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Studies on preparation of blended karonda-beet root ready to serve beverage

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ABSTRACT

A study was designed to prepare ready to serve (RTS) beverage by blending juice of *Karonda* with beetroot juice. Ready to serve beverage was prepared in different combinations of sugar, citric acid, water and sodium benzoate. The blended RTS was prepared using extracted juices from *Karonda* and beetroot in the ratios of 100:0, 90:10, 80:20, 70:30 and 60:40 and 50:50, respectively.The blends were homogenized and filled into 200 ml sterilized glass bottle and pasteurized at 85^{0}C for 10 min, cooled and stored at ambient temperature for three months. The physico-chemical and sensory evaluation of RTS were analysed at an interval of one month. Results of the nutritional properties showed that acidity, reducing and total sugars increased but TSS and ascorbic acid decreased during storage. *Karonda* blended beetroot juice in the ratio of 50:50 recorded the highest score 8.43, 7.69, 8.31 and 7.64 for colour, flavour, taste and overall acceptability. Blended *Karonda* RTS prepared in the ratio of Karonda:Beetroot:50:50 with treatment T_6 was found highly acceptable on the basis of sensory evaluation.

Key words: RTS, karonda, beet root, blended.

INTRODUCTION

Karonda is an indigenous fruit of India and belongs to the family Apocynaceae. The fruit is very hardy, evergreen bush growing well even on marginal and inferior land when most other fruits either fail to grow or give poor performance. It is found in Africa, Australia and Tropical Asia, particularly in Western Peninsula and dry tracts of India, Sri Lanka and Malaysia mainly in wild form. In India, it was cultivated by the Europeans in kitchen garden to get fruit for jelly preparation. *Karonda* fruits are sour and astringent in taste and are a rich source of iron and an excellent source of vitamin A, C and B complex, fibre, carbohydrates and minerals such as calcium, phosphorous, potassium, sodium and sulphur. Ripe fruits are sub-acidic to sweet in taste with peculiar aroma. The fruits may be fresh eaten as a dessert when ripe or used in the preparation of fruit products such as candies, jelly, squash and chutney. The storage life of *Karonda* fruit is very short because of its soft and high moisture content. It may be stored for a week at 13°C and 95% relative humidity. Under the changing world trade scenario, this fruit can be exploited on a commercial scale in the processing industries (Shaheel *et al*., 10). Beetroot (*Beta vulgaris*) is a member of the Chenopodiaceae family which include silver beet, sugar beet and fodder beet. It is a crop of temperate region where cool weather and high humidity are available. Beet is widely cultivated for the production of commercial sugar forage plants, natural dye and food for human consumption. Beetroot is a good tonic food for health. The main markets for beet greens and bunched beets are roadside, farmers markets and deliveries to wholesalers. The market for beetroot is not very large but is significant. Beetroot is a rich source of potent antioxidants and nutrients; it can also be used for blood pressure and cardiovascular disease prevention, for healthy liver function and cancer prevention. Beetroot is a potential source of valuable water soluble nitrogenous pigments, called betalins. Betalins have been extensively used in the modern food industry. They are one of the most important natural colourant. Betalins have several applications in food items, such as desserts, confectionaries, dry mixes, dairy and meet products (Sri Vidhya and Radhai Sri, 15).

It is a general assumption that juice from a single variety of fruit is not often palatable in taste and aroma. It may be lacking in one quality attribute or another. Blending is likely to compensate for certain characteristics by reuniting flavours and eliminating or diluting undesirable component of the juice and thus maintaining a balance between the quality characters in the final product. The blending of fruit juices could be an economic requisite to utilize some of fruits for processing, which may not otherwise have favourable characters such as colour, aroma, mouth feel including overall cost for the preparation of the processed products. It may also enhance the appearance, nutrition, flavour of the product and lead to new product development. Hence the

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present investigation is carried out for the utilization of *Karonda* fruit juice by blending with beetroot juice for preparation of ready to serve (RTS) beverage.

