The Pharma Innovation Journal 2021; 10(12): 700-706

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 700-706

www.thepharmajournal.com
Received: 14-10-2021
Accepted: 23-11-2021

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Standardization, physico-chemical & organoleptic assessment during storage of ready to serve blended kinnow-aonla beverage

Ankita Das, Vijay Bahadur, VM Prasad and Saket Mishra

Abstract
The current experiment was carried out during Dec 2020 to April 2021 in Post-Harvest Laboratory of Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Completely Randomized Design (CRD), with ten treatments and three replications. The treatments were T_1 (100% Kinnow pulp), T_2(10% Aonla+90% Kinnow pulp), T_3 (20% Aonla Pulp + 80% KinnowPulp), T_4(30% Aonla Pulp + 70% Kinnow Pulp), T_5(40% Aonla Pulp + 60% Kinnow Pulp), T_6(50% Aonla Pulp+50% Kinnow pulp), T_7 (100% Aonla Pulp), T_8 (90% Aonla Pulp+10%Kinnow Pulp), T_9(80%Aonla Pulp+20% Kinnow Pulp), T_{10} (70% Aonla Pulp+30% Kinnow Pulp).From the present research investigation it is observed that the T_6 treatment (50% Aonla pulp+ 50% Kinnow pulp) was found Best in respect of the conservative parameters Total Soluble Solids(Brix), Acidity (%), pH, Ascorbic acid (mg/100g) & Reducing Sugar (%). In terms of organoleptic properties like Colour and Appearance, Flavour and Taste, Texture and Overall AcceptabilityT_6 was found best. In terms of cost benefit ratio the highest net return, Cost Benefit Ratio was found highest in T_6 (50% Aonla pulp + 50% Kinnow pulp).Hence, T_6 was found superior basedon above Observative parameters.

Keywords: Aonla, kinnow, blended ready to serve, storage

Introduction
Emblica officinalis (Aonla) is native of tropical India and Southeast Asia, commonly named as 'Indian gooseberry' (Barthakar and Arnold, 1991) [6]. Aonlafruits are fleshy, yellowish green in colour having six vague perpendicular furrows enclosing seeds. Nutritional, commercial and medicinal significance of aonla fruit makes it popular all over the world (Goyal *et al.*, 2007) [16].Aonla is an excellent source of ascorbic acid (300-900 mg/100 g), amino acid and minerals along with phytochemicals such as polyphenols, tannins, emblicol, linoleic acid, corilagin, phyllemblin and rutin (Ghorai and Sethi, 1996; Jain and Khurdiya, 2004; Murthy and Joshi, 2007; Baliga and Dsouza, 2011) [14, 18, 29, 5]. Aonla fruit is helpful in the treatment of haemorrhage, dysentery, diarrhoea, gastric disorders, constipation, headache, jaundice and enlargement of liver (Parrotta, 2001; Goyal*et al.*, 2007) [16]. Various research studies show that aonla has prominent antibiotic, antiulcer genic, diuretic, laxative, adaptogenic, antitumor, antiscorbutic, hepatoprotective, cardio tonic, antiviral, and hypoglycaemic properties (Rege *et al.*, 1999; Jose and Kutton, 2000; Dahiya and Dhawan, 2001; Pragati *et al.*, 2003; Mishra *et al.*, 2009) [32, 36, 30, 9]. Hypolipidaemic effect of fruit juice of aonla was reported in a study by Mathur *et al.* (1996) [25].
Kinnow (*Citrus reticulata)* is first generation hybrid of king *(Citrus nobilis)* and willow leaf mandarin (*Citrus deliciosa*), and was developed by H.B. Frost at citrus research station, riverside, California. It was introduced and established in India by regional fruit research station, Abohar (Punjab) in 1969. Kinnow mandarin was introduced in India in the early 1940"s. At present its cultivation has assumed great importance among north Indian growers and a large acreage of land is being brought under cultivation particularly in Punjab, Haryana, Rajasthan and Himachal Pradesh (Jain *et al.*, 2003) [19]. Fully ripe fruits of kinnow have bright and deep attractive color, thin tight and compact skin. The fruits are juicy and the fresh juice extracted from the fruit harvested at appropriate stage of maturity, has refreshing flavor, characteristic pleasing aroma and thirst quenching properties, but also have the problem of short shelf life (Vikram and Prasad, 2014). Kinnow mandarin is a fairly important crop as it has a great variety of beverage, industrial and medicinal uses due to its attractive colour, distinctive flavour and is a rich source of Vitamins B & C, β-carotene, calcium and phosphorus

