



Short communication

Studies on Kinnow-aonla ready-to-serve beverages

Balaji Vikram*, V.M. Prasad and Surya Narayan**

Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology & Sciences (Deemed to-be-University), Allahabad 211007, Uttar Pradesh

ABSTRACT

The experiment was conducted to investigate the effect of different levels of herbals on Kinnow-aonla beverages during the year 2010-2011. This study aimed at 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. Highest mean TSS (15.13°Brix), pH (3.50) and ascorbic acid content (19.4%) were observed in T₅ (ginger extract 1%), all the sensory parameters were as based on the overall acceptability based on colour, texture and taste were recorded highest (7.78 score) in T₅. Precisely, on the basis of results obtained it may be concluded that treatment T₅ can be used in commercialization of Kinnow-aonla RTS. The studies on compositional changes in value-added Kinnow-aonla RTS revealed that there was increase in the level of TSS and pH during the storage period (six months).

Key words: Aonla, beverages, cardamom, ginger, RTS, Kinnow mandarin.

INTRODUCTION

The edible fruit tissue of aonla (*Emblica officinalis* Garten.) contains about three times as much protein and 160 times as much vitamin 'C' as apple (Chadha, 3). Antioxidant effect of gallic acid, present in aonla fruit is being well acknowledged. Fresh fruit of aonla is very rich source of ascorbic acid (454.40 mg/100 g) and appreciable source of total sugars (7.53 mg/100 g), calcium (14.91 mg/100 g), iron (0.62 mg/100 g) and phosphorus (11.81 mg/100 g) and also has great potential for processing. Kinnow mandarin is one of the most popular citrus fruit having attractive bright colour, appealing taste and flavour. It has great potential for its use in value-added products such as juice, nectar, squash and RTS drinks.

Ginger is a useful food preservative and has been proven to kill the harmful bacteria *Salmonella*. Ginger powder is also used in certain food preparations particularly for the pregnant or nursing women. Similarly, green cardamom powder is used as a spice for traditional flavouring in coffee and tea.

MATERIALS AND METHODS

Fully ripened, mature, fresh and sound fruit of Kinnow and aonla were procured from the orchard of the Department of Horticulture, SHIAT&S, Allahabad. Mature, uniform diseased free aonla fruits were selected. Fruits were then washed properly in tap water so that dirt that adhered was properly cleaned. After pricking the fruits were dipped in 2% salt solution

for 24 h, then washed with clean water and again dipped in 2% alum solution for 24 h, further washed with clean water and then blanched in boiling water for 10 min. 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 in a citrus juice extractor. After extraction, the juices were kept for 24 h in refrigerator (4-2°C) for sedimentation. Then the clear juices were siphoned off and strained through muslin cloth. Kinnow and aonla raw juice was heated at 96°C for 2 min. to inactivate enzymes. Following the heating, the juice was filtered through 8-folded cheese cloth to eliminate particulates and then cardamom and ginger extract were heated at 96°C for 15 min. and filtered through 8-folded cheese cloth. All prepared juices, sodium benzoate and sugar were blended in high speed blender at 8,000 rpm for 2 min. Concentration of ingredients shown is Table 1. Six treatment combinations were formulated with sugar and herbs (cardamom and ginger) as depicted in Table 2. The prepared beverage was kept in 250 ml

Table 1. Formulation of Kinnow-aonla ready-to-serve beverage.

Ingredient	Conc. (w/w)
Juice	Aonla (10%) + Kinnow (5%)
Water	85%
Sodium benzoate	0.1%
Sugar	15%

*Corresponding author's E-mail: balaji.vikram55@gmail.com

**Department of Horticulture, K.A.P.G. College, Allahabad

Table 2. Combinations of herbs used in Kinnow-aonla RTS preparations.

Treatment	Combination	Herb
T0	Plain product	Without herbal extract
T1	0.5%	Cardamom extract
T2	1.0%	Cardamom extract
T3	1.5%	Cardamom extract
T4	0.5%	Ginger extract
T5	1.0%	Ginger extract
T6	1.5%	Ginger extract

transparent and pre-sterilized glass bottles along with 1000 ppm SO₂. After bottling, all juice samples were again heated at 96°C for 20 min. Then samples were cooled with tap water and stored at 4°C. Treated RTS samples were evaluated at 0, 15, and 30 days at 6 month storage for physio-chemical analysis and sensory evaluation.

