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Development and Storage Stability of Selected RTS Beverage Developed from Carrot and Sour Orange Blend

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***Abstract* – RTS beverages with different combination are nowadays very popular among people because of their taste and nutritional characteristics. An experiment was conducted to prepare RTS beverage by blending carrot and sour orange. Carrot juice and sour orange juice were mixed in different combinations (in v/v) as 100:0, 60:40, 50:50 and 40:60 and sugar, citric acid, distilled water and Sodium metabisulphite were mixed considering the recommendations of Sri Lanka standards for RTS beverages. Best combination was selected based on the sensory evaluation and the selected combination was evaluated for its physico-chemical and sensory qualities. Carrot juice 50 % and Sour orange juice 50 % showed 0.48% titrable acidity, 13.2% total sugar, 4.8 mg/100ml ascorbic acid, 14˚Brix TSS, 2.86 pH and acceptable sensory qualities without any significant lose in the quality attributes at the end of 10 weeks storage at 5-10˚C refrigerated condition.**

***Keywords* – Carrot Juice, Nutritional Analysis, Ready-to-Serve Beverages, Orange Juice.**

I. INTRODUCTION

Blending can result in a value added fruit drinks which would be of high quality in respect of both sensory and nutritional aspects [1]. Carrot juice has a high nutritional value, as it is an important dietary source of carotenoids such as alpha- and beta-carotene, zeacarotene, lutein and lycopene [2]. Citrus fruits are distinguished, widely consumed fruits, particularly appreciated for their fresh flavor, vitamin C, and its natural antioxidants source having health benefits [3]. However, preservation of carrot juice is difficult due to its low acidity which provide ideal environment for the growth of many spoilage and spore forming bacteria [4]. Therefore, the present study was conducted to extend the shelf life of the Carrot and Sour-orange juices by blending them in different juice combinations.

II. MATERIALS AND METHODS

A. Preparation of RTS Beverage

Good quality carrots were thoroughly selected, peeled, washed, sliced and blended in an electrical blender (Model Smeeth) and the juice was filtered through muslin cloth to get clear juice. Fresh and matured sour orange were selected, washed, peeled off, cut into two halves, juice was extracted manually and extracted juice was filtered through muslin cloth to get clear juice. According to the recommendations of Sri Lanka standards, required amount of sugar and citric acid were dissolved in water to prepare sugar syrup up to boiling stage, cooled to TSS of 14˚ - 20˚Brix and mixed with carrot and Sour-Orange juices at correct quantity to get the RTS beverage. Then homogenized, heated at 85°C for 20 minutes for pasteurization and cooled for 10 minutes. 0.07g Sodium metabisulphite (SMS) was added, filled in pre-sterilized bottles and sealed. The bottles were sterilized in hot water bath at 80°C for 30 minutes, cooled. The best combination of RTS was selected on the sensory evaluation and the selected RTS was stored at refrigerator at 5-10˚C for 10 weeks.

The RTS beverages combinations were

T_1 - 100:0 carrot juice and sour orange juice (control)
T_2 - 60:40 carrot juice and sour orange juice
T_3 - 50:50 carrot juice and sour orange juice
T_4 - 40:60 carrot juice and sour orange juice

B. Storage Studies

Physico-chemical qualities of consumer accepted RTS beverage of Carrot juice with Sour-orange juice were measured for titrable acidity, total sugar, ascorbic acid, TSS and pH for 10 weeks at 2 weeks interval. Sensory qualities were measured using 7 point hedonic scale with 30 semi-trained panel members. (Score 1 is for "dislike very much" and 7 for "like very much").

C. Microbial Evaluation

Dilution series was made from 10° to 10^{-3} for the analysis. Diluted sample of 1 ml was poured into a petridish and cooled nutrient agar was poured into that kept in incubator at 30°C for 72 hours.

D. Statistical Analysis

Data obtained for the physico-chemical analysis were analyzed by Analysis of Variance (ANOVA) ($\alpha = 0.05$) and mean separation was done with Ducan's Multiple range Test (DMRT).

Data of sensory evaluation were analyzed using the Tukey's test. Both physico-chemical and sensory analysis were done through Statistical Analysis System (SAS) software statistical package.

III. RESULTS AND DISCUSSION

Sensory Evaluation of Fresh Carrot Juice and Sour Orange Juice Blend RTS

The results of sensory evaluation of freshly made Carrot Juice and Sour Orange Juice Blend RTS beverages are given in the Table 1. All the combinations received good consumer acceptability and among that 50:50 carrot juice and sour orange juice blend RTS (T3) received highest score and which was subjected to storage study.