(Sogi and Singh, 2001) [33]. Post-harvest shelf-life of kinnow fruit at room temperature is very limited (Jawanda and Singh, 1973) [20] and can be extended to a maximum of 45 days under refrigerated storage conditions. The fruit should be processed to extend its availability and to minimize glut in the market in peak season of production. Like in all fresh products, quality of kinnow mandarin juice changes with time. Several parameters influence the rate of microbial spoilage, enzymatic degradation, induce chemical change and deterioration in flavour, or turn bitter upon extraction. For improving taste, aroma, palatability and nutritive value, and for reducing the bitterness, kinnow juice was blended with other, highly nutritive fruit juices, namely pomegranate and aonla, with spice extracts like ginger. All these fruits are greatly valued for their refreshing juice with nutritional and medicinal properties. Ginger juice has anti-bacterial and anti-fungal properties. Jain and Khurdiya (2004) [18] and Bhardwaj and Mukherjee (2011) [11] reported that juice/pulp of two or more fruits may be blended in various proportions for preparation of nectar, RTS beverages, etc. Ranote and Bains (1982) [31], Mehta and Bajaj (1983) [26] and Bhardwaj and Mukherjee (2011) [11] conducted studies on use of chemical preservatives and processing of juice at high temperature (this checks growth of micro-organisms and reduces loss of quality).

Materials and Methods

The Experimental work of "Standardization, Physico-chemical& organoleptic assessment during storage of Ready To Serve blended kinnow- aonla beverage " was conducted in the Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Praygraj during the year 2020-2021. The blended Kinnow-Aonla ready to serve Beverage (RTS) during storage prepared has 10treatments with 3 replications and stored for 120 days under refrigerator. The Prayagraj District comes under subtropical belt in the southeast of U.P and 78 meters above the mean sea level. Which experience extremely hot summer and fairly cold winter. During the winter months (Dec.-Jan) temperature fall up to 2-5^{0}C or even low, while in summer months (May-June) it reaches as high as 49^{0}C. Hot blow winds are regular feature during the summers and an occasional spell of frost may be during winters. Most of the rainfall is received in the middle of July to end of September after which the intensity of rainfall decreases. The mean annual rainfall is about 850-1100mm. However, occasional precipitation is also not uncommon during winter months. The Kinnow and Aonla fruit were purchased from fruit market, of Allahabad in the research Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The fruits to be processed were washed thoroughly under tap water to remove dust, dirt and other undesired materials adhering to the fruits. The peel kinnow fruits were crushed in screw type juice extractor machine for extraction of juice. The clean aonla fruits blanched in boiling water for 15 minute. Then seeds were removed and segments were separated then passing through juicer to get juice. Afterjuice extraction, kinnow and aonla raw juice was heated separately at 96^{0}C for 2 minute to inactivate enzymes. The bottle of RTS was stored at refrigerator(10-12^{0}C). This was then subsequently used for periodical evaluation at 0, 30, 60,90 and 120 Days intervals for a period. The methodology adopted in recording observations of products prepared is being detailed below. The first observation was recorded immediately after product preparation followed subsequent observation at an interval of0, 30, 60, 90 and 120 Days of storage.

Physico chemical analysis

Total soluble solid of each fruit was determined with the help of hand refractometer of 0-32 scale while that of RTS was determined by hand refractometer of 32-80 scale. Acidity was determined by diluting the known volume of juice and the product by titrating the same against N/10 NaOH using phenolphthalein as an indicator. Appearance of light pink colour was taken as end point. The titrable acidity of fresh juice and product were expressed as percent malic acid present in 1000ml of sample. The pH of the fruit as well of RTS determined by using pH meter (Elico, India) which was standardized before use. The electrode of the pH meter was dipped into diluted cheese for 1 minute and then pH was recorded. The electrodes of the pH meter were washed with distilled water after each determination. The ascorbic acid content of aonla based blended RTS beverage was determined by diluting known volume of RTS beverage with 3 per cent met phosphoric acid as buffer and titrating against 2, 6-dichlorophenol indophenol dye solution until the stable faint pink colour was obtained (A.O.A.C, 1995). The results were expressed as milligram of ascorbic acid/ 100 ml of RTS beverages; it was expressed as mg ascorbic acid per 100m1 of RTS beverage. Reducing sugar was estimated by Fehling‟s solution method as given below take 25 ml of Juice by means of pipette in a 250 ml (v) volumetric flask and dilute with distilled water to make up the volume shake well. Take 5 ml of Fehling A+ B solution in conical flask by means of pipette. Take diluted sugar in the burette and 10 ml of this solution in conical flask containing fehling solution. Heat solution to boiling, continue boiling on low flame and add rapidly remaining quantity of juice from burette till light blue colour persists. Add 5-8 drops of methylene blue indicator and complete the titration until the blue colour of supernated liquid disappears.

