). The water activity was determined on Aqua lab 3TE equipment. The product was also assessed organoleptically on 9 point Hedonic scale as per method described in Ranganna, 1977. The data was analysed statistically and reported at 5% significance level (Panse and Sulhatame, 1951).

Table 1: Physico-chemical characteristics of fruits

Parameters	Banarasi	*Chakaiya*	NA-7	*Desi*
Average Fruit weight (g)	**30.21****	26.64	27.34	**15.63***
Average fruit height (cms)	**3.40****	3.10	3.22	**2.41***
Average diameter (cms)	**4.14** ***	3.88	3.90	**3.12***
Seed pulp ratio (%)	**1.23****	1.18	1.21	**1.14***
Moisture (%)	**86.90****	86.16	86.40	**82.10***
TSS°B	12.2	**8.1***	11.8	**13.7****
Acidity (%)	2.33	**2.18***	2.20	**2.55****
Total sugar (%)	8.03	**9.62****	8.21	**7.13***
Reducing sugar (%)	1.07	**2.01****	1.08	**1.06***
Pectin (%)	**0.53****	0.50	0.51	**0.47***
Ascorbic acid (mg/100g)	**647****	627	604	**486***

3. RESULTS AND DISCUSSION

From Table 1, among the four cultivars analysed, *Banarsi* had maximum weight 30.21g; average diameter 4.1cm and seed pulp ratio 1:1.23 per cent, this followed by NA-7 and *Chakaiya* cultivar having fruit weight of 27.34g. 26.64g; average diameter 3.9cm, 3.8cm and seed pulp ratio 1: 1.20 and 1: 1.18 per cent respectively. Similar findings were reported in *Banarsi* cultivar while comparing two varieties of aonla viz. *Banarsi* and *Chakaiya* (Singh and Arora, 1967). *Desi* cultivar had minimum weight and average diameter. *Banarsi* had maximum moisture content 86.90 per cent followed by NA-7 86.40; *Chakaiya* 86.14 and *Desi* 82.10 per cent respectively. Almost similar findings have been reported by (Singh and Arora, 1967) for moisture content in *Chakaiya* and *Desi* cultivar.

Among four cultivars, *Desi* had maximum TSS 13.7°B, followed by *Banarsi* 12.2°B; NA-7 11.8°B and *Chakaiya* 8.1°B. Maximum TSS 15.2°B have also been reported by Teaotia *et.al*., 1968, in *Desi* cultivar. *Banarsi*, NA-7 and *Chakaiya*. Maximum acidity was found in *Desi* cultivar followed by *Banarsi*, NA-7 and *Chakaiya*. Singh and Arora, 1967, have also reported higher acidity in *Banarsi* variety when compared with *Chakaiya* variety of aonla. Total sugars and reducing sugar percentage were found higher in *Chakaiya* followed by NA-7, *Banarsi* and *Desi* 9.62 and 2.01; 8.2 and 1.08; 8.03 and 1.07 and 7.13 and 1.06, respectively. Higher total sugar of 9.6 (Teaotia *et.al*., 1968) and 9.78 per cent (Singh *et.al*., 1987) have been reported for *Chakaiya* cultivar. Pectin content was found higher in *Banarsi* 0.53 per cent followed by NA-7, *Chakaiya* and then *Desi* 0.51' 0.50 and 0.47 per cent respectively. Similar results have been reported by Tripathi *et. al.,* 1988, in *Banarsi* aonla variety.

Aonla is rich in Vitamin C and the maximum ascorbic acid 647mg/100g was found in *Banarsi* followed by *Chakaiya* 627mg/100g; NA-7 640mg/100g and *Desi* 486mg/100g. These findings were quite similar with Singh and Arora, 1967, in *Banarsi* cultivar followed by *Chakaiya*. These results are also in accordance with Singh *et.al*., 1984, that *Banarsi* contained more ascorbic acid 645.5mg/100g than *Desi* 540.7mg/100g. It has been found that ascorbic acid content of the fruit varies directly with the fruit weight.

Banarsi variety was found higher in fruit weight and thus higher ascorbic acid (Singh *et.al.,* 1987).

The biochemical parameters analysed in aonla *supari* are reported in Table 2,3, and 4 respectively. The data revealed that (Table-2) acidity declined slightly during storage period in aonla *supari*. At the beginning of the storage period, the highest value of acidity 8.83 per cent was recorded in *Desi* cultivar. The minimum acidity was recorded in *Chakaiya* cultivar. The decrease in acidity might be attributed to bio conversion of acids to sugar and also there is formation of complex compounds such as citrate with salts. However decrease in acidity level in dehydrated aonla during storage have also been reported by Tripathi *et.al.,* 1988, and Mehta 1995. Moisture plays as important role in growth of microorganisms. The data in Table-3 revealed that moisture content of aonla *supari* decreased with progression of storage period. As the storage period advanced, a gradual decrease in moisture content was observed. The decrease in moisture content might be due to natural dehydration of product during storage at room temperature. Similar results have been reported in dehydrated ber (Gadakh *et.al*., 1999).

