



'Cashew apple' juice blend with mango, pineapple and sapota for improving quality of RTS beverages and economic feasibility thereof

Anindita Roy, B. Prasanna Kumar*, D.V. Swami, P. Subbramamma

Department of Fruit science
Horticultural College & Research Institute
Dr. YSR Horticultural University, Venkataramannagudem
Tadepalligudem - 534 101, West Godavari Dist., Andhra Pradesh, India
*E-mail: prasanna652002@yahoo.com

ABSTRACT

The present study on value-addition in cashew apple (*Anacardium occidentale* L.) juice by blending it with mango, pineapple and sapota juices for preparation of RTS beverage was conducted during the year 2012-2013 at Horticultural College and Research Institute, Dr. YSR Horticultural University, Andhra Pradesh, in Completely Randomized Design (CRD) with 3 replications and 10 treatments. In the present investigation, 'cashew apple' juice extracted from the fruit was blended with fruit juices of mango, pineapple and sapota in various proportions. RTS beverages prepared from different blends of cashew apple juice were evaluated for physico-chemical and organoleptic properties at 0, 30 and 60 days of storage, and significant differences were observed. RTS beverage prepared from a blend of 25% cashew apple juice + 75% mango juice (T₃) recorded a gradual decrease in pH, titrable acidity and ascorbic acid content from 0 to 60 days after storage, whereas, density of the blended juice increased gradually at 0 to 30 days of storage; thereafter it decreased. Total soluble solids, reducing sugars and TSS/Acid ratio gradually increased from 0 to 60 days of storage, followed by 25% cashew apple juice + 75% pineapple juice (T₄). Organoleptic score for RTS prepared from 25% cashew apple juice + 75% mango juice blend (T₃), followed by 50% cashew apple juice + 50% mango juice blend (T₂), 25% cashew apple juice + 75% pineapple juice blend (T₄) and 50% cashew apple juice + 50% pineapple juice blend (T₅), were found to be high on quality, viz., colour, taste and overall acceptability, up to 60 days of storage, and were economical for RTS preparation.

Key words: Acidity, cashew apple RTS, mango, pineapple, reducing sugars, sapota

INTRODUCTION

Cashew in Andhra Pradesh was cultivated in the year 2013 in an area of 1.84 lakh hectares with an annual nut production of 1.18 lakh tonnes with an average productivity of 650kg/ha. Statistics on production/productivity/area under cultivation are released by Directorate of Cashewnut and Cocoa Development (DCCD), Delhi. The main by-product of the cashew nut is its peduncle (false fruit) called cashew apple, to which the kidney shaped nut is attached. For every tonne of cashew nut, about 10-15 tonnes of cashew apple is produced, but is not of much use. It is discarded in the orchards under the trees and gets spoiled. Wastage of this cashew apple is a great economical loss, both in terms of nutrients and national wealth. It is one of the richest sources of ascorbic acid, and, B-complex and other vitamins. The juice is astringent due to presence of tannins and

anacardic acid, which causes bitter sensation on both the tongue and the throat when the apples are eaten as such. Owing to the very high tannin content, cashew apple juice is clarified by treating it with fining agents. After refining, the cashew apple clarified juice is used for blending it with other fruit juices and RTS beverage prepared. The present investigation was carried out to estimate juice content and to standardize RTS beverage preparation by blending cashew apple juice with mango, pineapple or sapota juice for quality at different time intervals (days) after storage.

MATERIAL AND METHODS

The experiment was conducted in a laboratory of Department of Post Harvest Technology, Horticulture College and Research Institute, Venkataramannagudem, during the year 2012-2013 in Completely Randomized Design (CRD) with 3 replications and 10 treatments. Fruits

of cashew apple harvested were transported under refrigeration to the laboratory, and were analyzed for physico-chemical properties as well as for preparation of cashew apple juice blends. The other fruits used, viz., mango, pineapple and sapota, were purchased from the local market.