Sensory evaluation

After the preparation of blended Kinnow-Aonla ready to serve Beverage(RTS) and replications were presented to a panel of judges for organoleptic evaluation based on 9 point Hedonic scale (Amerin *et al.*, 1965) [27].

Statistical analysis

The data recorded during the course of investigation were subjected to statistical analysis using CRD (Complete Randomized Design) as per the method of "Analysis of variance" technique (Panse and Sukhatme, 1967) [28]. The significant Difference between the treatments means were tested at 5% level of significance.

Table 1: Treatment details

Treatment notations	Treatment combinations
T_1	100% kinnow
T_2	10%Aonla+90% Kinnow
T_3	20%Aonla+80% Kinnow
T_4	30%Aonla+70% Kinnow
T_5	40%Aonla+60% Kinnow
T_6	50% Aonla+50% Kinnow
T_7	100%Aonla
T_8	90%Aonla+10% Kinnow
T_9	80%Aonla+20% Kinnow
T_{10}	70%Aonla+30% Kinnow

Results and Discussion

TSS

The T.S.S. (Total soluble solid ^{0}Brix) showed that there were

significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent increase in T.S.S. (Total soluble solid ^{0}Brix)at different periods of storage at initial, 30, 60, 90 and 120 days. The maximum T.S.S. (Total soluble solid) (12.66,12.72,12.89,12.90 and 12.95^{0}Brix) at initial, 30, 60, 90 and 120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatmentT_4 (30%Aonla+70%Kinnow), T_5 (40%Aonla+60% Kinnow), T_3(20%Aonla+80% Kinnow) and T_2 (10%Aonla+90% Kinnow). Whereas the minimum T.S.S. (Total soluble solid) (10.39, 10.41,10.47,10.58 and10.67^{0}Brix) was observed in treatment T_7 100%Aonla during periods of storage at initial, 30, 60,90 and 120 days. Total soluble solids of the squash were observed to be increased gradually up to the end of experiment in all treatments under ambient storage conditions. Similar result was reported by Deka *et al.*, (2004) [22]. TSS was found gradually increased with increase in storage period. 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 by Gaikwad *et al.*, 2013 [23] in their studies on lime juice; these results are also in agreement with previous studies of Sasi *et al.*, 2013 [34] while studying on therapeutic ready to serve made from blend of Aloe vera, aonla and ginger juice.

Acidity

The Acidity showed that there were significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent increase in Acidity (%)at different periods of storage at initial, 30, 60, 90 and 120 days. The minimum Acidity (%) (0.18,0.21,0.28,0.33 and0.37) at initial, 30, 60, 90 and 120 days respectively was observed in treatment T_6 (50% Aonla+50% Kinnow) followed by treatmentT_4 (30%Aonla+70%Kinnow), T_5 (40%Aonla+60% Kinnow), T_3 (20%Aonla+80% Kinnow) and T_2 (10%Aonla+90% Kinnow). Whereas the maximum Acidity (%) (0.50,0.46,0.52,0.60 and 0.68) was observed in treatment T_7 (100%Aonla) during periods of storage at initial, 30, 60,90 and 120 days. 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 blended RTS. 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. Similar observations were also reported by Satwadha r *et al.*, (2011) [35]. Aggarwal and Sandhu (2003) in kinnow juice and Chandan *et al.*, (2001) in aonla RTS beverages.