The total soluble solids in the all treatments of Kinnow-aonla RTS samples were directly recorded by the help of hand refractometer (Erma, Japan) for six month storage at 15 day intervals and expressed as per cent soluble solids (°Brix) as described in AOAC (1). The pH of each Kinnow-aonla RTS sample was determined with digital pH meter. Kinnow-aonla RTS beverages were stored at room temperature for a period of 6 month by drawing samples at 0, 15 and 30 days. In Kinnow-aonla RTS beverage after storage were evaluated for changes in chemical and organoleptic parameters. Standard sensory evaluation procedures were followed to perform descriptive analysis; panellists 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., colour, texture and flavour/ taste and overall acceptability by a panel of 10 judges using a 9-point Hedonic scale.

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 six treatments.

RESULTS AND DISCUSSION

TSS of Kinnow-aonla RTS was found to be increased with increase in storage duration (Table 3). After 6 month of storage, the level of TSS reached up to 15.13°Brix, which was 15.01°Brix, only in the initial stage. The effect of treatments on TSS change was observed to be significant. The lowest mean TSS (15.10°Brix) was recorded in control, while the highest TSS (15.13°Brix) was observed in T₆ (1.5% ginger extract) and T₅ (1.0% ginger extract). All the ginger treatment levels were proved better in relation to TSS over cardamom extract, respectively. Among the herbs, cardamom was found inferior in improving the TSS level in all the treatments. Higher level of herb extract yielded higher TSS value. This might be due to the conversion of polysaccharides into sugars during hydrolysis process. Increase in TSS might also be attributed to the reduction in moisture content of the product with storage. Increase in TSS with storage time was also reported (Gaikwad *et al.*, 5; Sasi *et al.*, 10).

The data on pH (Table 3) indicated that there was variation in control and value-added treatments. Highest pH (3.51) was observed in T₆ (1.5% ginger extract) and 3.50 closely followed by T₅ (1.0% ginger extract). The lowest pH (3.42) was recorded in the T₀ (control). Storage interval also influenced the pH of the Kinnow-aonla RTS. A decline in pH towards

Table 3. Effect of treatments on physio-chemical properties of Kinnow-aonla RTS.

Treatment	TSS			Mean	pH			Mean	Acidity (%)			Mean	Ascorbic acid (mg/100 ml)			
	Month				Month				Month				Month			
	0	3	6		0	3	6		0	3	6		0	3	6	
T ₀	15.03	15.09	15.17	15.10	3.46	3.42	3.38	3.42	0.50	0.53	0.55	0.53	24.0	15.0	13.2	17.5
T ₁	15.04	15.10	15.19	15.11	3.50	3.43	3.41	3.45	0.47	0.50	0.52	0.50	24.0	16.0	13.2	17.7
T ₂	15.02	15.10	15.20	15.11	3.52	3.46	3.42	3.47	0.46	0.49	0.51	0.49	24.2	17.2	13.4	18.3
T ₃	15.01	15.11	15.21	15.11	3.54	3.47	3.43	3.48	0.44	0.47	0.49	0.47	24.3	18.7	13.7	18.9
T ₄	15.02	15.12	15.21	15.12	3.54	3.48	3.44	3.49	0.42	0.45	0.48	0.45	24.3	19.2	14.1	19.2
T ₅	15.03	15.14	15.25	15.13	3.56	3.49	3.44	3.50	0.40	0.43	0.46	0.43	24.4	19.5	14.4	19.4
T ₆	15.03	15.14	15.23	15.13	3.56	3.50	3.46	3.51	0.41	0.43	0.46	0.44	24.4	19.6	14.4	19.4
CD at 5%	0.069	0.083	0.345		0.062	0.341	0.069		0.032	0.007	0.070		0.083	0.088	0.069	

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 *et al.* (2).

Acidity is also an important attribute because tartness is a major factor in the acceptability of Kinnow-*aonla* RTS drink. Citric acid is the major acid in Kinnow and *aonla* juice that enhances the characteristic flavour of Kinnow-*aonla* RTS. The data regarding acidity in different treatments of Kinnow-*aonla* ready-to-serve drink is presented in Table 3. Highest acidity (0.53%) was recorded in T₀ (control), while lowest (0.43%) was observed in T₅ (1.0% ginger extract). Increase in acidity with storage time in the ready-to-serve beverage from *aonla* fruits was also reported by Chandan *et al.* (5).