Cashew apple juice contains a fair amount of tannins, which were strained through a muslin cloth and collected into a wide-mouthed stainless steel container. Then, poly vinyl pyrrolidone (PVP) @ 1.4g/l of juice, was added slowly by stirring the juice in a circular motion, till the entire juice formed a curd-like precipitate. The precipitate was allowed to stand for 8 to 12 hours after which the clear supernatant was collected carefully, without disturbing the residue. The clear juice obtained was strained through a muslin cloth and used in differently blended juices as stated by Jayalekshmy and Salam (2007). Treatments were set up in terms of mixing (blending) various juices in different proportions as follows:

Treatment details

T1: 75% Cashew apple juice + 25% Mango juice
 T2: 50% Cashew apple juice + 50% Mango juice
 T3: 25% Cashew apple juice + 75% Mango juice
 T4: 75% Cashew apple juice + 25% Pineapple juice
 T5: 50% Cashew apple juice + 50% Pineapple juice
 T6: 25% Cashew apple juice + 75% Pineapple juice
 T7: 75% Cashew apple juice + 25% Sapota juice
 T8: 50% Cashew apple juice + 50% Sapota juice
 T9: 25% Cashew apple juice + 75% Sapota juice
 T10: 100% Cashew apple juice

The blended juices were then filled in sterilized bottles of 250ml capacity each, crown-corked and heat-processed in boiling water (65°C for 30 min), cooled and stored (Srivastava and Sanjeev Kumar, 2002). Initial physico-chemical properties of blended juices (pH, density, TSS and acidity) are presented in Table 1 (i.e., before preparation of RTS beverage from each of the blends).

RTS made from Treatment 1 contained 10ml of blended cashew apple juice and mango juice @ 75% and 25%, respectively, along with 10g of sugar and 80 ml of water. This made up 100ml of RTS beverage. Similarly, Treatment 2 to Treatment 10 were also readied (100ml RTS beverage each) and poured (while still hot) into sterilized bottles of 250 ml capacity each, and, crown-corked and heat-processed in boiling water at 65°C for 30 min. These were then cooled and stored as per Srivastava and Sanjeev Kumar (2002). Quality attributes such as colour, taste and overall acceptance were assessed by a panel of 15 judges, by scoring

on a 9-point Hedonic scale, as per Amerine *et al* (1965). Colour of the clarified juices, blended juices and RTS beverage was recorded as per the scale in the descriptor catalogue of Directorate of Cashew Research (DCR), Puttur, Karnataka.

RESULTS AND DISCUSSION

Quality parameters for RTS beverage

Change in the colour of RTS beverage at 0, 30 and 60 days of storage was observed, and the best colour that was recorded in mango and cashew apple blends was at 0 day. A gradual change in colour was observed in 25% cashew apple juice + 75% mango juice blend (T3). This could be due to oxidation of the product, leading to the onset of Millard reaction, as reported by Sastry *et al* (1963) in cashew apple.

The pH of RTS juice prepared from different blends recorded a decreasing trend from 0 to 60 days of storage. pH 3.45 was recorded in 25% cashew apple juice + 75% mango juice blend (T3) among various other RTS juices at 0 day of storage, and pH 3.11 at 60 days of storage in 25% cashew apple juice + 75% mango juice blend (T3). This could perhaps be due to an increase in titrable acidity, as, acidity and pH are inversely proportional, as per Awis jan

Table 1. Physico-chemical parameters of cashew apple blended juices before RTS beverage preparation using various treatments