P^H

The P^H showed that there were significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent decrease in P^H at different periods of storage at initial, 30, 60, 90 and 120 days. The minimum pH (2.54, 2.48, 2.40, 2.28 and 2.08) at initial, 30, 60, 90 and 120 days respectively was observed in treatment $T_6$50% Aonla+50% Kinnow followed by treatment T_4 (30%Aonla+70%Kinnow), T5 (40%Aonla+60% Kinnow), T_3(20%Aonla+80% Kinnow) and T_2(10%Aonla+90% Kinnow). Whereas the maximum pH (2.93,2.87,2.70,2.57 and2.51) was observed in treatment T_7 (100%Aonla) during periods of storage at initial, 30, 60,90 and 120 days. The pH of the most accepted formulation with 45% Aloe pulp was found to be 4.32 which is acidic as observed by Mishra *et al* (2013) [37]. The acidic pH of the blends will improve the prolonged storage of the prepared RTS.

Ascorbic acid

The Ascorbic Acid showed that there were significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent increasein Ascorbic Acidat different periods of storage at initial, 30, 60, 90 and 120 days. The maximum Ascorbic Acid (29.47,26.80,25.48,22.43 and 19.44) at initial, 30, 60, 90 and 120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatment T_4(30%Aonla+70%Kinnow), T_5(40%Aonla+60% Kinnow), T_3(20%Aonla+80% Kinnow) and T_2(10%Aonla+90% Kinnow). Whereas the minimum Ascorbic Acid (22.21,18.35,16.25,14.60 and 12.47) was observed in treatment T_7 (100%Aonla) during periods of storage at initial, 30, 60, 90 and 120 days. The trend observed same throughout the storage period. Ascorbic acid content reduced considerably during storage period might be due to the oxidation or irreversible conversion of L-ascorbic acid into dihydro ascorbic acid oxidase (ascorbinase) because of heat processing and the presence of air at the head space of glass bottles. Similar, trend of declining was noticed by Palainswamy and Muthukrishnan (1974) [38] in lemon juice during storage varied between 21.76 to 62.06 mg/100ml juice. Ray and Singh (1979) [39] in bael beverages and by Reddy and Chikkasubbanna (2008) [40] in lime blended amla squash during storage period of 90 days.

Reducing sugar

The Reducing Sugar (%) showed that there were significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent increasein Reducing Sugar (%)at different periods of storage at initial, 30, 60, 90 and 120 days. The maximum reducing Sugar (%) (6.83,6.97,7.08,7.19 and 7.32) at initial, 30, 60, 90 and 120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatmentT_4 (30%Aonla+70% Kinnow), T_5(40%Aonla+60% Kinnow), T_3(20%Aonla+80% Kinnow) and T_2 (10%Aonla+90% Kinnow). Whereas the minimum reducing Sugar (%) (6.83,6.97,7.08,7.19 and7.32) was observed in treatment T_7 (100%Aonla) during periods of storage at initial, 30, 60,90 and 120 days. Reducing sugar of the RTS was observed to be increased gradually up to the end of experiment in all treatments under ambient storage conditions. Similar result was reported by Garge *et al.*, (2008) [41]. A sharp increase in reducing sugar of all treatments was found at later stage of the experiment (i.e. 90 and 120 days). Changes in reducing sugars were found statistically significant up to end of experiment.

Colour & Appearance

The colour and appearance score showed that there were significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent increase in colour and appearance score at different periods of storage at initial, 30, 60, 90 and 120 days. The maximum colour and appearance score(8.38,8.18,8.07,7.39 and7.58) at initial, 30, 60, 90 and

120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatment T_4(30%Aonla+70%Kinnow), T_5(40%Aonla+60% Kinnow),T_3(20%Aonla+80% Kinnow) and T_2(10%Aonla+90% Kinnow). Whereas the minimum colour and appearance score (5.34,5.175.17,5.13 and5.06) was observed in treatment T_7 (100%Aonla) during periods of storage at 0, 30, 60,90 and 120 days. As the storage period increased, a slight decline in colour score was noted. Similar loss in colour during storage of blended aonla and bael RTS beverages was reported by Ram *et al.,* (2011) [42].

Aroma

The Aroma score showed that there were significant differences among all the treatments during storage at 0, 30, 60, 90 and 120 days. There was subsequent increasein Aroma score at different periods of storage at initial, 30, 60, 90 and 120 days. The maximum Aroma score (8.51,8.18,8.15,7.40 and 7.53) at initial, 30, 60, 90 and 120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatment T_4(30%Aonla+70%Kinnow), T_5(40%Aonla+60% Kinnow), T_3(20%Aonla+80% Kinnow) and T_2(10%Aonla+90% Kinnow).Whereas the minimum Aroma score (5.53,5.17,5.10,5.12 and4.98) was observed in treatment T_7 (100%Aonla) during periods of storage at initial, 30, 60,90 and 120 days. As the storage period increased, a slight decline in aroma score was experienced. The gradual loss aroma due to volatile compounds of kinnow-aonla RTS. Aroma deterioration in beverage products was also reported by Sowjanya *et al.* (2009) [43].