Table – 2 : Effect of storage period and cultivars on acidity (%) of aonla *supari*.

Cultivars	Acidity (%)				
	Storage Interval (Days)				
	0	45	90	135	Mean
Banarasi	8.33	8.32	8.32	8.27	8.31
Chakaiya	**8.26**	8.24	8.22	**8.22**	8.23
NA-7	8.29	8.30	8.27	8.26	8.28
Desi	**8.83**	8.82	8.80	**8.78**	8.80
Mean	**8.42**	8.42	8.40	**8.38**	

Factor	C.D.	S.E.(d)	SE(m)
Day	0.014	0.007	0.005
Cultivar	0.014	0.007	0.005
Days x Cultivar	N.S.	0.013	0.009

Water activity of aonla *supari* declined in all the cultivars till the end of storage period (Table-3). Negligible changes were recorded in pectin content of aonla *supari* during storage of 135 days. The maximum pectin content 0.91 per cent was recorded in *Banarsi* cultivar. Similarly no loss in pectin content during storage period of 4 months in dehydrated anola have been reported by Tripathi *et.al.,* (1988)[14]. The ascorbic acid content (Table-4) in aonla *supari* was significantly reduced in all the four cultivars during 135 days storage. The mean ascorbic acid content decreased from its mean initial value of 288.05mg/100g to 243.38mg/100g during storage. The decline in ascorbic acid content might be due to thermal oxidation during processing and subsequent oxidation in storage. A similar trend in reduction of ascorbic acid in direct solar dried *Banarsi* aonla has been reported by Tripathi *et.al.,* (1988)[14]. Further, ascorbic acid content of aonla products have been found to decrease during storage (Pathak, 1988 and Deen, 1992).

The retention of ascorbic acid in *supari* was highest in *Banarsi* cultivar 42.8 per cent followed by *Chakaiya* and NA-7 i.e. 41.07 and 40.6 per cent, respectively. It has been observed that adding black salt is helpful in retaining ascorbic acid. 65 per cent loss in vitamin C content during sun drying, while 34 to 72 per cent loss during artificial drying at elevated temperature has also been reported by Morten, 1987, but the product is capable to fulfil part of requirement of vitamin C in human beings. Results of sensory evaluation of the stored *supari* from four aonla cultivars are discussed in Table 5& 6 respectively. The initial colour score for *supari* is in the order of *Banarsi* (7.62) > *Chakaiya* (7.50) > NA-7 (7.42) > *Desi* (7.18) which declined to 7.03, 6.97, 6.52 and 6.22, respectively after 135 days of storage. The decrease in appeal of colour was probably due to browning reactions occurring in the product during storage. The colour decreased as the storage period increased. However, the colour of the product remained within acceptable limits even after 135 days of storage. Similar trends have been reported for colour score in dehydrated papaya and mango slices (Sagor *et.al.,* 1998).

Table – 3: Effect of storage period and cultivars on Moisture (%) and water activity (a_w) of aonla *supari*

Cultivars	Moisture (%)					Water Activity (a_w)				
	Storage intervals (Days)					Storage Interval (Days)				
	0	45	90	135	Mean	0	45	90	135	Mean
Banarasi	7.09	6.98	6.95	6.93	6.98	0.572	0.527	0.501	0.481	0.520
Chakaiya	6.98	6.86	6.82	6.78	6.86	0.558	0.510	0.488	0.356	0.478
NA-7	7.01	6.95	6.92	6.86	6.93	0.562	0.523	0.492	0.459	0.509
Desi	5.20	5.07	4.97	4.95	5.04	0.521	0.495	0.463	0.432	0.478
Mean	**6.57**	6.46	6.41	**6.38**		**0.553**	0.514	0.486	**0.432**	

Factor	C.D.	SE(d)	SE(m)	C.D.	S.E.(d)	SE(m)
Day	0.009	0.004	0.003	0.036	0.017	0.012
Cultivar	0.009	0.004	0.003	0.036	0.017	0.012
Day x Cultivar	0.018	0.008	0.006	N.S.	0.035	0.025

Table – 4 : Effect of storage period and cultivars on pectin (%) and ascorbic acid (mg/100g) of aonla *supari*

Cultivars	Pectin (%)					Ascorbic acid				
	Storage intervals (Days)					(mg/100g)				
	0	45	90	135	Mean	0	45	90	135	Mean
Banarasi	**0.91**	0.91	0.92	**0.92**	0.91	**318.72**	309.51	282.43	**272.31**	295.74
Chakaiya	0.84	0.85	0.85	0.85	0.85	306.21	293.06	277.40	257.63	283.57
NA-7	0.85	0.86	0.86	0.86	0.85	293.60	280.56	264.06	245.26	270.87
Desi	**0.76**	0.76	0.75	**0.75**	0.75	**233.70**	217.30	218.36	**194.33**	215.92
Mean	**0.84**	0.84	0.84	**0.84**		**288.05**	275.11	260.56	**242.38**	

