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Studies on Preparation of Value Added Herbal Kinnow – Aonla Beverages (RTS and Squash) during Storage

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ABSTRACT

The comparative studies on compositional changes in value added kinnow – aonla blended beverages such as RTS and squash revealed that there was increase in level of TSS and acidity with decrease in pH, ascorbic acid and organoleptic parameters was observed during storage period (eight months). The concept of formulation of kinnow and aonla mix beverage with three levels of each cardamom and ginger as herbal additives. All the herbal treatments were found better in respect of TSS, pH, acidity and ascorbic acid content over control. Among the beverages, kinnow – aonla squash recorded significantly the highest TSS, acidity and ascorbic acid. All the sensory parameters except color, texture, taste and overall acceptability declined significantly during storage period (eight months). Based on the overall acceptability kinnow – aonla blended beverages such as RTS and squash the ginger added treatments was the most acceptable, but was slightly costlier as compared to cardamom based treatments.

Key words: *Kinnow, Aonla, Beverages, Ascorbic acid, Cardamom, Ginger, RTS, Squash.*

INTRODUCTION

The aonla (*Emblica officinalis* syn. *Phyllanthus emlica*), is an important minor fruit and a crop of commercial significance. The fruits of aonla are very extensively utilized by processing industry. It is an essential ingredient of *Chyawanprash*, a popular *ayurvedic* medicine Madhuri[18] *et al*. Fruits can also be dried and powdered to be used subsequently in the preparation of oils, hair dyes and hair oils. In traditional medicine it is considered a health and vitality restorer. Khan[16] have reported the fresh fruit of aonla is very rich source of ascorbic acid (454.40 mg/100g) and appreciable source of total sugar (7.53mg/100g), calcium (14.91 mg/100g), iron (0.62 mg/100g) and phosphorus (11.81 mg/100g) and also has great potential for processing. Vijay [32] *et al.* noted that vitamin 'C' content is in no way lower than that of Barbados cherry. A number of the products like jam, squash, candy, dried shreds, powder, tablets, chutney, murabba and preserve may be prepared with ease from aonla fruit Priyanka[23] *et al.*

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Kinnow Mandarin (*Citrus reticulata*) is one of the most popular citrus fruit having attractive bright colour, appealing taste and flavor. There is a great potential to use this fruit in value added products such as juice, squash and RTS drinks Aggarwal and Sandhu[1]. These types of citrus drinks are probably the most recognized and globally accepted fruit drinks Vikram and Nishad[35]; Ullah[31] *et al*.

Young ginger rhizomes are juicy and fleshy with a very mild taste. They are often pickled in vinegar or sherry as a snack or just cooked as an ingredient in many dishes. They can also bestrewed in boiling water to make ginger tea, to which honey is often added. Ginger is a useful food preservative and has been proven to kill the harmful bacteria *Salmonella* Ali[2] *et al*.

Green cardamom in South Asia is broadly used to treat infections in teeth and gums, to prevent and treat throat troubles, congestion of the lungs and pulmonary tuberculosis, inflammation of eyelids and digestive disorders. Cardamom is used as a spice and as an medicine in systems of the traditional Chinese medicine in China, Japan, Korea and used in Ayurveda in India. Green cardamom powder is used as a spice for sweet dishes as well as traditional flavouring in coffee and tea Alvarez and Gudiel[3].

Introduction of new types of value added and blended beverages with kinnow and aonla might increase the taste and flavors with improve socio-economic status of the country. Aonla and kinnow fruits are not commonly use on table purpose but both have very high nutritional quality. In this condition value added products are the only option left to receive a considerable amount of attention reflecting a growing awareness of the potential of these products in the market place Chadha[7]. The development of any process for its economical utilization would be of great benefit to the beverage industry and fruits growers. These could be particularly useful in place where there is lack of employment, food and improper nutrition leading to deficiencies of certain nutrients. The development of nutritionally value added product with kinnow and aonla could help on improving the health of consumers.