Flavor and taste

The Flavor and taste score showed that there were significant differences among all the treatments during storage at initial, 30, 60, 90 and 120 days. There was subsequent increase in Flavor and taste score at different periods of storage at initial, 30, 60, 90 and 120 days. The maximum Flavor and taste score(8.55,8.13,7.48,7.32 and7.31) at 0, 30, 60, 90 and 120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatment T_4(30%Aonla+70%Kinnow),T_5(40%Aonla+60% Kinnow),T_3(20%Aonla+80% Kinnow) and T_2(10%Aonla+90% Kinnow). Whereas the minimum flavor and taste score (5.75,6.12,5.08,5.08 and 4.97) was observed in treatment T_7 (100%Aonla) during periods of storage at initial, 30, 60,90 and 120 days. The flavour and taste difference and loss due to time and temperature and duration of storage. Similar findings were reported by Jain *et al.* (2004) [18].

Overall acceptability

The Overall acceptability score showed that there were significant differences among all the treatments during storage at Initial, 30, 60, 90 and 120 days. There was subsequent increasein Overall acceptability score at different periods of storage at initial, 30, 60, 90 and 120 days. The maximum Overall acceptability score(8.48,8.16,7.90,7.37 and7.48) at 0, 30, 60, 90 and 120 days respectively was observed in treatment T_6(50% Aonla+50% Kinnow) followed by treatment T_4(30%Aonla+70%Kinnow), T_5(40%Aonla+60% Kinnow), T_3(20%Aonla+80% Kinnow) and T_2(10%Aonla+90% Kinnow). Whereas the minimum Overall acceptability score (5.54, 5.49, 5.12, 5.11 and 5.00) was observed in treatment T_7 (100%Aonla) during periods of storage at 0, 30, 60,90 and 120 days. However, the organoleptic characters showed a gradual decreasing during storage due to the increasing time, temperature and enzymes activity at room temperature. This finding was conformity with Priyanka *et al.,* (2012) [44] in aonla beverages.

Table 2: Effect of various treatment combinations on TSS and acidity of kinnow-aonla blended ready to serve beverage (rts) during storage

Treatment notations	Treatment combinations	Total soluble solid (^{0}Brix)					Acidity				
		Initial	30 Days	60 Days	90 Days	120 days	Initial	30 Days	60 Days	90 Days	120 days
T_1	100% kinnow	11.24	11.32	11.48	11.53	11.61	0.36	0.42	0.43	0.53	0.56
T_2	10%Aonla+90% Kinnow	12.05	12.1	12.29	12.58	12.68	0.21	0.29	0.34	0.42	0.45
T_3	20%Aonla+80% Kinnow	12.08	12.14	12.33	12.39	12.52	0.23	0.26	0.34	0.37	0.44
T_4	30%Aonla+70%Kinnow	12.1	12.14	12.41	12.52	12.65	0.23	0.25	0.3	0.35	0.39
T_5	40%Aonla+60% Kinnow	12.14	12.19	12.28	12.68	12.78	0.22	0.26	0.37	0.35	0.44
T_6	50% Aonla+50% Kinnow	12.66	12.72	12.89	12.9	12.95	0.18	0.21	0.28	0.33	0.37
T_7	100%Aonla	10.39	10.41	10.47	10.58	10.67	0.5	0.46	0.52	0.6	0.68
T_8	90%Aonla+10%Kinnow	10.81	10.93	11.08	10.27	12.42	0.21	0.28	0.37	0.41	0.48
T_9	80%Aonla+20% Kinnow	10.94	10.96	11.15	11.32	11.4	0.25	0.28	0.36	0.38	0.57
T_{10}	70%Aonla+30% Kinnow	11.06	11.1	11.18	11.36	11.46	0.24	0.26	0.31	0.36	0.45
	F-Test	S	S	S	S	S	S	S	S	S	S
	S.Ed. (+)	0.023	0.031	0.047	0.033	0.037	0.012	0.049	0.029	0.019	0.038