MATERIALS AND METHODS

The lab study was conducted at Rainfed Research Sub-Station for Sub-Tropical Fruits (RRSS), Raya, SKUAST-J, Samba, Jammu and Kashmir UT (32° 39" N 74° 53" E, elevation of 332 m MSL) during the year 2015-16. The study was conducted under adhoc Research Project entitled, "Exploitation of under-utilized fruits of *kandi* areas of Jammu region through value addition for human resource development" funded by SERB-DST, New Delhi, GOI. The *Karonda* fruit was procured from RRSS, Raya whereas beet root was purchased from the local market. The defective and injured fruits of karonda and beetroot were sorted out and healthy ones were retained for juice extraction after washing with water then Karonda fruits put into juice extractor and extracted the juice. The beetroot was cut into slices of about of 2-3 mm thick and subjected to extraction using juice pulper. The juice so obtained was passed through stainless steel strainer, homogenized followed by heating at 85°C for 30 sec. and filling in pre-sterilized glass bottles. Bottles were crown corked and pasteurized for 20 min. in boiling water, cooled, labeled and stored at ambient temperature for further use.

For the preparation of blended RTS, the *Karonda* and Beetroot juices were mixed together in different ratios. The various treatment combinations were T_1: 100:0, T_2: 90:10, T_3: 80:20, T_4: 70:30, T_5: 60:40 and T_6: 50:50, by mixing of *Karonda* and beetroot juices, respectively. After evaluating the blends for the TSS and acidity, a required quality of sugar and citric acid was added to the mixture to maintain 15° Brix TSS and 0.3% acidity of the blended RTS. The mixture was then heated to dissolve the sugar completely. Before hot filling, the sodium benzoate @ 200 ppm was added to the blended RTS. The product was then hot filled in pre-sterilized glass bottles. The bottles were then sealed air tight, pasteurized, labelled and stored at a cool and dry place. The RTS was stored at ambient temperature conditions to study the storage behaviour of the product with respect to the changes in chemical and sensory qualities during storage. The product was evaluated immediately after preparation and then at an interval of one month up to three months of storage. Total soluble solids (TSS), titratable acidity, sugars and ascorbic acid were determined as per the method suggested by Ranganna (8). The samples were evaluated on the basis of sensory evaluation by semi-trained taste panels of 6-7 judges using 9 point hedonic scale. A score of 5.5 and above was considered acceptable (Amerine *et al*., 1). The lab experiment was carried out in completely randomized design with factorial concept for the interpretation of results through analysis of variance (Gomez and Gomez, 4).

RESULTS AND DISCUSSION

Data in Table 1 represent the chemical characteristics of Karonda and Beetroot. The TSS, acidity, ascorbic acid, reducing sugar and total sugar of Karonda were 11.2°B, 1.19%, 6.70 mg/100 g, 5.21% and 6.34%, respectively. Almost similar values for the chemical characteristics of Karonda were also reported by Singh *et al*. (14) except for the values of TSS in Karonda fruit and the slight variations might be due to varietal and agro climatic differences. The data presented in Table 1 showed that the total soluble solids, titratable, acidity, ascorbic acid of beetroot was to the tune of 6.0^0 B, 0.13% and 3.55 mg/100 g, respectively which were in close compliance to the findings of Thakur and Das Gupta (16). The values of reducing and total sugars recorded in beetroot were 1.50 and 5.00%, respectively which were in accordance with the findings of Rodriguez Sevilla *et al*. (9).

A decrease in total soluble solids (TSS) content during storage in blended ready to serve (RTS) beverage was observed (Table 2). Different treatment combinations had a significant effect on TSS of blended RTS. Among the various mean treatments, T_1 (100:0) recorded statistically higher mean value (14.78°Brix) of TSS which was significantly superior to the other treatments. The mean TSS content of fresh Karonda based RTS was 15.00 °B for all the blends *i.e.* 100:0, 90:10, 80:20, 70:30, 60:40 and 50:50. During storage the mean TSS content of RTS decreased from 15.00° B to 14.68° B, 14.51° B and 14.35° B after storage period of 30, 60 and 90 days, respectively. The decrease in TSS Karonda blended RTS during storage may be due to increase in acidity during storage. The results are in conformation to those reported by Badal *et al.*, 2.

Titratable acidity of blended RTS varied significantly with different treatments as well as the

Table 1. Chemical characteristics of karonda and beet root.