Treatment	pH	Density (kg/m ³)	Total Soluble Solids (°Brix)	Titrable acidity (%)
T1: 75% Cashew apple juice + 25% Mango juice	3.63	0.83	10.16	0.91
T2: 50% Cashew apple juice + 50% Mango juice	3.47	0.9	9.63	0.92
T3: 25% Cashew apple juice + 75% Mango juice	3.53	1.03	8.53	0.86
T4: 75% Cashew apple juice + 25% Pineapple juice	3.56	0.9	10.1	0.97
T5: 50% Cashew apple juice + 50% Pineapple juice	3.48	0.9	10	0.93
T6: 25% Cashew apple juice + 75% Pineapple juice	3.44	1.03	11.56	0.85
T7: 75% Cashew apple juice + 25% Sapota juice	3.58	0.9	11.06	0.95
T8: 50% Cashew apple juice + 50% Sapota juice	3.66	1.03	13.1	0.92
T9: 25% Cashew apple juice + 75% Sapota juice	3.6	1.06	15.7	0.92
T10: 100% Cashew apple juice	3.53	0.8	9.93	0.89
SE(m)	0.02	0.02	0.08	0.01
CD (<i>P</i> =0.05)	0.09	0.07	0.25	0.02

Blending cashew apple juice with other fruits juices

Table 2. Effect of length of storage on colour, pH, density and Total Soluble Solids in RTS beverage prepared from cashew apple blended juices

Treatment	Colour			pH			Density (kg m ⁻³)			Total Soluble Solids (°Brix)		
	Days after storage			Days after storage			Days after storage			Days after storage		
	0 days	30 days	60 days	0 days	30 days	60 days	0 days	30 days	60 days	0 days	30 days	60 days
T1: 75% Cashew apple juice + 25% Mango juice	Light yellow	Light yellow	Light yellow	3.63	3.16	3.05	0.9	1.06	1.01	15.1	15.43	15.5
T2: 50% Cashew apple juice + 50% Mango juice	Yellow	Light yellow	Light yellow	3.52	3.77	3.07	0.92	1.05	0.9	14	14.93	15.12
T3: 25% Cashew apple juice + 75% Mango juice	Yellow	Light yellow	Light yellow	3.45	3.25	3.11	0.91	1.07	1.01	14.86	15.46	15.7
T4: 75% Cashew apple juice + 25% Pineapple juice	Dull white	Light yellow	Light yellow	4.36	3.14	3.08	0.9	1.04	1.03	14.96	15.03	15.2
T5: 50% Cashew apple juice + 50% Pineapple juice	Dull white	Light yellow	Light yellow	3.7	3.26	2.84	0.9	1.06	1.05	15.03	15.13	15.14
T6: 25% Cashew apple juice + 75% Pineapple juice	Dull white	Light brown	Light brown	3.55	3.18	3.11	0.94	1.08	1.02	15.1	15.5	15.66
T7: 5% Cashew apple juice + 25% Sapota juice	Dull white	Light brown	Light brown	3.53	3.16	2.73	0.95	1.05	1.02	15.4	15.63	15.96
T8: 50% Cashew apple juice + 50% Sapota juice	Dull white	Light brown	Light brown	3.58	2.86	3.12	0.87	1.06	1.01	15.8	16.36	16.73
T9: 25% Cashew apple juice + 75% Sapota juice	Dull white	Light brown	brown	3.52	2.9	2.64	0.97	1.07	1.04	16.4	16.76	17.1
T10: 100% Cashew apple juice	Creamy white	Dusky white	Dusky white	3.6	3.24	3.08	0.92	1.07	1.03	15.1	15.66	16.06
SE(m)	—	—	—	0.05	0.01	0.01	0.01	0.01	0.01	0.08	0.09	0.08
CD (<i>P</i> =0.05)	—	—	—	0.17	0.035	0.02	0.03	0.01	0.03	0.24	0.27	0.27

and Dorcus Masih (2012). Similarly, reduction in pH during storage of cashew apple RTS juice is due to an increase in level of sugars by hydrolysis and decrease in level of acidity, as reported by Sarvesh Rustagi and Pravesh Kumar (2013) in *amla*-mango blends (Table 1, Fig. 1).

A study on density of the RTS beverage in different treatments showed that in cashew apple and sapota juice blend RTS, it ranged between 0.87 and 0.97 kg mg⁻³; but, the lowest range of 0.92 kg mg⁻³ was observed in cashew apple and mango RTS beverage at 0 day of storage, while,

the other treatments showed an increasing trend (minimum 0.90 to 1.08 kg mg⁻³ at 30 and 60 days of storage). However, a moderate range of density (0.91 to 1.01 kg mg⁻³) was observed in 25% cashew apple juice + 75% mango juice blend (T3), which is optimum for the quality of RTS beverage, followed by T5 compared of 50% cashew apple juice + 50% pineapple juice.