Marginal differences in ascorbic acid contents were observed in various treatments (Table 3). Statistical analysis showed that the results are highly significant for storage period. Ascorbic acid content decreased significantly at all storage intervals. These loss of ascorbic acid was attributed to the effect of processing, storage time and exposure to light. Highest ascorbic acid (19.4 mg/100 ml) was recorded in T₆ (1.5% ginger extract) and T₅ (1.0% ginger extract). The lowest (17.5 mg/100 ml) was observed in T₀ (control). The degradation of ascorbic acid in *Morinda citrifolia* juice may follow aerobic and an-aerobic pathways (Satwadhari *et al.*, 11). 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 report (Jain *et al.*, 7).

The effect of treatments on colour of Kinnow-*aonla* RTS due to herbs is also depicted (Table 4). T₅ (1.0% ginger extract) was (7.97 score) ranked highest for followed by colour score (6.68 score), 6.62 and

(6.47 score) was followed by T₃ (1.5% cardamom extract), T₆ (1.5% ginger extract) and T₄ (0.5% ginger extract). T₀ (control) had (5.90 score) and ranked lowest as regard to its colour characteristics. Storage had a significant effect on colour perception of Kinnow-*aonla* RTS. The maximum scores for colour was observed when it was freshly prepared in T₅ (1.0% ginger extract). As the storage period increased, a slight decline in colour score was noted. Previous studies (Ram *et al.*, 9) also reported similar loss in colour during storage of blended *aonla* and *bael* RTS beverages.

Texture of the drink was affected significantly by treatments. T₅ (1.0% ginger extract) got (7.90 score) the maximum score for texture was followed by (7.73 score) T₆ (1.5% ginger extract), (7.55 score) T₄ (0.5% ginger extract) and (7.16 score) in T₂ (1.0% cardamom extract). The lower texture perception (6.44 score) was recorded in T₀ (control). A significant variation was observed in flavour perception of Kinnow-*aonla* RTS beverage at various storage levels. The maximum scores for texture (8.09 score) was observed T₅ (1.0% ginger extract), when it was freshly prepared. As the storage period increased, a slight decline in texture score was experienced (Table 4). The gradual loss in texture scores over the entire storage period was due to changes in volatile compounds of Kinnow-*aonla* RTS. Texture deterioration in beverage products was also reported by Sowjanya *et al.* (12).

Statistical analysis revealed a significant affects of treatment and storage on flavour and taste Kinnow-*aonla* RTS. T₅ (1.0% ginger extract) sample (8.33 score) got higher scores of flavour and taste was followed by (8.11 score) T₆ (1.5% ginger extract), (7.84 score) T₄ (0.5% ginger extract) and (7.56 score) in T₃ (1.5% cardamom extract) then (7.42 score) T₂

Table 4. Effect of treatments on organoleptic properties of Kinnow-*aonla* RTS.

Treatment	Colour				Texture				Taste				Overall acceptability			
	Month			Mean	Month			Mean	Month			Mean	Month			Mean
	0	3	6		0	3	6		0	3	6		0	3	6	
T ₀	6.16	5.98	5.55	5.90	6.60	6.49	6.24	6.44	7.35	7.20	6.93	7.16	6.70	6.56	6.24	6.50
T ₁	6.21	6.03	5.61	5.95	6.99	6.84	6.59	6.81	7.55	7.41	7.22	7.39	6.92	6.76	6.47	6.72
T ₂	6.38	6.16	5.88	6.14	7.35	7.20	6.93	7.16	7.57	7.44	7.26	7.42	7.10	6.93	6.69	6.91
T ₃	6.87	6.73	6.44	6.68	7.22	7.10	6.88	7.07	7.70	7.58	7.40	7.56	7.26	7.14	6.91	7.10
T ₄	6.60	6.55	6.25	6.47	7.74	7.59	7.32	7.55	8.00	7.86	7.66	7.84	7.45	7.33	7.08	7.29
T ₅	7.23	7.15	6.97	7.12	8.09	7.94	7.67	7.90	8.48	8.35	8.16	8.33	7.93	7.81	7.60	7.78
T ₆	7.04	6.89	6.62	6.85	7.92	7.77	7.50	7.73	8.25	8.13	7.95	8.11	7.74	7.60	7.36	7.57
CD at 5%	0.077	0.095	0.080		0.098	0.127	0.077		0.095	0.092	0.089		0.094	0.249	0.138	