S. No.	Particulars	Karonda	Beetroot
1.	TSS	11.2	6.00
2.	Acidity	1.19	0.13
3.	Ascorbic acid	6.70	3.55
3.	Reducing sugar	5.21	1.50
4.	Total Sugar	6.34	5.00

Table 2. Effect of treatments and storage periods on total soluble solids and acidity of karonda blended RTS.

Treatments	TSS (°Brix)					Acidity (%)				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1:Karonda:Beetroot:: 100:0	15.00	14.90	14.70	14.50	14.78	0.30	0.55	0.68	0.72	0.56
T_2:Karonda: Beetroot ::90:10	15.00	14.80	14.60	14.43	14.71	0.30	0.51	0.55	0.60	0.49
T_3:Karonda: Beetroot ::80:20	15.00	14.80	14.53	14.38	14.68	0.30	0.41	0.49	0.58	0.45
T_4:Karonda: Beetroot ::70:30	15.00	14.70	14.50	14.32	14.63	0.30	0.36	0.45	0.54	0.41
T_5:Karonda: Beetroot ::60:40	15.00	14.52	14.42	14.29	14.56	0.30	0.35	0.42	0.50	0.39
T_6:Karonda: Beetroot ::50:50	15.00	14.35	14.30	14.18	14.46	0.30	0.32	0.38	0.45	0.36
Mean	15.00	14.68	14.51	14.35		0.30	0.42	0.50	0.57	

Factors	CD (5%)	CD (5%)
Treatments	0.02	0.02
Storage	0.01	0.01
Treatments × Storage	0.03	0.03

storage period (Table 2). After one month of storage it was noticed that acidity of the blended *Karonda*: Beetroot RTS was significantly higher in treatment T_1 (0.55%) and lowest in T_6 (0.32) which was significantly increased at the end of storage *i.e* 0.72 and 0.45%. The mean titratable acidity was also increased from initial 0.30 to 0.57% up to 90 days of storage period. The interaction between treatment and storage was significant. The increase in acidity during storage might be due to the formation of organic acid by the degradation of ascorbic acid. Similar findings have been reported by Nidhi *et al*. (7).

Blended RTS recipe as well as storage period exhibited significant changes in the reducing sugar content of the blended RTS (Table 3). Significantly higher values of reducing sugar content were recorded in treatment T_6 (9.41%) which was followed statistically different values observed by T_5 and T_4 treatments to the tune of 9.32 and 9.19%, respectively. However, the lowest mean reducing sugar content (8.89%) was noticed in T_1 treatment. The variation in reducing sugars during storage was found significant after three months of storage period. The reducing sugar content of the blended RTS was increased from 8.74 to 9.61% after 90 days of storage. The reducing sugars were found to increase with the advancement of the storage period. This increase might be due to hydrolysis of non-reducing sugars into reducing sugars. Similar results were also obtained by Ulah *et al*. (17) in blended Carrot: Kinnow RTS. The interaction between treatments and storage period was also found to be significant.

Total sugar content of blended RTS exhibited variation due to the treatments and it increased significantly during storage (Table 3). Treatment T_6 recorded the significantly higher (13.33%) mean

Table 3: Effect of treatments and storage periods on reducing and total sugar of karonda blended RTS.

Treatments	Reducing Sugar (%)					Total Sugar (%)				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1: Karonda: Beetroot:: 100:0	8.57	8.66	9.10	9.23	8.89	12.56	12.78	13.08	13.68	13.01
T_2: Karonda: Beetroot ::90:10	8.60	8.70	9.26	9.48	9.01	12.60	12.80	13.20	13.75	13.08
T_3: Karonda: Beetroot ::80:20	8.72	8.80	9.37	9.55	9.11	12.74	12.86	13.25	13.82	13.16
T_4: Karonda: Beetroot ::70:30	8.78	8.86	9.48	9.62	9.19	12.80	12.90	13.30	13.88	13.22
T_5: Karonda: Beetroot ::60:40	8.84	8.90	9.68	9.87	9.32	12.88	12.96	13.40	13.92	13.29
T_6: Karonda: Beetroot ::50:50	8.97	8.95	9.80	9.95	9.41	12.94	12.98	13.44	13.96	13.33
Mean	8.74	8.81	9.45	9.61		12.58	12.88	13.27	13.83	