Total Soluble Solids (TSS) studied in various treatments showed that cashew apple and sapota mix RTS ranged between 15.40 and 16.40°Brix; but, the lowest range

of 14.0 to 15.10°Brix was observed in the RTS blend of cashew apple and mango at 0 day of storage, while, the other treatments showed an increasing trend of a minimum of 14.00°Brix (T2) to 17.10°Brix (T9) at 0, 30 or 60 days of storage. However, a moderate range of TSS (14.86 to 15.70) was observed in a blend of 25% cashew apple juice + 75% mango juice (T3), followed by 50% cashew apple juice + 50% pineapple juice (T5) at 30 and 60 days of storage, respectively. This increased level of TSS could be due to hydrolysis of sugars and decreased levels of acidity, as reported by Pawar *et al* (2011) in sapota, and by Sarvesh Rustagi and Pravesh Kumar (2013) in cashew apple and amla-mango blends (Table 1, Fig. 2 & 7).

Titration acidity among different treatments with cashew apple and sapota blend RTS ranged between 0.53 – 0.64; but, the lowest range of 0.48 - 0.65 was observed in

RTS juice of cashew apple and mango juice blend at 0 days of storage. The other treatments showed a decreasing trend in titration acidity ranging from 0.48 to 0.24 at 0, 30 and 60 days of storage. However, a moderate range of titration acidity (0.56 - 0.26) in 50% cashew apple juice + 50% pineapple juice (T5), followed by 25% cashew apple juice + 75% mango juice blend (T3) was recorded at 0, 30 and 60 days of storage. This decreasing trend could be due to increased levels of sugars by hydrolysis and by the decreased levels of acidity. Release of acid by decomposition, hydrolysis or oxidation (which modifies the hydrogen ion concentration), results in changed acidity of the RTS beverage, as reported by Jain *et al* (1984) in orange and Uma *et al* (2011) in cashew (Table 2, Fig. 4).

Reducing sugars (%) among different treatments constituting cashew apple and pineapple RTS beverages

Table 3. Effect of storage period on titration acidity, reducing sugars, TSS/Acid ratio and ascorbic acid in RTS beverages prepared from cashew apple blended juices

Treatment	Titration acidity (%)			Reducing sugars (%)			TSS/Acid ratio			Ascorbic acid (mg/100g)		
	Days after storage						Days after storage					
	0 days	30 days	60 days	0 days	30 days	60 days	0 days	30 days	60 days	0 days	30 days	60 days
T1: 75% Cashew apple juice + 25% Mango juice	0.55	0.53	0.32	2.13	2.37	2.42	27.54	28.23	51.5	13.48	13.1	12.87
T2: 50% Cashew apple juice + 50% Mango juice	0.48	0.48	0.31	3.76	3.92	4.28	30.35	31.08	33.6	13.05	12.71	12.47
T3: 25% Cashew apple juice + 75% Mango juice	0.65	0.59	0.32	2.22	2.59	2.64	22.87	26.82	49.4	12.51	11.76	11.66
T4: 75% Cashew apple juice + 25% Pineapple juice	0.55	0.54	0.24	3.07	3.16	3.18	27.66	25.82	63.3	11.51	10.9	10.9
T5: 50% Cashew apple juice + 50% Pineapple juice	0.56	0.53	0.26	5.1	5.18	5.47	26.63	26.33	58.1	16.25	15.05	14.91
T6: 25% Cashew apple juice + 75% Pineapple juice	0.58	0.53	0.33	5.04	5.04	5.52	25.56	30.06	49.87	25.25	22.2	20.93
T7: 75% Cashew apple juice + 25% Sapota juice	0.53	0.51	0.34	3.73	3.8	4.22	28.57	29.36	50.76	30.65	24.64	23.6
T8: 50% Cashew apple juice + 50% Sapota juice	0.64	0.61	0.37	3.38	3.56	3.56	25.42	27.1	48	18.79	16.69	16.41
T9: 25% Cashew apple juice + 75% Sapota juice	0.58	0.56	0.36	3.24	3.49	3.57	27.49	29.44	49.61	26.45	24.09	22.48
T10: 100% Cashew apple juice	0.97	0.83	0.5	3.12	3.94	4.24	15.46	19.55	32.86	38.07	35.17	34.38
SE(m)	0.01	0.01	0.04	0.27	0.2	0.09	0.34	0.71	0.18	0.55	0.53	0.81
CD (<i>P</i> =0.05)	0.02	0.02	0.1	0.67	0.6	0.28	1.01	2.11	0.05	1.67	1.61	2.39

