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Research Paper

Suitability of varieties for aonla chutney

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■ **ABSTRACT :** Chutney samples were prepared using fruits of NA-6, NA-7 and Chakaiya for storage studies. A recipe consisting of 1.0 kg fruit, 1.5 kg sugar, 50 g salt, 15 g ginger, 25 g hot spices, 10 g red chilli, 10 ml glacial acetic acid was found most ideal to prepare chutney. The prepared chutney samples were kept under ambient condition for storage study. The chutney remained acceptable upto 150 days. The chutney prepared from fruits of the cultivar NA-7 had highest content of ascorbic acid, total soluble solids, TSS/acidity ratio, pH, total sugar, non-reducing sugar and also scored highest organoleptic value at initial stage. While, the content of acidity and reducing sugar were found to be highest in chutney prepared from cultivars NA-6 and Chakaiya. During the storage period of chutney, the acidity, TSS, total sugar, reducing sugar and microbial evaluation (bacterial counts, yeast counts and mould counts) showed increasing trend while ascorbic acid, pH, TSS/acidity ratio, non-reducing sugar and organoleptic evaluation showed decreasing trend with advancement of storage period till 150 days under ambient condition. The chutney prepared from fruits of cultivar NA-7 had the B : C ratio, good sensory evaluation and high nutritional quality which could be considered suitable for developing chutney processed products for commercialization.

■ **KEY WORDS :** Indian gooseberry, Chutney, Biochemical composition, Microbial examination, Organoleptic evaluation

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Aonla being hardy, amenable to cultural practices, remunerative, nutritious, prolific bearer, finds due importance in horticultural scenario of the country. Its stress tolerance mechanism makes it suitable to grow even under stress environment over wasteland. Aonla is a quite hardy, prolific bearer and highly remunerative even without much care. The trees thrive well throughout the tropical and subtropical parts of India and is found growing wild or in cultivated form in different parts of the country. It can be grown easily under conditions where other fruit crops do not thrive well. It is the richest source of ascorbic acid among fruit except Barbados cherry. The fruit has important place as a source of mineral, carbohydrate, B-carotene, thiamine, riboflavin. The stability of ascorbic acid accounted to the presence of polypohenols adds special value of to aonla fruits in human health. The gallic acid present in aonla fruit has antioxidant property. The amenability of fruits to value added products is worth exploiting when there is massive demand of health safe green foods in the market. Owing to restricted marketing as fresh fruit consumption and high perishability of aonla fruits, value addition and processing would be the only effective tool for economic utilization of increased production of aonla in future. This will avoid glut of aonla fruits during the season and will definitely safeguard the overall interest of the farmers to bag lucrative price out of cultivation of fruit which is essential too to really keep the growers interest intact with aonla cultivation. Information is limited on processing into aonla chutney. Therefore, the present investigation was necessitated so as to standardize cultivar for processing aonla into chutney while studying its nutritional attributes as well as storability.

■ RESEARCH METHODS

The present study was carried out at the Department of Horticulture, College of Agriculture, SKRAU, Bikaner (Rajasthan) during the year 2006-07. Mature fruits of the cultivars NA-7, NA-6 and Chakaiya were selected for the preparation of chutney. The fruits were washed in running water to remove dirt and dust particles. They were sliced into small pieces and seeds were removed by using hand crusher. The slices were ground by adding warm water to half volume of fruits in a waring blender. The whole mass was obtained in the form of fine pulp. After getting the pulp,

Table A : Chemical composition of different aonla cultivars at mature fruits

Character/ Cultivar	TSS (°Brix)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	pH	Acidity (%)	Ascorbic acid (mg/100 g)	TSS / acidity ratio
NA-6	13.05	3.95	2.39	1.56	2.45	2.24	672.65	5.82
NA-7	14.16	3.12	2.05	1.07	2.51	2.06	765.74	6.87
Chakaiya	12.73	4.53	2.43	2.10	2.32	2.34	575.43	5.44
C.D.	0.80	0.54	0.14	0.11	0.22	0.13	4.89	0.23

the requisite quantity of ingredients as per recipe (1.0 kg fruit, 1.5 kg sugar, 50 g salt, 15 g ginger) was mixed to develop the products. All the ingredients were cooked in water for 20 minutes to make a uniform consistent product. Thereafter, 10 g red chilli and 25 g hot spices were added as per recipe and mixture was cooked for another 10 minutes. Finally, 10 ml glacial acetic acid was added to the prepared chutney and again cooked for 5 minutes to obtain semi-solid aonla chutney of uniform consistency. The products were poured into hot and dry sterilized bottles of 500 g capacity and after lidding, it was sealed with wax emulsion. The bottles of chutney were kept at ambient condition for further study. Samples were drawn out at monthly interval and analyzed for their biochemical quality constituents till the acceptability of the product. The physico-chemical composition *viz.*, TSS was determined by hand refractrometer, while total sugar, reducing sugar, acidity ascorbic acid and microbial counts were estimated through standard methods as suggested by Ranganna (1997). Non-reducing sugar was determined by subtracting the value of reducing sugar from total sugar. The pH value was taken on digital pH meter. The TSS/acidity ratio was determined by dividing TSS with acid content. Organoleptic evaluation was done using 9 point Hedonic scale (Amerine *et al.*, 1965). The data were statistically analyzed applying Completely Randomized Design.