Factors	CD (5%)	CD (5%)
Treatments	0.02	0.02
Storage	0.01	0.01
Treatments × Storage	0.03	0.03

total sugars, whereas T_1 recorded significantly lower (13.01%) mean total sugar content of the blended RTS, followed by T_2 treatment. Thus, it is clear from the data that *Karonda* juice level in the product had significant effect on the total sugar content of the product. The total sugar content increased significantly from 12.58% at the time of preparation to 13.83% after 90 days of storage. This could be attributed to the fact that the hydrolysis of polysaccharides during storage resulted into increase in the soluble sugars. Similar findings have been reported by Verma and Gehlot (18) in bael RTS and Marimuthu and Thirumaran (6) in Jamun syrup where the total sugar content was increased during storage. The interaction between treatment and storage period was found to be significant.

Data recorded on ascorbic acid content (mg/100 g) in blended Karonda RTS clearly indicates that there was a significant variation among the treatments. There was a significant decline in the ascorbic acid content of blended Karonda RTS from initial month of storage (8.62 mg/100 g) to three months of storage (5.47 mg/100 g). Among the mean treatments, the maximum retention of ascorbic acid content (7.43 mg/100 g) was observed in treatment T_1 while the minimum ascorbic acid content (6.43 mg/100 g) was observed in treatment T_6. The mean value of ascorbic acid in Karonda RTS was 8.62 mg/100 ml which was decreased significantly ($P < 0.05$) to 7.53, 5.99 and 5.47 mg/100 ml during storage (Table 4). Degradation of ascorbic acid to carbolic acid due to increased acidity of the stored product could be attributed as one of the reasons for decrease in ascorbic acid (Krishnaveni *et al*., 5).

It could be well observed from the results presented in Table 4 that the microbial growth in Karonda blended RTS was not observed during storage and the product was totally free from bacteria as well as fungi throughout the storage period of 90 days.

Analogues observations were recorded by Gaikwad (3) and they reported that blended pineapple:pomegranate RTS was free from microbial spoilage during storage period of 90 days.

The data on the changes in the organoleptic score for colour of blended RTS influenced by different treatments and storage period are presented in Table 5.

It could be noticed from the data that the changes in the organoleptic score for colour of the RTS, prepared by six different treatments were statistically significant. The treatment T_6 recorded highest (8.43) mean score for colour, the lowest mean (7.53) score for colour was recorded by the treatment T_1. The variations in the organoleptic score for colour during storage were found statistically significant. The significantly higher (8.54) mean organoleptic score for colour was recorded immediately after preparation which was decreased with increase in the storage period. The interaction effect between storage and treatment was found to be statistically significant. Analogous observation to these finding were reported by Sindhumati and Premlata (13) in papaya:pineapple RTS beverage. The changes in the organoleptic score for flavour of blended RTS are presented in Table 5. The treatment T6 i.e. RTS recorded the highest (7.69) sensory score for flavour of the product. Whereas the treatment T_1 recorded the lowest (6.58) sensory score for flavour of the product. The organoleptic score for flavour of the blended RTS reduced significantly during storage, which was maximum (7.62) immediately after preparation, but

Table 4: Effect of treatments and storage periods on ascorbic acid and microbial count of karonda blended RTS.

Treatments	Ascorbic acid					Microbial count (cfu/ml)				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1: Karonda: Beetroot:: 100:0	9.23	8.18	6.57	5.75	7.43	ND	ND	ND	ND	ND
T_2: Karonda: Beetroot ::90:10	9.00	7.90	6.10	5.60	7.15	ND	ND	ND	ND	ND
T_3: Karonda: Beetroot ::80:20	8.76	7.70	6.00	5.52	6.995	ND	ND	ND	ND	ND
T_4: Karonda: Beetroot ::70:30	8.500	7.300	5.920	5.400	6.78	ND	ND	ND	ND	ND
T_5: Karonda: Beetroot ::60:40	8.200	7.160	5.800	5.360	6.63	ND	ND	ND	ND	ND
T_6: Karonda: Beetroot ::50:50	8.000	6.920	5.600	5.200	6.43	ND	ND	ND	ND	ND
Mean	8.62	7.53	5.998	5.47		ND	ND	ND	ND	

Factors	CD (5%)	CD (5%)
Treatments	0.10	ND
Storage	0.08	ND
Treatments × Storage	0.21	ND

Table 5: Effect of treatments and storage periods on color and flavour of karonda blended RTS.