Blending cashew apple juice with other fruits juices

Table 4. Effect of storage period on organoleptic score of cashew apple RTS beverage prepared from blended juices for colour, taste and overall acceptability

Treatment	Colour			Taste			Overall acceptability		
	Days after storage			Days after storage			Days after storage		
	0 days	30 days	60 days	0 days	30 days	60 days	0 days	30 days	60 days
T1: 75% Cashew apple juice + 25% Mango juice	5	6	6	8	6.23	6.66	6.5	6.11	6.33
T2: 50% Cashew apple juice + 50% Mango juice	5	6	5.66	6.66	5.66	6.38	5.83	5.83	6.02
T3: 25% Cashew apple juice + 75% Mango juice	5.1	5.1	5.1	8.66	8.66	8.52	8.33	7.83	7.89
T4: 75% Cashew apple juice + 25% Pineapple juice	6	5.66	4.9	7	6.16	5.79	6.5	5.91	5.39
T5: 50% Cashew apple juice + 50% Pineapple juice	4.9	5.16	5.16	7.66	6.83	6.9	6.33	5.99	6.03
T6: 25% Cashew apple juice + 75% Pineapple juice	5.66	5.66	5.66	8	7.66	7.6	6.83	6.66	6.63
T7: 75% Cashew apple juice + 25% Sapota juice	6	6.33	6.33	6.66	5.16	4.76	6.33	5.74	5.54
T8: 50% Cashew apple juice + 50% Sapota juice	5	4.9	5	7.33	6.66	6.68	6.16	5.83	5.84
T9: 25% Cashew apple juice + 75% Sapota juice	5.66	5.66	5.66	7.33	6.5	6.87	6.49	6.08	6.25
T10: 100% Cashew apple juice	8.66	8.5	8.33	8	7.16	7.46	6.83	6.83	6.76
SE(m)	0.61	0.61	0.6	0.36	0.24	0.11	0.48	0.42	0.35
CD ($P=0.01$)	2.02	1.81	1.79	1.08	0.71	0.33	1.54	1.26	1.06

Hedonic rating scale:

Dislike extremely - 1 Dislike very much - 2 Dislike moderately - 3 Dislike slightly - 4 Neither like nor dislike - 5
 Like slightly - 6 Like moderately - 7 Like very much - 8 Like extremely - 9

Table 5. Cost of production of RTS beverage (1000ml) prepared from variously blended juices in different treatments

Treatment	Cost of blended juice (Rs.)	Cost of preservative (Rs.)	Cost of bottle (Rs.)	Cost of labour (Rs.)	Cost of sugar (Rs.)	Miscellaneous (Rs.)	Total cost (Rs.)
T1: 75% Cashew apple juice + 25% Mango juice	4.02	1.35	4	3	4.4	5.1	21.87
T2: 50% Cashew apple juice + 50% Mango juice	4.45	1.35	4	3	4.4	5.1	22.3
T3: 25% Cashew apple juice + 75% Mango juice	4.87	1.35	4	3	4.4	5.1	22.72
T4: 75% Cashew apple juice + 25% Pineapple juice	4.14	1.35	4	3	4.4	5.1	21.99
T5: 50% Cashew apple juice + 50% Pineapple juice	4.7	1.35	4	3	4.4	5.1	22.55
T6: 25% Cashew apple juice + 75% Pineapple juice	5.24	1.35	4	3	4.4	5.1	23.09
T7: 75% Cashew apple juice + 25% Sapota juice	3.45	1.35	4	3	4.4	5.1	21.3
T8: 50% Cashew apple juice + 50% Sapota juice	3.32	1.35	4	3	4.4	5.1	21.17
T9: 25% Cashew apple juice + 75% Sapota juice	3.18	1.35	4	3	4.4	5.1	21.03
T10: 100% Cashew apple juice	3.6	1.35	4	3	4.4	5.1	21.45