Table 3: Effect of Various Treatment Combination On P^H And Ascorbic Acid of kinnow-Aonla Blended Ready To Serve Beverage (RTS) During Storage

Treatment notations	Treatment combinations	P^H					Ascorbic Acid				
		Initial	30 Days	60 Days	90 Days	120 days	Initial	30 Days	60 Days	90 Days	120 days
T_1	100% kinnow	2.85	2.8	2.75	2.69	2.48	23.52	21.02	18.61	16.46	13.21
T_2	10%Aonla+90% Kinnow	2.75	2.7	2.64	2.57	2.38	26.82	24.61	20.73	18.68	14.41
T_3	20%Aonla+80% Kinnow	2.83	2.78	2.67	2.59	2.38	27.34	26.47	24.57	22.59	18.6
T_4	30%Aonla+70%Kinnow	2.73	2.7	2.65	2.57	2.46	26.24	24.38	20.72	20.28	17.28
T_5	40%Aonla+60% Kinnow	2.76	2.73	2.66	2.63	2.39	25.47	23.54	20.74	18.34	16.74
T_6	50% Aonla+50% Kinnow	2.54	2.48	2.4	2.28	2.08	29.47	26.8	25.48	22.43	19.44
T_7	100%Aonla	2.93	2.87	2.7	2.57	2.51	22.21	18.35	16.25	14.6	12.47
T_8	90%Aonla+10%Kinnow	2.75	2.71	2.6	2.59	2.43	28.23	24.11	20.42	16.71	14.29

T_9	80%Aonla+20% Kinnow	2.77	2.69	2.61	2.53	2.4	27.35	25.1	21.66	17.33	14.39
T_{10}	70%Aonla+30% Kinnow	2.78	2.69	2.63	2.52	2.33	26.61	22.39	19.48	15.68	13.64
	F-Test	S	S	S	S	S	S	S	S	S	S
	S.Ed. (+)	0.042	0.015	0.018	0.032	0.18	0.107	0.539	0.153	0.148	0.406
	C.D. at 0.5%	0.088	0.03	0.038	0.068	0.131	0.266	1.132	0.322	0.31	0.852

Table 4: Effect Of Various Treatment Combination On Reducing sugar and colour and appearance of kinnow-Aonla Blended ready to serve beverage(RTS) During Storage

Treatment notations	Treatment combinations	Reducing Sugar					Colour and appearance score				
		Initial	30 Days	60 Days	90 Days	120 days	Initial	30 Days	60 Days	90 Days	120 days
T_1	100% kinnow	5.64	5.61	5.7	6.12	6.22	5.83	5.52	5.46	5.28	5.16
T_2	10%Aonla+90% Kinnow	6.29	6.35	6.52	6.66	6.75	7.11	6.52	6.4	6.26	6.09
T_3	20%Aonla+80% Kinnow	6.38	6.53	6.64	6.77	6.86	7.39	7.2	7.12	7.04	6.52
T_4	30%Aonla+70%Kinnow	6.3	6.4	6.57	6.71	6.85	7.42	7.28	7.19	7.09	6.85
T_5	40%Aonla+60% Kinnow	6.4	6.44	6.64	6.72	6.89	7.38	7.22	7.14	7.08	6.34
T_6	50% Aonla+50% Kinnow	6.83	6.97	7.08	7.19	7.32	8.38	8.18	8.07	7.39	7.58
T_7	100%Aonla	4.44	4.54	4.66	4.84	4.89	5.34	5.17	5.17	5.13	5.06
T_8	90%Aonla+10%Kinnow	6.34	6.49	6.7	6.75	6.82	6.71	6.4	6.35	6.22	6.08
T_9	80%Aonla+20% Kinnow	6.37	6.47	6.61	6.66	6.82	7.32	7.29	7.22	7.18	7.05
T_{10}	70%Aonla+30% Kinnow	6.3	6.4	6.55	6.83	6.86	6.64	6.27	6.23	6.16	5.9
	F-Test	S	S	S	S	S	S	S	S	S	S
	S.Ed. (+)	0.092	0.033	0.051	0.155	0.076	0.243	0.0777	0.042	0.101	0.106
	C.D. at 0.5%	0.192	0.068	0.106	0.324	0.159	0.506	0.162	0.088	0.211	0.222