■ RESEARCH FINDINGS AND DISCUSSION

The findings obtained from the present study have been discussed under the following sub-heads:

Biochemical changes:

The biochemical composition in chutney showed changing trend with advancement of storage period till 150 days at ambient condition (Table 2). The ascorbic acid, pH, TSS/acidity ratio and non-reducing sugar were found to decrease with advancement of storage period at ambient condition in chutney irrespective of cultivars the fruits of which were used for the preparation. The ascorbic acid content was observed significantly higher in the chutney prepared from fruits of cultivar NA-7 (255.31 mg/100 ml) followed by NA-6 (240.36 mg/100 ml) and Chakaiya (206.79 mg/100 ml) at the initial stage. Almost similar trend was observed upto 150 days. At the end of 150 days of storage, chutney prepared from fruits of cultivar NA-7 contained maximum ascorbic acid (112.11 mg /100 ml), which was significantly higher than those prepared from NA-6 (97.14 mg/100 ml) and Chakaiya (64.31 mg/100 ml) fruits. The decrease in ascorbic acid in chutney during storage might be due to oxidation of ascorbic acid to dehydroascorbic acid. It has also been observed by other workers in case of storage of turnip pickle (Bhasin and Bhatia, 1981) and papaya chutney (Gupta, 2000). The non-reducing sugar content was observed to be higher in the chutney prepared from fruits of cultivar NA-7 (26.82%) followed by NA-6 (19.56%) and Chakaiya fruits (18.45%) at the time of preparation. Almost same trend was observed upto 150 days of storage. At the end of 150 days of storage, chutney prepared from fruits of cultivar NA-7 contained maximum non-reducing sugar (22.21%), which was significantly higher than NA-6 (15.20%) and Chakaiya (13.77%). The chutney prepared from fruits of cultivar NA-7 (28.22) had significantly higher TSS/acidity ratio followed by NA-6 (25.88) and Chakaiya (23.44) fruits at the time of preparation. Thereafter, a similar trend was observed upto 150 days of storage. At the end of storage, the chutney prepared from fruits of cultivar NA-7 (23.67) contained maximum TSS/acidity ratio followed by NA-6 (21.99) and Chakaiya (19.82). The TSS/acidity ratio in chutney decreased with advancement of storage period till 150 days in ambient condition. Since both TSS and acidity variables are dependent on each other, the TSS/acidity ratio also showed decreasing trend. The product prepared from fruits of cultivar NA-7 (1.62) had significantly a higher pH followed by NA-6 (1.55) and Chakaiya (1.44). During storage, the chutney prepared from fruits of cultivar NA-7 contained maximum pH at all stages upto 150 days. The decrease in pH was due to breakdown of organic matter into simple organic acids.

The biochemical composition *i.e.*, acidity, TSS, total and reducing sugar showed increase with advancement of storage period till 150 days under ambient condition. The acidity increased and was found to be significantly higher in the chutney prepared from fruits of cultivar Chakaiya (1.74%) followed by NA-6 (1.70%) and NA-7 (1.59%). Almost same trend was observed upto 150 days. At the end of 150 day of storage, aonla chutney prepared from fruits of cultivar Chakaiya contained maximum acidity (2.14%), which was significantly higher than NA-6 (2.05%) and NA-7 (1.93%). The acidity increased with advancement of storage period till

Table 1 : Effect of different cultivars on biochemical composition of stored aonla chutney