ranged between 3.07 and 5.10; but, the lowest range of (2.13 to 3.76) was observed in RTS blend of cashew apple and mango at 0 days of storage. All treatments showed an increasing trend in reducing sugars, ranging from 2.37 to 5.52 at 30 and 60 days of storage. However, a moderate range of reducing sugars (2.22 to 2.64) in 25% cashew apple juice + 75% mango juice blend (T3), followed by 50% cashew apple juice + 50% pineapple juice (T5) was recorded at 0, 30 and 60 days of storage. This increasing trend may

be due to the conversion of polysaccharides into reducing sugars in the presence of citric acid, and due to the addition of sugars as reported by Sakhale (2012) in mango RTS beverage and Sarvesh Rustagi and Pravesh Kumar (2013) in mango and *amla* blend (Table 2, Fig. 5).

Similarly, TSS/Acid ratio in all the treatments showed that total soluble solids increased and the acidity was reduced. Correspondingly, TSS/Acid ratio increased

Table 6. Economics of RTS beverage prepared from various cashew apple blended juices

Treatment	Cost incurred per 1000ml RTS (Rs.)	Estimated price per 1000ml RTS (Rs.)	Net benefit (Rs.)
T1: 75% Cashew apple juice + 25% Mango juice	21.87	45	23.13
T2: 50% Cashew apple juice + 50% Mango juice	22.3	50	27.7
T3: 25% Cashew apple juice + 75% Mango juice	22.72	55	32.28
T4: 75% Cashew apple juice + 25% Pineapple juice	21.99	54.75	32.76
T5: 50% Cashew apple juice + 50% Pineapple juice	22.55	69.5	46.95
T6: 25% Cashew apple juice + 75% Pineapple juice	23.09	84.25	61.16
T7: 75% Cashew apple juice + 25% Sapota juice	21.3	42.5	21.2
T8: 50% Cashew apple juice + 50% Sapota juice	21.17	45	23.83
T9: 25% Cashew apple juice + 75% Sapota juice	21.03	47.5	26.47
T10: 100% Cashew apple juice	21.45	40	18.55

*Price was estimated based on the price prevailing in local market of the respective RTS, as follows:

1. 1 litre mango RTS costs ₹ 60/-
2. 1 litre pineapple RTS costs ₹ 99/-
3. 1 litre sapota RTS costs ₹ 50/-
4. 1 litre cashew apple RTS costs ₹ 40/-

with increasing days of storage, viz., 0, 30 and 60 days. However, the highest TSS/Acid ratio (30.35) was seen in 50% cashew apple juice + 50% mango juice blend (T2) at 0 and 30 days; but, at 60 days of storage, 75% cashew apple juice + 25% pineapple juice blend had a ratio of 63.30 (T4). A steady increase was observed in 25% cashew apple juice + 75% mango juice blend (T3), followed by that in 50% cashew apple juice + 50% pineapple juice (T5) at 0, 30 and 60 days of storage. Similar results were reported earlier by Akinwale (2000) in cashew apple (Table 2, Fig. 6).