Table 5: Effect of Various Treatment Combinatin On Aroma and flavour and taste of kinnow-Aonla Blended ready to serve beverage (RTS) During Storage

Treatment notations	Treatment combinations	Aroma					Flavor and taste				
		Initial	30 Days	60 Days	90 Days	120 days	Initial	30 Days	60 Days	90 Days	120 days
T_1	100% kinnow	5.8	5.49	5.44	5.19	5.12	5.77	5.77	5.31	5.11	5.1
T_2	10%Aonla+90% Kinnow	7.13	6.52	6.34	6.24	6.06	7.15	6.28	6.11	6.13	6.05
T_3	20%Aonla+80% Kinnow	7.41	7.26	7.1	7.02	6.46	7.43	7.16	6.87	6.97	6.39
T_4	30%Aonla+70%Kinnow	7.45	7.3	7.21	7.09	6.78	7.48	7.18	7.16	6.92	6.52
T_5	40%Aonla+60% Kinnow	7.41	7.26	7.08	7.08	6.33	7.43	7.15	6.86	6.81	6.33
T_6	50% Aonla+50% Kinnow	8.51	8.18	8.15	7.4	7.53	8.55	8.13	7.48	7.32	7.31
T_7	100%Aonla	5.53	5.17	5.1	5.12	4.98	5.75	6.12	5.08	5.08	4.97
T_8	90%Aonla+10%Kinnow	6.71	6.4	6.2	6.21	6.06	6.66	6.94	6.21	6.15	6.03
T_9	80%Aonla+20% Kinnow	7.33	7.13	7.17	7.17	7.03	7.36	7.07	6.79	7.13	6.94
T_{10}	70%Aonla+30% Kinnow	6.64	6.27	6.23	6.18	5.86	6.69	6.21	6.16	6.17	5.75
	F-Test	S	S	S	S	S	S	S	S	S	S
	S.Ed. (+)	0.247	0.093	0.07	0.098	0.103	0.258	0.551	0.349	0.154	0.181
	C.D. at 0.5%	0.516	0.193	0.145	0.204	0.215	0.538	1.15	0.728	0.322	0.377

Table 6: Effect of Various Treatment Combination On Overall acceptability of kinnow-Aonla Blended ready to serve beverage(RTS) During storage

Treatment notations	Treatment combinations	Overall acceptability				
		Initial	30 Days	60 Days	90 Days	120 days
T_1	100% kinnow	5.80	5.59	5.40	5.19	5.12
T_2	10%Aonla+90% Kinnow	7.13	6.44	6.28	6.21	6.07
T_3	20%Aonla+80% Kinnow	7.41	7.21	7.03	7.01	6.45
T_4	30%Aonla+70%Kinnow	7.45	7.25	7.19	7.03	6.72
T_5	40%Aonla+60% Kinnow	7.40	7.21	7.02	6.99	6.33
T_6	50% Aonla+50% Kinnow	8.48	8.16	7.90	7.37	7.48
T_7	100%Aonla	5.54	5.49	5.12	5.11	5.00
T_8	90%Aonla+10%Kinnow	6.70	6.58	6.25	6.19	6.06
T_9	80%Aonla+20% Kinnow	7.34	7.16	7.06	7.16	7.00
T_{10}	70%Aonla+30% Kinnow	6.66	6.25	6.21	6.17	5.84
	F-Test	S	S	S	S	S
	S.Ed. (+)	0.242	0.206	0.124	0.102	0.107
	C.D. at 0.5%	0.504	0.430	0.258	0.213	0.224

Conclusion

Based on findings of the present experiment it is concluded that treatment T_6(50% Aonla+50% Kinnow) was found superior in respect of the physio chemical parameters like

Total soluble solid (^{0}Brix), Acidity (%), pH, Ascorbic Acid and Reducing Sugar (%). With respectively sensory attributes like Colour and appearance, Aroma, Flavor and taste and Overall acceptability also $T_6$50% Aonla+50% Kinnowwas found best. In terms of cost benefit ratio the highest net return, Cost Benefit Ratio was found in T_6(50% Aonla+50% Kinnow).

Acknowledgement
The author conveys their thanks to the staff of Horticulture department Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (U.P) India for their colossal assistance, without which the trial would not have been successful.

Conflict of Interest
As a Corresponding Author, 1 Ankita Das, confirm that none of the others have any conflicts of interest associated with this publication.

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