MATERIALS AND METHODS

Fully ripened, mature, fresh and sound kinnow and aonla fruit were purchased from the orchard of the Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad and the materials such as sodium benzoate was sourced from the P.G. laboratory, Deportment of Horticulture, SHIATS, Allahabad. Commercial grade white crystalline cane sugar, big green cardamom and big size dried ginger were also purchased from local market. Matured, uniform diseased free aonla fruits were selected. Fruits were then washed properly in tap water so that dirt that adhered on the fruits was properly cleaned. After pricking fruits were dipped in 2% salt solution for 24 h., then washed with clean water and again dipped in 2% alum solution for 24 hrs., further washed with clean water and then blanched in boiling water for 10 mins. Then seeds were removed and segments were separate then passing through juicer to get juice. Kinnow fruits were washed in tap water and then were peeled and divided into halves. Fruit juice was extracted with a citrus juice extractor. After juice extraction the juices were kept for 24 hours in refrigerator (4 - 2°C) for sedimentation. Then the clear juice was siphoned off and strained through muslin cloth. Kinnow and aonla raw juice was heated at 96^{o}C for two minute to inactivate enzymes. Following the heating juice was filtered through 8-folded cheese cloth to eliminate particulates and then cardamom and ginger extract were heated at 96^{o}C for 15 minute and also filtered through 8-folded cheese cloth. All prepared juices, sodium benzoate and sugar were blended in high speed blender at 8000 rpm for 2 min. Six treatments combination were formulated with sugar and herbs (cardamom and ginger). The combinations of herbs in used kinnow – aonla RTS and Squash treatments are following T_0 (without herbal extract), T_1 (0.5% Cardamom extract), T_2 (1.0% Cardamom extract), T_3 (1.5%

Cardamom extract), T_4 (0.5% Ginger extract), T_5 (1.0% Ginger extract) and T_6 (1.5% Ginger extract). Preparation of kinnow - aonla RTS beverage aonla juice (10%) + kinnow juice (5%) and in squash aonla juice (30%) + kinnow juice (5%) were used**.** The prepared beverage was kept in 250 ml transparent and pre-sterilized glass bottles along with 1000 ppm SO2. After bottling, all juice samples were again heated at 96^{o}C for 20 min. Then samples were cooled with tap water and stored at 4°C. Treated RTS and squash samples are evaluated at (30 days intervals) at 8 months storage for physiochemical analysis and sensory evaluation.

PHYSIOCHEMICAL ANALYSIS

The total soluble solids in the all treatments of kinnow – aonla RTS and Squash samples were directly recorded by the help of hand refractrometer (Erma made Japan) for eight months storage at 30 days intervals. A hand refractometer is based on the principle of total refraction. The refractometer is first checked for accuracy before use by placing a few drops of distilled water on the prism in the specimen of the refractometer with the help of a glass rod after folding back the cover. A few drops of well homogenized sample were taken on prism of refractometer and direct reading was taken by reading the scale in meter and the results were expressed as per cent soluble solids (°Brix) and the values were corrected at 20^{o}C as described in AOAC [4]. The pH of each kinnow – aonla RTS and Squash sample was determined with the help of digital pH meter. The pH meter was standardized by using buffers of pH 7.00 and 4.00 prior to recording pH of the samples. A sufficient quantity (50mL) of Beverage was taken in 100mL beaker and pH meter was used to record pH according to method described by Rangana [25]. The ascorbic acid in kinnow – aonla RTS and Squash sample was determined by Freed [12] sample solution equivalent to 0.2mg ascorbic acid mL^{-1} was prepared in water containing 3% (w/v) metaphosphoric acid. It was titrated against standard 2, 6-dichlorophenol indo-phenol (2, 6 DCIP) solution of 0.5 mg mL^{-1} concentration until the pink colour developed completely. The acidity in each sample was determined according to standard procedure given in AOAC [4], 10mL of Beverage along with 100mL water was taken and then titrated with 0.1 N NaOH using phenolphthalein as an indicator (1-2 drops) till light pink color was achieved.

SENSORY EVALUATION

Kinnow – aonla RTS and Squash beverages were stored at room temperature for a period of 8 months by drawing samples at 0, 30 and 60 days (30 days intervals). In kinnow – aonla RTS and Squash beverages storage intervals to evaluate changes in chemical and organoleptic parameters. Standard sensory evaluation procedures were followed to perform descriptive analysis; panelists were trained using repeated round table and individual evaluations of trial formulations of the control and value added samples. The products were also evaluated for sensory qualities viz., color, texture and taste and overall acceptability by a panel of 10 judges using a 9-point Hedonic scale where, score 1 is for 'dislike extremely' and 9 for 'like extremely'. Hedonic scale method as described by (Morten [19] *et al.* was used for the organoleptic evaluation of kinnow – aonla RTS and Squash during storage period.

STATISTICAL ANALYSIS

Statistical analyses of data were done by using ANOVA on all experimental groups with three replicates each. The data were statistically analysed by using (CRD) design with 6treatments of different value additions. Calculation was done as suggested by Fisher[11].