Ascorbic acid content among different treatments showed that the cashew apple and sapota RTS beverage ranged between 18.79 and 30.65 mg/100g; But, the lowest range of 12.51 to 13.48 mg/100g was observed in the RTS beverage of cashew apple and mango at 0 days of storage. All the treatments showed a decreasing trend of a minimum of 10.90 to 23.60 mg/100g at 30 and 60 days of storage. However, a moderately lowest decrease was observed in 25% cashew apple juice + 75% mango juice blend (T3), followed by 50% cashew apple juice + 50% mango juice (T2) and 50% cashew apple juice + 50% pineapple juice

(T5) at 0, 30 and 60 days of storage. Ascorbic acid content of the RTS beverage decreased with advancement in storage period, probably due to the fact that ascorbic acid is sensitive to oxygen, light and heat, and was easily oxidized in the presence of oxygen by enzymatic and non-enzymatic catalysts. This has been stated by Mapson (1970) and Bhardwaj and Mukherjee (2011) in *kinnow*, *aonla* and ginger blended RTS beverages (Table 2, Fig. 7).

Organoleptic score for cashew apple RTS for taste was highest (8.66) in 25% cashew apple juice + 75% mango juice blend (T3) at 0, 30 days of storage, followed by 25% cashew apple juice + 75% pineapple juice (T6), and, 75% cashew apple juice + 25% mango juice blend (T1) which were on par with each other. Also, at 60 days storage, a score of 8.52 was recorded in 25% cashew apple juice + 75% mango juice blend (T3).

Overall acceptability was rated highest (8.33) in 25% cashew apple juice + 75% mango juice blend (T3), followed by (6.83) 25% cashew apple juice + 75% pineapple juice (T6), at 0 days of storage. However, organoleptic score for colour, taste and overall acceptability in different treatments decreased with advancing storage period; but, RTS beverage prepared from a blend of 25% cashew apple juice + 75% mango juice blend (T3), followed by 25% cashew apple juice + 75% pineapple juice (T6), was stable. Similar results were reported by Bhardwaj and Mukherjee (2011) in *kinnow*, *aonla* and ginger blended RTS beverages. If the maximum possible quantity of mango or pineapple juice is used in a blend, we can hope to get a higher sensory score and adjust acidity, to yield a good taste to the RTS beverage on blending with cashew apple juice (Table 3, Figs. 8, 9 & 10).

Economics of ready-to-serve (RTS) beverage prepared from cashew apple juice blends

Cost of production of a unit a quantity of RTS beverage in different treatments is presented in Tables 4 & 5. The net benefit over cashew apple RTS beverage as per prevailing price in the local market was considered (pineapple RTS costs Rs. 99 per liter, mango RTS costs Rs. 60 per litre, sapota RTS costs Rs. 50 per litre, and cashew apple RTS costs Rs. 40 per litre). The price was estimated for arriving at the net benefit, and the data is presented in Table 5. The highest net benefit for RTS beverage was Rs. 61.16 in 25% cashew apple juice + 75% pineapple juice (T6), followed by 50% cashew apple juice + 50% pineapple juice (T5) at Rs. 46.95. The lowest net benefit was recorded in 75% cashew apple + 25% sapota juice (T7) over the

Control, i.e., 100% cashew apple juice (Rs. 18.55); the net benefit for other RTS beverages was intermediate between treatment combinations, and the data is presented in Tables 5 & 6 and Figures 15 & 16. Similar results were reported by Jayalekshmy and Salam (2007). However, based on organoleptic score, the RTS beverage prepared using mango with cashew apple juice as blend was the best, and as per cost-economics, pineapple with cashew apple juice blend was found to be the best with regard to quality parameters under the study.

CONCLUSION

Ingredient composition of 25% cashew apple juice + 75% mango juice blend (T₃), or, 25% cashew apple juice + 75% pineapple juice blend (T₆), followed by 50% cashew apple juice + 50% pineapple juice blend (T₅) revealed increased levels of density, Total Soluble Solids (TSS), reducing sugars, TSS:Acid ratio, and, decreased levels of pH, titrable acidity and lowest decrease rate in ascorbic acid content in Treatment T₃, followed by T₅ and T₆. RTS beverages prepared from cashew apple and mango-juice blend, and cashew apple and pineapple-juice blend, were suitable for increasing the value of cashew apple RTS beverage prepared from various fruit-juice-blends.