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Table 1. Sensory Analysis of Fresh Carrot Juice and Sour Orange Juice Blend RTS

Treatments	Colour	Flavour	Consistency	Overall acceptability
T_1	6.66 ±0.08^a	5.40 ±0.141^b	6.33 ±0.12^a	6.36 ±0.112^a
T_2	6.16 ±0.12^b	4.33 ±0.161^c	4.63 ±0.089^c	4.40 ±0.113^c
T_3	5.63 ±0.13^c	6.6 ±0.091^a	5.30 ±0.12^b	6.66 ±0.087^a
T_4	4.73 ±0.14^d	5.50 ±0.11^b	4.20 ±0.16^d	4.80 ±0.162^b

Values are means of 30 replicates ± standard error
Values with different letters are significantly different at $p<0.05$
Sensory parameters were measured using seven point hedonic scales

Physico-chemical Evaluation of Selected Carrot Juice and Sour Orange Juice Blend RTS

Titrable acidity of the RTS beverage was increased throughout the storage period which reaches the maximum value of 0.48% (Figure 1). This is because of hydrolysis polysaccharides and oxidation of sugars leads to formation of acids [5] Similar results were obtained by [6] in blended pineapple – watermelon ready – to drink juice.

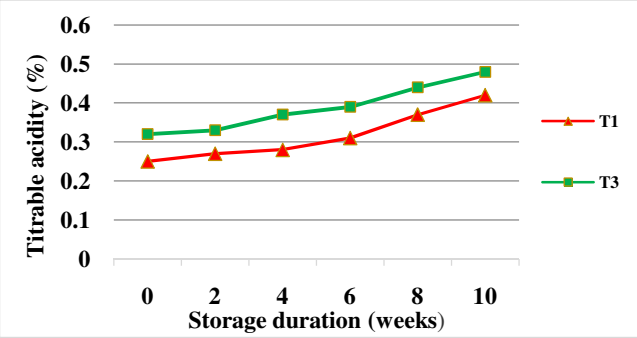


Fig. 1. Titrable acidity of Carrot Juice and Sour Orange Juice Blend RTS during Storage

The changes in total sugar of Carrot juice with Sour Orange juice blend of RTS beverages during storage are shown in Figure 2. According to DMRT, total sugar decreased significantly ($p<0.05$) throughout the storage period. The reduction in total sugars might be due to reaction of sugars with amino acids for non-enzymatic browning, which is agreed by [7] in hill lemon RTS beverage.

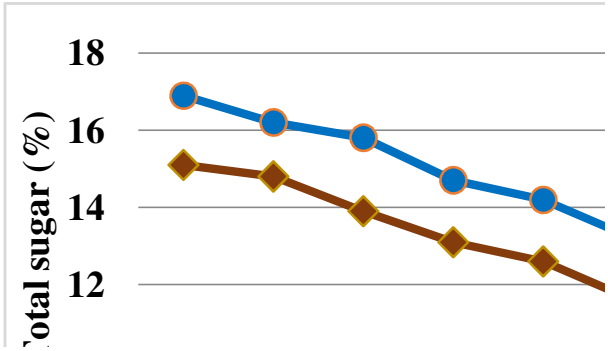


Fig. 2. Total sugar of Fresh Carrot Juice and Sour Orange Juice Blend RTS during storage

The ascorbic acid content (Figure 3) of the RTS beverage decreased during storage due to the fact that ascorbic acid being sensitive to oxygen, light and heat was easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst [8]. This is supported by [9] in Indian gooseberry juice blends.

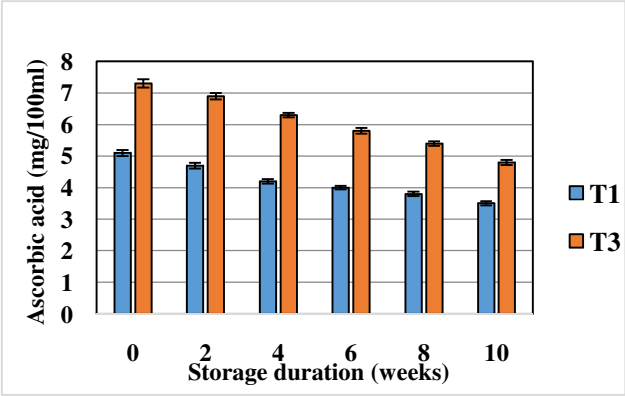


Fig. 3. Ascorbic acid of Carrot Juice and Sour Orange Juice Blend RTS during Storage

The changes in TSS and pH of Carrot Juice and Sour Orange Juice Blend RTS beverages during storage was shown in Table 2. The TSS of RTS beverages decreased slightly with the increase in storage duration which might be due to the chemical interactions taking place among the organic constituents of the beverage [10]. No significant changes observed in TSS of four different combinations of carrot juice with two levels each of beet root (5 and 10%) and black carrot (10 and 20%) [11]. Recommended TSS for commercial RTS production is 15°Brix (SLS 729:1985).