Storage /	Ascorbic acid (mg / 100 ml)						Non-reducing sugar (%)						pH					
Cultivars	0	30	60	90	120	150	0	30	60	90	120	150	0	30	60	90	120	150
NA-6	240.36	223.10	206.78	179.92	135.95	97.14	19.65	18.85	17.96	16.91	15.85	15.20	1.55	1.51	1.45	1.37	1.34	1.29
NA-7	255.31	237.36	220.05	199.39	153.69	112.11	26.82	26.03	25.13	24.22	23.24	22.21	1.62	1.58	1.51	1.47	1.41	1.36
Chakaiya	206.79	182.26	166.52	158.78	116.86	64.31	18.45	17.64	16.69	15.58	14.58	13.77	1.41	1.39	1.37	1.33	1.28	1.22
Mean	234.16	214.24	197.78	179.36	135.50	91.19	21.64	20.84	19.93	18.90	17.89	17.06	1.52	1.49	1.44	1.41	1.35	1.29
C.D. (P=0.05)	0.614	0.597	0.654	0.597	1.453	1.236	0.186	0.186	0.505	0.597	0.505	0.597	0.007	0.028	0.067	0.027	0.017	0.037
Storage /	TSS/Acicity ratio						Acidity (%)						TSS (^{0}Brix)					
Cultivars	0	30	60	90	120	150	0	30	60	90	120	150	0	30	60	90	120	150
NA-6	25.88	25.01	24.41	23.65	22.86	21.99	1.70	1.77	1.82	1.89	1.96	2.05	42.73	42.94	43.30	43.49	43.72	43.99
NA-7	28.22	27.23	26.29	29.03	24.59	23.67	1.59	1.65	1.72	1.78	1.85	1.93	46.96	47.04	47.38	47.64	47.87	48.12
Chakaiya	23.44	22.53	21.87	21.25	20.52	19.82	1.74	1.81	1.89	1.96	2.04	2.14	39.49	39.71	40.07	40.35	40.59	40.90
Mean	25.84	24.92	24.20	24.64	22.59	21.83	1.68	1.75	1.81	1.88	1.95	2.04	43.06	43.23	43.58	43.83	44.06	44.34
C.D. (P=0.05)	0.175	0.775	0.375	0.217	0.817	0.676	0.017	0.016	0.016	0.016	0.018	0.016	0.453	1.236	1.506	1.506	1.603	2.028
Storage /	Reducing sugar (%)						Total sugar (%)						Bacterial counts ($X10^{-3}$ cfu/ml)					
Cultivars	0	30	60	90	120	150	0	30	60	90	120	150	0	30	60	90	120	150
NA-6	17.02	18.02	19.15	20.36	21.55	22.81	36.66	36.88	37.12	37.27	37.50	38.02	0.21	0.28	0.35	0.41	0.56	0.68
NA-7	13.71	14.73	15.87	16.93	18.14	19.30	40.53	40.76	41.00	41.15	41.38	41.51	0.13	0.20	0.23	0.29	0.38	0.45
Chakaiya	15.58	16.60	17.80	19.09	20.33	21.50	34.03	34.27	34.49	34.67	34.92	35.28	0.26	0.34	0.41	0.48	0.69	0.86
Mean	15.43	16.45	17.61	18.79	20.04	21.21	37.07	34.30	37.53	37.69	37.93	38.27	0.20	0.28	0.33	0.39	0.54	0.66
C.D. (P=0.05)	0.025	0.016	0.016	0.017	0.017	0.017	0.614	0.597	0.654	0.597	0.597	0.505	NS	NS	NS	NS	NS	NS
Storage /	Yeast counts ($X10^{-3}$ cfu/ml)						Mould counts ($X10^{-3}$ cfu/ml)						Organoleptic score					
Cultivars	0	30	60	90	120	150	0	30	60	90	120	150	0	30	60	90	120	150
NA-6	0.21	0.27	0.35	0.47	0.55	0.67	0.27	0.36	0.47	0.56	0.64	0.73	8.77	8.57	8.46	8.15	7.64	7.10
NA-7	0.15	0.19	0.30	0.32	0.38	0.48	0.20	0.22	0.32	0.38	0.45	0.52	8.85	8.74	8.54	8.24	7.74	7.24
Chakaiya	0.28	0.35	0.47	0.57	0.65	0.77	0.32	0.40	0.57	0.65	0.74	0.90	8.70	8.50	8.39	8.06	7.55	6.99
Mean	0.21	0.27	0.37	0.45	0.53	0.64	0.26	0.33	0.45	0.53	0.61	0.72	8.78	8.57	8.47	8.15	7.64	7.11
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS=Non-significant