Treatments	Color					Flavour				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1: Karonda: Beetroot:: 100:0	8.20	8.00	7.50	6.40	7.53	7.00	6.67	6.66	6.00	6.58
T_2: Karonda: Beetroot ::90:10	8.35	8.20	7.65	6.55	7.69	7.50	7.00	6.50	6.17	6.79
T_3: Karonda: Beetroot ::80:20	8.40	8.32	7.80	6.60	7.78	7.60	7.19	6.73	6.17	6.92
T_4: Karonda: Beetroot ::70:30	8.75	8.40	7.90	6.70	7.94	7.50	7.00	6.50	6.17	6.79
T_5: Karonda: Beetroot ::60:40	8.90	8.75	8.00	6.82	8.12	8.03	7.20	6.90	6.37	7.13
T_6: Karonda: Beetroot ::50:50	8.65	8.65	8.60	7.80	8.43	8.07	7.85	7.50	7.33	7.69
Mean	8.54	8.39	7.91	6.81		7.62	7.15	6.80	6.37	

Factors	CD (5%)	CD (5%)
Treatments	0.05	0.10
Storage	0.04	0.08
Treatments × Storage	0.10	0.19

decreased to a score of 6.37 after 90 days of storage. The interaction between treatment and storage was found to be statistically significant. Similar observations were also reported by Marimuthu and Thirumaran (6). The taste scores for RTS prepared by treatment T6 was rated maximum (8.31) followed by the RTS prepared by treatment T_5 (8.19). In general, it was observed that RTS prepared by treatment T_6 was more acceptable in case of colour and taste. In respect of storage interval the mean taste scores in all the blends decreased with increase in storage period from 8.37 to 7.81 after 90 days of storage (Table 6). The decrease in taste scores with increase in storage might be due to reduction of volatile flavoring components during storage which might ultimately be responsible for decreased taste scores. Similar findings have been recorded by Sharma (11).

The changes in organoleptic score for overall acceptability of blended RTS due to treatments were found to be statistically significant (Table 6). It is noticed from the data that the treatment T_6 was significantly superior to the rest of treatments with respect to overall acceptability. The lowest (7.25) mean organoleptic score for overall acceptability of the product was recorded by the treatment T_1 which was immediately followed by T_2 and T_3 treatments. The highest organoleptic score was observed in treatment T_6 (7.64%). In storage, the organoleptic score for overall acceptability of the RTS declined significantly from 8.11 to 6.91 after 90 days of storage. Analogous observations in conformity to these finding were also reported by Sharma *et al*. (12) in jamun-mango blended ready-to-serve beverage. The interaction effects between treatment and

Table 6: Effect of storage on taste and overall acceptability of karonda blended RTS.

Treatments	Taste					Overall acceptability				
	Storage period (Months)					Storage period (Months)				
	0	1	2	3	Mean	0	1	2	3	Mean
T_1: Karonda: Beetroot:: 100:0	8.10	8.00	7.85	7.70	7.91	8.13	7.78	6.59	6.50	7.25
T_2: Karonda: Beetroot ::90:10	8.20	8.17	8.10	7.80	8.07	8.10	7.94	6.80	6.70	7.39
T_3: Karonda: Beetroot ::80:20	8.41	8.40	7.92	7.82	8.14	8.03	7.69	7.09	6.95	7.44
T_4: Karonda: Beetroot ::70:30	8.35	8.32	7.90	7.80	8.09	8.19	7.97	6.95	6.80	7.48
T_5: Karonda: Beetroot ::60:40	8.50	8.45	7.95	7.84	8.19	8.29	8.15	7.05	7.00	7.62
T_6: Karonda: Beetroot ::50:50	8.65	8.67	8.00	7.90	8.31	7.92	7.53	7.59	7.50	7.64
Mean	8.37	8.34	7.95	7.81		8.11	7.84	7.01	6.91	

Factors	CD (5%)	CD (5%)
Treatments	0.07	0.02
Storage	0.06	0.01
Treatments × Storage	0.14	0.03

storage were found statistically significant. Among the various treatments, treatment T_6 (Karonda: Beetroot:50:50) was found to be acceptable on the basis of sensory evaluation.

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