RESULTS AND DISCUSSION

The changes in chemical composition of kinnow – aonla RTS and Squash are presented in Table 1. The TSS level of kinnow – aonla RTS and Squash was found to increase significantly irrespective of the end of eight months of storage. All the ginger treatments levels were proved better in relation to TSS over cardamom respectively. This might be due to solubilisation of juice constituents during storage and hydrolysis of

polysaccharides. Similar results were reported by Gaikwad[13] *et al.* in their studies on aonla – ginger RTS; these results are also in agreement with previous studies of Kumar[17] *et al.* while studying on therapeutic ready to serve made from blend of Aloe vera, aonla and ginger juice. Cardoso and Bolini[6] were reported same trend of TSS in peach nector.

The pH has great importance to maintain shelf stability; pH can also influence the flavour and processing requirements of the kinnow – aonla RTS and Squash. In thepresent study, the pH level of RTS was lower than squash. The storage intervals also influenced the pH of the kinnow – aonla RTS and Squash. A decline in pH towards acidic region was noticed as the storage of beverage increased. Similar trend of decreasing pH in blended papaya - aloe vera ready to serve beverage was also reported by Boghani[5] *et al*., Nath and Yadav[20] were also reported in ginger kinnow squash.

The Acidity level increased significantly with corresponding decreased in pH irrespective of the treatments during storage. This is also an important attribute because tartness is a major factor in the acceptability of kinnow – aonla RTS and Squash. Acid gives the characteristic sourness to the product. Citric acid is the major acid in kinnow and aonla juice that enhance the characteristic flavor of kinnow – aonla Squash. Highest acidity in aspartame treated sample was due to acidic nature of aspartame. This might be attributed to chemical reactions between organic constituents of fruit juice induced by temperature and action of enzymes during storage Patel[22] *et al*. Similar observations were also reported by Satwadhar[26] *et al*., Aggarwal and Sandhu[1] in kinnow juice and Chandan[8] *et al.* in aonla RTS beverages.

Marginal differences in ascorbic acid contents were observed in kinnow – aonla RTS and Squash various treatments. Statistical Analysis showed that the results are highly significant for storage period. Ascorbic acid contents decreased significantly at all storage intervals. These losses of ascorbic acid were attributed to the effect of processing, storage time and exposure to light. The degradation of ascorbic acid in Morinda citrifolia juice may follow aerobic and an-aerobic pathways Satwadhar[26] *et al*. Similar decreasing trend for ascorbic acid contents in Vitamin C enrichment of fruits juice based ready to serve beverages through blending of Indian gooseberry juice was also reported by the Jain[14] *et al.* and Vikram[34] *et al.*, in aonla candy. Deka[10] *et al.* also found same changes in lime – aonla spiced beverages.

The data pertaining to the changes in sensory qualities of kinnow – aonla RTS and Squash are presented in Table 2. The RTS and squash had highly acceptable colour without any significant variation among them and showed a decline in score values during storage. The most acceptable treatment according to colour was found in ginger based RTS and Squash. As the storage period increased, a slight decline in color score. Previous studies by Ram[24] *et al.* reported similar loss in color during storage of blended aonla and bael RTS beverages. Deen and Singh[9] also reported in karonda squash.

As regards textural qualities, kinnow – aonla RTS and Squash recorded maximum points for texture and it was observed that addition of ginger which was preferred by the panel. Due to the optimum level of ingredients like ginger 1.5% was found better followed by cardamom. A significant variation was observed in flavour perception of kinnow – aonla RTS and Squash beverage at various storage levels. The maximum scores for texture was observed in T_6 1.5% ginger when it was freshly prepared. As the storage period increased, a slight decline in texture score was experienced Table 2. The gradual loss in texture scores over the entire storage period was due to changes in volatile compounds of kinnow – aonla RTS and Squash. Texture deterioration in beverage products was also reported by Sowjanya[29] *et al.* and Vikram and Prasad[33]. Similar observations have been made by Jaiswal[15] *et al.* in aonla squash.

In organoleptic evaluation taste is very important factor after colour and texture.

Statistical Analysis revealed a significant affects of treatment and storage on taste of kinnow aonla RTS and Squash. The ginger based sample got higher scores of taste was followed by cardamom. It was noted that kinnow – aonla produces without herbs got less scores as compared to kinnow – aonla RTS and Squash both samples in which combination of herbals were used. A significant variation was observed in taste of kinnow – aonla RTS and Squash at various storage levels. The gradual loss in taste scores over the entire storage period was due to changes in volatile compounds of the aonla beverages. The flavor and taste difference and loss might be due to time and temperature and duration of storage. Similar findings were also reported by Yadav[36] *et al.* in whey based banana herbal beverages. These findings are in accordance with that of Sogi and Singh[28] in kinnow squash.