Further, organoleptic score for RTS juice blend prepared from 25% cashew apple juice + 75% mango juice blend (T₃), followed by 50% cashew apple juice + 50% mango juice blend (T₂), 25% cashew apple juice + 75% pineapple juice blend (T₆), and 50% cashew apple juice + 50% pineapple juice blend (T₅), was superior in quality in terms of colour, taste and overall acceptability up to 60 days of storage; and, these processes were economical for utilization of cashew apple juice blended variously with mango and pineapple juice for RTS beverage preparation, thereby imparting value-addition to cashew apple juice.

REFERENCES

Akinwale, T.O. 2000. Cashew apple juice: Its use in fortifying the nutritional quality of some tropical fruits. *Europ. Food Res. Technol.*, **211**:205-207

Amerine, M.A., Pangborn, R.M. and Roessler, E.B. 1965. Principles of sensory evaluation of food. In: Food Science and Technology Monographs, Academic Press, New York, USA, pp. 338-339

Awsi Jan and Dorcus Masih Er. 2012. Development and

quality evaluation of pineapple juice blend with carrot and orange juice. *Int'l. J. Scientific & Res. Publications*, **2**(8):1-7

Bhardwaj, R.L. and Mukherjee, S. 2011. Effects of fruit juice blending ratios on kinnow juice preservation at ambient storage condition. *African J. Food Sci.* **5**:281-286

Hiremath, J.B. and Rokhade, A.K. 2012. Preparation and preservation of sapota juice. *Int'l. J. Food Agri. & Veterinary Sci.*, **2**:87-91

Hemalatha, R. and Anbuselvi, S. 2013. Physico-chemical constituents of pineapple pulp and waste. *J. Chem. & Pharmaceutical Res.*, **5**:240-242

Jain, S.P., Tripathi, K.V., Ram, H.B. and Singh, S. 1984. Effect of storage conditions on the keeping quality of fruit squashes. *Indian Food Packer*, **38**:33-39

Jayalekshmy, V.G. and Salam, M.A. 2007. Cost of establishment of a cashew apple processing unit and production cost of cashew apple syrup. *Cashew*, **16**:29-33

Mapson, L.W. 1970. Vitamins in fruits. In: The biochemistry of fruits and their products. Vol 1. Hulme, A.C. (ed.). Academic Press, London, P. 369

Pawar, C.D., Patil, A.A. and Joshi, G.D. 2011. Physico-chemical parameters of sapota fruits at different maturity stages. *Karnataka J. Agril. Sci.*, **24**:420-421

Sakhale, B.K., Pawar, V.N. and Ranveer, R.C. 2012. Studies on the development and storage of whey-based RTS beverage from mango cv. Kesar. *J. Food Process Technol.*, **3**:148 doi:10.4172/2157-7110.1000148

Santos, F.H.C., Cavalcanti, J.J.V. and Silva, F.P. 2010. Detection of quantitative trait loci for physical traits of cashew apple. *Crop Breed. Appl. Biotech.*, **10**:101-109

Sarvesh Rustagi and Pravesh Kumar. 2013. To study the storage analysis of developed amla mango blended. *Adv. Biores.*, **4**:109-117

Sastry, L.V.L., Chakraborty, R.N., Pruthi, J.S. and Siddappa, G.S. 1963. Preservation and storage of cashew apple juice and its blends. *Indian J. Tech.*, **1**:431-433

Srivastava, R.P. and Kumar, S. 2002 Fruit and vegetable Preservation: Principles and Practices. International Book Distribution Company, Lucknow, U.P., India, pp. 184-185

Uma, T., Rama Rao Vechalapua and Khasim Beebi Shaikh. 2011. Preservation and shelf-life extension of cashew apple juice. *Internet J. Food Safety*, **13**:275-280

(MS Received 02 January 2015, Revised 25 April 2016, Accepted 27 April 2016)