150 days in ambient condition. The increase in acidity was due to oxidation of organic content into organic acids due to metabolism of microbes present in chutney. The TSS was found to be significantly higher in the chutney prepared from fruits of cultivar NA-7 (46.96 ^{0}Brix) followed by NA-6 (42.73 ^{0}Brix) and Chakaiya (39.49 ^{0}Brix). Further, almost similar trend was observed upto 150 days. At the end (150 days) of storage, the chutney prepared from fruits of cultivar NA-7 contained maximum TSS (48.12 ^{0}Brix), which was significantly higher than NA-6 (43.99 ^{0}Brix) and Chakaiya (40.90 ^{0}Brix). The increased TSS in chutney during storage might be due to the gradual loss in moisture which resulted in increased concentration of total soluble solids. In addition to loss of moisture, the breakdown of complex/organic molecules to simple forms might also increased TSS. Similar results were also reported in sweet papaya chutney (Gupta, 2000).The reducing sugar content in aonla chutney was observed to be maximum in the chutney prepared from fruits of cultivar NA-6 (17.02%) followed by Chakaiya (15.58%) and NA-7 (13.71%). Similar trend was observed upto 150 days of storage. At the end of 150 days of storage, chutney prepared from fruits of cultivar NA-6 contained maximum reducing sugar (22.81%), which was significantly higher than Chakaiya (21.50%) and NA-7 (19.30%). The total sugar content was observed to be significantly higher in the chutney prepared from fruits of cultivar NA-7 (40.53%) followed by NA-6 (36.66%) and Chakaiya (34.03%). Almost same trend was observed upto 150 days of storage. The chutney prepared from fruits of NA-7 contained maximum total sugar (41.51%), which was significantly higher than NA-6 (38.02%) and Chakaiya (35.28%) at 150 day of storage. The total sugar increased with advancement of storage period under ambient condition. The increase in reducing sugar as well as the total sugar corresponded to the increase in total soluble solids (TSS) and ultimate decrease in non-reducing sugar in chutney during storage period. The variation in different fractions of sugar might be due to gradual loss of moisture and hydrolysis of starch and pectin and inversion of non-reducing sugar to reducing sugar, as increase in reducing sugar was correlated with the decrease in non-reducing sugar. The increased level of total sugar was probably due to conversion of starch and pectin into simple sugars. Similar finding were reported by Gupta (2000) in papaya chutney.

Microbial examination:

The microbial examination indicated increase during storage till 150 days under ambient condition (Table 2). The bacterial counts was observed to be the maximum in the chutney prepared from fruits of cultivar Chakaiya (0.26 x 10^{-3} cfu/ml) followed by NA-6 (0.21 x 10^{-3} cfu/ml) and NA-7 (0.13 x 10^{-3} cfu/ml) at the time of chutney preparation. A similar trend was observed upto 150 days of storage. At the end of 150 days of storage, chutney prepared from fruits of cultivar Chakaiya had maximum bacterial counts (0.86X10^{-3} cfu/ml), which was higher than NA-6 (0.68 x 10^{-3} cfu/ml) and NA-7 (0.45 x 10^{-3} cfu/ml). The level of yeast counts was found to be higher in the chutney prepared from fruits of cultivar Chakaiya (0.28 x 10^{-3} cfu/ml) followed by NA-6 (0.21 x 10^{-3} cfu/ml) and NA-7 (0.15 x 10^{-3} cfu/ml) at the time of chutney preparation. Almost same trend was observed upto 150 days of storage. At the end of 150 days of storage, aonla chutney prepared from fruits of cultivar Chakaiya had maximum yeast counts (0.77 x 10^{-3} cfu/ml), which was maximum than NA-6 (0.67 x 10^{-3} cfu/ml) and NA-7 (0.48 x 10^{-3} cfu/ml). The mould counts in aonla chutney was observed to be higher in the chutney prepared from fruits of cultivar Chakaiya (0.32 x 10^{-3} cfu/ml) followed by NA-6 (0.27 x 10^{-3} cfu/ml) and NA-7 (0.20 x 10^{-3} cfu/ml). Almost same trend was observed upto 150 days of storage. The chutney prepared from fruits of cultivar Chakaiya had maximum mould counts (0.90 x 10^{-3} cfu/ml), which was maximum than NA-6 (0.73 x 10^{-3} cfu/ml) and NA-7 (0.52 x 10^{-3} cfu/ml) at 150 day of storage. The variation observed in total microbial counts might be due to contamination occurred during preparation and evaluation of the product. Similar findings were reported in the value added aonla products by Sharma (2005).

Organoleptic evaluation:

Organoleptic evaluation of chutney was carried out at 30 days interval by a panel of five judges. The scores are presented in Table 2. It is apparent from the score data that organoleptic rating of chutney exhibited decreasing trend ireespective of the fruits of cultivars used to prepare the product with advancement of storage period upto 150 days under ambient condition. The chutney prepared from fruits of cultivar NA-7 scored maximum (8.85) at the time of preparation. The same trend was observed upto 150 days of storage period. At the end of 150 days of storage, the chutney prepared from fruits of cultivar NA-7 and NA-6 were found highly acceptable for consumption. The decrease in organoleptic score might be due to the breakdown of complex metabolites into simpler one leading to volatilization of flavoriferous components.

Economics analysis:

The chutney prepared from fruits of cultivar NA-7 (1.88 : 1) had the highest B : C ratio followed by those prepared from fruits of Chakaiya (1.74 : 1) and NA-6 (1.72 : 1). It may be due to variation in ratio and recipe ingredients used to prepare the product. Similar findings were also reported in the value added products of aonla by Sharma (2005).

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