(1.0% cardamom extract) as compared to treated samples (Table 4). It was noted that Kinnow-aonla products without herbs got less scores as compared to RTS samples in which combination of herbs were used. A significant variation was observed in flavour and taste of RTS at various storage levels. The maximum scores for flavour and taste (8.48 score) were observed in T₅ (1.0% ginger extract) when it was freshly prepared. As the storage period increased, a slight decline in flavour and taste score was experienced (Table 4). The gradual loss in flavour and taste scores over the entire storage period was due to changes in volatile compounds of the aonla beverages (Priyanka *et al.*, 8). The flavour and taste difference and loss might be due to time and temperature and duration of storage. Similar findings were also reported by Jain *et al.* (6).

Higher level of herbal extract could not produce top acceptability due to deviation from standard colour, texture, flavour and taste of the product retained after 6th month of storage. Though, the best result was recorded (7.78 score) in T₅ (1.0% ginger extract). No pattern was observed with overall acceptability with treatments. Storage duration had significant influence on overall acceptability, which was initially 7.16 score and reduced to 6.14 after 6th month of storage and liked by the panel of judges due to its excellent flavour and taste. It can be concluded that the herbs can be effectively used as alternative source of value-addition in Kinnow-aonla RTS.

REFERENCES

1. AOAC. 1995. *Official Methods of Analysis* (16th Edn.), Association of Official Analytical Chemists, Washington, DC, USA.
2. Boghani, A.H., Raheem, A. and Hashmi, S. 2012. Development and storage studies of blended papaya-Aloe vera ready-to-serve (RTS) beverage. *J. Fd. Process. Tech.* **3**: 1-4.
3. Chadha, K.L. 2003. *Handbook of Horticulture*, ICAR Pub., New-Delhi.
4. Chandan, K., Prashanth, S.J., Nataraj, S.K., Indudhara, S.M. and Rokhade, A.K. 2010. Preparation of dehydrated slices and RTS beverages from aonla (*Emblica officinalis* Gaertn.) fruits. *Int. J. Agric. Sci.* **6**: 30-34.
5. Gaikwad, K.K., Singh, S. and Shakya, B.R. 2013. Studies on the development and shelf-life of low calorie herbal aonla-ginger RTS beverage by using artificial sweeteners. *J. Fd. Process Tech.* **4**: 1-4.
6. Jain, S., Sankhla, A.P.K., Dashora, A. and Sankhla, A.K. 2003. Physio-chemical and sensory properties of orange drink. *J. Fd. Sci. Tech. India*, **40**: 656-59.
7. Jain, S.K. and Khurdiya, D.S. 2004. Vitamin C enrichment of fruit juice based ready-to-serve beverages through blending of Indian gooseberry (*Emblica officinalis* Gaertn.) juice. *Plant Foods Hum. Nutr.* **59**: 63-66.
8. Priyanka, N., Dileep, K.T. and Devendra, K.B. 2012. Study on changes of nutritional and organoleptic quality of flavoured candy prepared from aonla (*Emblica officinalis* G.) during storage. *Int. J. Nutr. Metabolism*, **4**: 100-06.
9. Ram, R.B., Meena, M.L., Sonkar, P., Lata, R. and Upadhyay, A.K. 2011. Standardization and evaluation of blended aonla (*Emblica officinalis* Gaertn.) and bael (*Aegle marmelos* Correa) RTS beverages. *Plant Arch.* **11**: 205-08.
10. Sasi Kumar, R., Ray, R.C., Paul, P.K. and Suresh, C.P. 2013. Development and storage studies of therapeutic ready to serve made from blend of Aloe vera, aonla and ginger juice. *J. Fd. Process Tech.* **4**: 255-66.
11. Satwadhar, P.N., Deshpande, H.W., Syed, I.H. and Syed, K.A. 2011. Nutritional composition and identification of some of the bioactive components in *Morinda citrifolia* juice. *Int. J. Pharm. Sci.* **3**: 58-59.
12. Sowjanya, G., Rokhada, A.K., Madalageri, M.B., Swamy, G.S.K. and Patil, C.P. 2009. Preparation and storage of carbonated ready to serve (RTS) pomegranate beverage. *Bev. Fd. World*, **36**: 30-32.

Received : February, 2013; Revised : October, 2015;
Accepted : February, 2016