Among the kinnow –aonla RTS and squash ginger based treatments were recorded highest sensory score for overall acceptability. Higher level of herbal extract could not produce top acceptability due to deviation from standard colour, texture and taste of the product retained after 8th month of storage. Though, the best result was recorded Ginger based kinnow – aonla RTS and squash. No certain pattern was observed with overall acceptability with treatment concerned. In general, sensory score for overall acceptability declined significantly throughout the storage Singh [27] *et al.* in mixed fruits squash. This has been due to continuous decline in colour and taste acceptability of the beverages. Storage duration had influence on overall acceptability after 8th months of storage and liked by the panel of judges due to its excellent colour, texture and taste. Nidhi[21] *et al.* and Tiwari and Deen[30] also reported decreasing trend in overall acceptability of bael, guava and aloe vera RTS in storage.

Table 1: Effect of treatments on physiochemical properties of Kinnow – Aonla RTS and Squash

Treatments	Period of storage (month)							
	RTS				Squash			
	0	4	8	Mean	0	4	8	Mean
Colour								
T0	6.12	5.96	5.51	**5.86**	7.00	6.45	5.73	**6.39**
T1	6.20	6.00	5.59	**5.93**	7.54	6.91	6.09	**6.85**
T2	6.37	6.13	5.84	**6.11**	7.64	7.00	6.36	**7.00**
T3	6.85	6.70	6.42	**6.66**	8.00	7.27	6.66	**7.31**
T4	6.60	6.51	6.20	**6.44**	7.82	7.18	6.64	**7.21**
T5	7.21	7.13	6.96	**7.10**	8.18	7.64	7.00	**7.61**
T6	7.05	6.84	6.59	**6.83**	8.27	7.73	7.09	**7.70**
S. Ed. (±)	0.077	0.095	0.080		0.1512	0.2654	0.0278	
C. D. (P =0.05)	0.178	0.218	0.185		0.3221	0.5653	0.0592	
Texture								
T0	6.60	6.45	6.20	**6.42**	7.18	6.45	5.73	**6.45**
T1	6.97	6.81	6.55	**6.78**	7.35	6.64	5.91	**6.63**
T2	7.33	7.16	6.88	**7.12**	7.82	7.18	6.45	**7.15**
T3	7.21	7.07	6.83	**7.04**	7.91	7.22	6.50	**7.21**
T4	7.73	7.56	7.30	**7.53**	8.09	7.36	6.73	**7.39**
T5	8.08	7.90	7.62	**7.87**	8.18	7.64	6.91	**7.58**
T6	7.90	7.75	7.47	**7.71**	8.91	8.18	7.45	**8.18**
S. Ed. (±)	0.098	0.127	0.077		0.1080	0.1975	0.2808	
C. D. (P =0.05)	0.224	0.293	0.177		0.2301	0.4207	0.5982	
Taste								
T0	7.32	7.20	6.90	**7.14**	7.00	6.27	5.54	**6.26**
T1	7.54	7.40	7.20	**7.38**	7.82	7.09	6.36	**7.09**
T2	7.55	7.41	7.23	**7.40**	7.91	7.36	6.73	**7.33**
T3	6.98	7.55	7.40	**7.31**	8.00	7.27	6.64	**7.30**
T4	8.00	7.84	7.62	**7.82**	8.18	7.64	7.18	**7.67**
T5	8.45	8.32	8.12	**8.30**	8.36	7.73	7.09	**7.73**
T6	8.23	8.11	7.91	**8.08**	9.36	8.72	8.18	**8.75**
S. Ed. (±)	0.095	0.092	0.089		0.1389	0.2253	0.3086	
C. D. (P =0.05)	0.218	0.211	0.204		0.2958	0.4799	0.6573	
Overall acceptability								
T0	6.70	6.55	6.21	**6.49**	7.06	6.36	5.67	**6.36**
T1	6.90	6.74	6.44	**6.69**	7.79	7.18	6.51	**7.16**
T2	7.07	6.90	6.64	**6.87**	7.91	7.21	6.61	**7.24**
T3	7.24	7.11	6.87	**7.07**	7.57	6.88	6.12	**6.86**
T4	7.42	7.30	7.03	**7.25**	8.09	7.42	6.80	**7.45**
T5	7.91	7.77	7.55	**7.74**	8.24	7.46	7.00	**7.57**
T6	7.73	7.56	7.33	**7.54**	8.85	8.21	7.57	**8.21**
S. Ed. (±)	0.094	0.249	0.138		0.1234	0.2099	0.1512	
C. D. (P =0.05)	0.216	0.572	0.317		0.2629	0.4470	0.3221	