Factor	C.D.	SE(d)	SE(m)	C.D.	S.E.(d)	SE(m)
Day	N.S.	0.003	0.002	**0.1354**	**0.0664**	**0.0470**
Cultivar	0.006	0.003	0.002	**0.1354**	**0.0664**	**0.0470**
Day x Cultivar	N.S.	0.006	0.004	**0.271**	**0.1329**	**0.0940**

Table – 5 : Effect of storage period and cultivars on colour and texture (mg/100g) of aonla *supari*

Cultivars	Colour					Texture				
	Storage intervals (Days)					Storage intervals Days				
	0	45	90	135	Mean	0	45	90	135	Mean
Banarasi	7.62	7.23	7.09	7.03	7.24	8.22	7.92	7.63	7.60	7.84
Chakaiya	7.50	7.26	7.01	6.97	7.18	8.10	7.70	7.50	7.40	7.67
NA-7	7.42	7.09	6.86	6.52	6.97	8.20	7.50	7.60	7.40	7.67
Desi	7.18	6.97	6.83	6.22	6.80	7.90	7.70	7.50	7.10	7.55
Mean	**7.43**	7.14	6.95	**6.68**		**8.10**	7.70	7.55	**7.37**	

Factor	C.D.	SE(d)	SE(m)	C.D.	S.E.(d)	SE(m)
Day	0.022	0.011	0.007	0.075	0.036	0.026
Cultivar	0.022	0.011	0.007	0.075	0.036	0.026
Day x Cultivar	0.045	0.022	0.015	0.15	0.073	0.052

Table – 6: Effect of storage period and cultivars on taste and overall acceptability of aonla *supari*

Cultivars	Taste					Overall acceptability				
	Storage intervals (Days)					Storage intervals (Days)				
	0	45	90	135	Mean	0	45	90	135	Mean
Banarasi	**8.21**	8.10	7.93	**7.56**	7.95	**8.51**	8.43	8.01	**7.81**	8.19
Chakaiya	**8.01**	7.82	7.53	**7.41**	7.69	8.32	8.14	7.82	**7.53**	7.95
NA-7	7.69	7.53	7.21	7.13	7.39	7.93	7.72	7.52	7.23	7.60
Desi	**7.51**	7.21	7.12	**6.88**	7.18	**7.62**	7.31	6.82	**6.52**	7.06
Mean	**7.85**	7.66	7.45	**7.24**		**8.09**	7.90	7.54	**7.27**	

Factor	C.D.	SE(d)	SE(m)	C.D.	S.E.(d)	SE(m)
Day	0.008	0.004	0.002	0.009	0.004	0.003
Cultivar	0.008	0.004	0.002	0.009	0.004	0.003
Day x Cultivar	0.016	0.007	0.005	0.018	0.009	0.006

Supari prepared from *Banarsi* cultivar had best colour followed by *Chakaiya* among four cultivars during storage. A gradual decrease in texture of aonla *supari* was observed in all cultivars during storage. Similar findings have been reported in dehydrated onion flakes (Kumar, 2000). Maximum score of 8.22 was recorded in *Banarsi* followed by 8.20 in NA-7 and 8.10 in *Chakaiya*. Sensory score of taste showed a gradual decrease upto 135 days of storage. At initial day maximum score of 8.21 for aonla *supari* was recorded in *Banarsi* followed by 8.01 in *Chakaiya*. Minimum score of 7.51 was recorded in *Desi* cultivar. The score for overall acceptability of aonla *supari* was highest 8.52 in *Banarsi* followed by 8.33 in *Chakaiya*. During storage period there was decrease in the mean scores from8.09 at initial day to 7.27 at the end of storage period but remained within the acceptable limits. Almost similar findings have been reported in ber (Dhawan, 1980 and Singh, 1992).

Sensory evaluation (colour, texture, taste and overall acceptability) indicated that *Banarsi*, *Chakaiya* and NA-7 cultivars of aonla can be suitable used for preparation of aonla *supari*. Further aonla *supari* prepared is light in colour and softer in texture as compared to market samples that are dark brown/black in colour and not so palatable. Taste wise it is also better. Blanching with hot water before drying checks the enzymatic spoilage and also improves the colour and texture of the *supari*. Similar findings have been reported in aonla shreds (Prajapati *et.al.*, 2009). The present findings are also supported by Singh et.al., 2006, who obtained aonla cultivars NA-7 of excellent sensory quality when dried after blanching with hot water and with KMS.

4. CONCLUSION

On the basis of ascorbic acid retention and sensory evaluation, *Banarsi* cultivar was found to be best for preparation of aonla *supari* followed by *Chakaiya* and NA-7 cultivar.

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