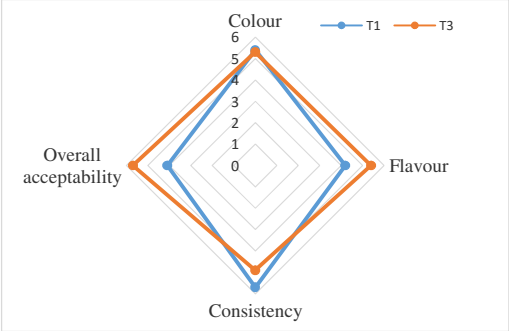
pH of all blend of RTS formulation decreased slightly as the storage period proceeded. This might be due to the increment of acidity during storage period. [12] found slight decrease in pH in ready-to-serve bael-guava blended beverage during 60 days of storage.

Table 2. TSS and pH of Carrot Juice and Sour Orange Juice Blend RTS during Storage

Storage Duration (weeks)	TSS		pH	
	T_1	T_2	T_1	T_2
0	14.2 ±0.291^a	16.1 ±0.289^a	3.25 ±0.005^a	3.07 ±0.008^b
2	13.9 ±0.115^b	15.8 ±0.115^a	3.21 ±0.008^a	3.05 ±0.005^b
4	13.8 ±0.009^b	14.7 ±0.057^a	3.18 ±0.004^a	3.04 ±0.005^b
6	13.6 ±0.115^b	14.3 ±0.057^a	3.13 ±0.007^a	2.91 ±0.012^a
8	13.5 ±0.115^b	14.2 ±0.115^a	3.07 ±0.008^a	2.88 ±0.115^a
10	13.2 ±0.112^b	14.0 ±0.008^a	3.00 ±0.002^a	2.86 ±0.115^a

Sensory Evaluation of Carrot Juice and Sour Orange Juice Blend RTS during Storage

The significant changes were noticed among the control and treatment in both formulations. The results indicated that during storage there was a slight decrease in colour and taste of RTS formulations. Decrease in taste which may be due to the degradation of ascorbic acid and furfural production. This is supported by [13]. The taste difference and loss might also be due to time and temperature, and duration of storage.



Values are means of 30 replicates ± standard error
Values with different letters are significantly different at $p<0.05$
Sensory parameters were measured using seven point hedonic scales

Fig. 4. Sensory Analysis of Carrot Juice and Sour Orange Juice Blend RTS after 10 weeks Storage

RTS with 100:0 carrot juice and sour orange juice got higher mean value of 5.7±0.15 while RTS with 50:50 carrot juice and sour orange juice got the mean value of 4.9±0.18 for consistency. There was significant reduction in overall acceptability of all RTS beverage formulations at 2 months of storage. [14] also reported a decrease in overall acceptability of beverages prepared from different ratios of bitter gourd during storage. According to the results of sensory evaluation 50:50 carrot juice and sour orange juice had good sensory qualities after 10 weeks storage.

Microbial Test for RTS Beverages Stored at Ambient Temperature after Two months

According to the observation of microbial colony for the RTS beverage samples after two months of storage 10^0 concentration level were not shown any colony forming units but 10^{-1}, 10^{-2} and 10^{-3} samples (T_1 and T_3) were shown mild growth colony forming units. According to the theory behind microbiological tests the concentrated sample contains high number of microbes. Therefore, these results may be due to laboratory contamination of samples.

IV. Conclusions

All the combination of RTS beverages prepared by using Sour-Orange juice and carrot juice received high scores for the sensory evaluation after preparation and RTS beverage with 50:50 carrot juice and sour orange juice (T_3) received higher mean value. During the storage period, the pysico-chemical parameters such as titrable acidity, total sugar, ascorbic acid, TSS and pH showed acceptable values. The sensory analysis of stores RTS beverage with 50:50 carrot juice and sour orange juice (T_3) revealed there were significant ($p<0.05$) differences for the organoleptic characters at 10 weeks of storage. Therefore, RTS beverage with 50:50 carrot juice and sour orange juice (T_3) can be stored for 10 weeks without any significant loss in the quality characteristics.

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