Table 2: Effect of treatments on organoleptic properties of Kinnow – Aonla RTS and Squash

Treatments	Period of storage (month)							
	RTS				Squash			
	0	4	8	Mean	0	4	8	Mean
TSS								
T0	15.03	15.09	15.19	**15.10**	50.04	50.25	50.71	**50.33**
T1	15.04	15.11	15.21	**15.12**	50.05	50.27	50.75	**50.36**
T2	15.02	15.11	15.25	**15.13**	50.02	50.28	50.82	**50.37**
T3	15.01	15.12	15.27	**15.13**	50.03	50.30	50.93	**50.42**
T4	15.02	15.13	15.29	**15.15**	50.03	50.30	50.83	**50.39**
T5	15.03	15.16	15.33	**15.17**	50.05	50.33	51.10	**50.49**
T6	15.03	15.16	15.35	**15.18**	50.05	50.36	51.14	**50.52**
S. Ed. (±)	0.013	0.014	0.020		0.0617	0.0741	0.2438	
C. D. (P=0.05)	0.028	0.029	0.043		0.1315	0.1578	0.5193	
pH								
T0	3.46	3.40	3.35	**3.40**	2.35	2.27	2.09	**2.24**
T1	3.50	3.41	3.39	**3.43**	2.37	2.28	2.18	**2.28**
T2	3.52	3.44	3.40	**3.45**	2.37	2.29	2.20	**2.29**
T3	3.54	3.46	3.41	**3.47**	2.38	2.32	2.21	**2.30**
T4	3.52	3.44	3.42	**3.46**	2.39	2.32	2.23	**2.31**
T5	3.56	3.44	3.42	**3.47**	2.40	2.34	2.27	**2.34**
T6	3.56	3.48	3.43	**3.49**	2.40	2.37	2.30	**2.36**
S. Ed. (±)	0.062	0.341	0.069		0.0154	0.0247	0.0093	
C. D. (P=0.05)	0.142	0.784	0.159		0.0329	0.0526	0.0197	
Acidity								
T0	0.50	0.54	0.56	**0.53**	1.016	1.029	1.064	**1.036**
T1	0.47	0.52	0.54	**0.51**	1.011	1.027	1.046	**1.028**
T2	0.46	0.49	0.52	**0.49**	1.011	1.027	1.043	**1.027**
T3	0.44	0.48	0.50	**0.47**	1.009	1.022	1.045	**1.025**
T4	0.42	0.46	0.49	**0.46**	1.007	1.019	1.040	**1.022**
T5	0.41	0.45	0.49	**0.45**	1.005	1.016	1.030	**1.017**
T6	0.40	0.44	0.48	**0.44**	1.006	1.013	1.029	**1.016**
S. Ed. (±)	0.032	0.007	0.070		0.0069	0.0123	0.0216	
C. D. (P=0.05)	0.073	0.016	0.162		0.0147	0.0263	0.0460	
Ascorbic acid								
T0	24.0	14.8	13.0	**17.27**	39.11	28.35	11.21	**26.22**
T1	24.0	15.9	13.0	**17.63**	39.23	29.08	12.96	**27.09**
T2	24.2	17.0	13.2	**18.13**	39.51	29.62	13.70	**27.61**
T3	24.3	18.5	13.5	**18.77**	39.78	31.16	14.59	**28.51**
T4	24.3	19.1	13.9	**19.10**	39.98	31.27	20.43	**30.56**
T5	24.4	19.4	14.0	**19.26**	40.10	31.51	21.32	**30.98**
T6	24.4	19.5	14.0	**19.30**	40.15	31.83	22.02	**31.33**
S. Ed. (±)	0.083	0.088	0.069		0.0432	0.0524	0.0987	
C. D. (P=0.05)	0.191	0.203	0.159		0.0920	0.1117	0.2103	

CONCLUSION

From the present study, it was concluded that the addition of 1.5% ginger extracts could be gainfully utilized for enhancing the value of kinnow – aonla based RTS and Squash preparation. This herbal combination not only improved the nutraceutical value, but also hiked the organoleptic score of the finished product.

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