

# Preparation of Ready-To-Serve (RTS) Beverage from Carrot with Sour-Orange Juices

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**ABSTRACT:** A study was designed to prepare RTS beverage by blending juice of Carrot with Sour orange juice. Ready to serve beverage was prepared in different combinations of Sour- Orange juices with sugar, citric acid, water and Sodium metabisulphite, considering the recommendations of Sri Lanka standards for RTS beverages. Four formulations of the blends of Carrot juice with Sour-Orange juices at the ratios of 100:0, 60:40, 50:50 and 40:60 were prepared. The results of the nutritional properties showed that titrable acidity, ascorbic acid, total sugar and TSS total sugar increased and pH decreased when increase the sour orange percentage. Carrot juice with Sour-Orange juices at the ratios of 50:50 showed 0.32% titrable acidity, 7.3 mg/100g ascorbic acid, 16.9% total sugar, 16.1° Brix TSS and 3.03 pH. Sensory assessment revealed that, there were significant differences between the treatments. Carrot juice with Sour-Orange juices at the ratios of 50:50 received 6.66±0.087 for overall acceptability. Based on the quality characteristics, most preferred (50:50) Carrot with Sour- Orange juice was selected.

**KEYWORDS:** Carrot juice, Nutritional analysis, Ready-to-serve beverages, Orange juice..

## I. INTRODUCTION

Carrot (*Daucus carota* L) is one of the popular root vegetables grown throughout the world and is the most important source of dietary carotenoids in Western countries including the United States of America. Carrot is highly nutritional, and an important source of  $\beta$ -carotene besides its appreciable amount of vitamins and minerals often used for juice production [1]. The most commonly eaten part of carrot is taproot. Carrot contain good amount of dietary fibre which has laxative effect and aids in digestion and absorption of nutrients and prevents constipation. Consumers like carrot juice because of its high nutritive value, fiber, carbohydrates, vitamin A derived from its high  $\alpha$  carotene ( $\beta$   $\epsilon$ -carotene),  $\beta$ -carotene content, colour, aromatic compounds and refreshing characteristics [2].

Sour-Orange (*Citrus aurantium*) is also known as Bitter, Bigarade and Seville orange. It belongs to family Rutaceae. It is native to Southeastern Asia. There are various well- established forms of the Sour orange. Prominent subspecies is the Bergamot orange. Citrus fruits are distinguished, widely consumed fruits, particularly appreciated for their fresh flavor, vitamin C, and its natural antioxidants source having health benefits [3].

Fruit juices are important trade commodities in most countries [4]. Juices are available in their natural concentrations or in processed forms. Juices are fat-free, nutrient-dense beverages rich in vitamins, minerals and naturally occurring phytonutrients that contribute to good health [5]. Juice blending is one of the best methods to improve the nutritional quality of the juice. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used [6].

Therefore, the present study was conducted to develop an acceptable quality of RTS beverages with different ratios of Sour-orange and Carrot juices and to assess the physico-chemical, sensory properties along with the shelf life of different juice blends.

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## II. MATERIALS AND METHODS

The RTS beverage was prepared by using freshly prepared carrot juice, sour orange juice, water and sugar as per FPO specification. The juice of carrot and sour-orange were mixed in four different proportions i.e.100:0, 60:40, 50:50, and 40:60 respectively. The requisite amount of sugar and citric acid were dissolved in water to prepare sugar syrup up to boiling stage, and strained through the muslin cloth and added after cooling, to get the desired TSS of 14°Brix -20°Brix. The combined carrot and sour orange juices were then mixed with the sugar syrup in the correct quantity to get the RTS beverage. All the ingredients were dissolved through homogenizing, and heated at 85°C for 20 minutes. It was removed from the fire and allowed to cool for 10 minutes. Subsequently 70 ppm Sodium metabisulphite (SMS) was added and mixed well with the solution. Prepared RTS beverage was poured into pre-sterilized 200ml capacity glass bottles and capped with stopper immediately, leaving 1” head space on the top and closed with caps air tightly. The sealed bottles were sterilized in hot water bath at 80°C for 30 minutes. The bottles were removed from the water bath and allowed to cool.

The treatments are listed below

T<sub>1</sub> - RTS beverage with 100:0 carrot juice and sour orange juice (control)

T<sub>2</sub> - RTS beverage with 60:40 carrot juice and sour orange juice

T<sub>3</sub> - RTS beverage with 50:50 carrot juice and sour orange juice

T<sub>4</sub> - RTS beverage with 40:60 carrot juice and sour orange juice

### *Nutritional Analysis*

The prepared RTS beverage formulations blend of Carrot juice with Sour-orange juice were analyzed initially for the parameters of TSS, titrable acidity, pH, Total sugar and ascorbic acid using AOAC methods. The TSS of each sample was analyzed using hand held refractometer (Model ATAGO-S-28E) and the values were expressed as °Brix. The acidity in each sample was determined according to standard procedure given in AOAC (2002) [7]. The pH of each sample was recorded with the help of digital pH meter (Model HANNA HI 98130 ).The ascorbic acid content was estimated by using detective dye, DCPIP (2, 6-dichlorophenol indophenol) according to the standard method of AOAC (2002) [7]. Analyses were carried out for all the formulations (samples) for each parameter and the analyses were replicated thrice.

### *Sensory Analysis*

In sensory evaluation, different sensory characteristics such as colour, taste, aroma, appearance and overall acceptability attributes, was conducted by 30 semi-trained panelists subjectively using 7 point hedonic scale, where score 1 is for “dislike very much” and 7 for “like very much”.

### *Microbial Test*

Microbial analysis was done by total plate count method using nutrient agar. Microbial counts were taken in three replicates. The total plate count was determined by observing the colonies formed especially bacteria.

### *Statistical Analysis*

Completely Randomized Design (CRD) was used to test the significance of results The data obtained in the experiments were recorded and analyzed statistically using analysis of variance technique (ANOVA) to determine

# International Journal of Innovative Research in Science, Engineering and Technology

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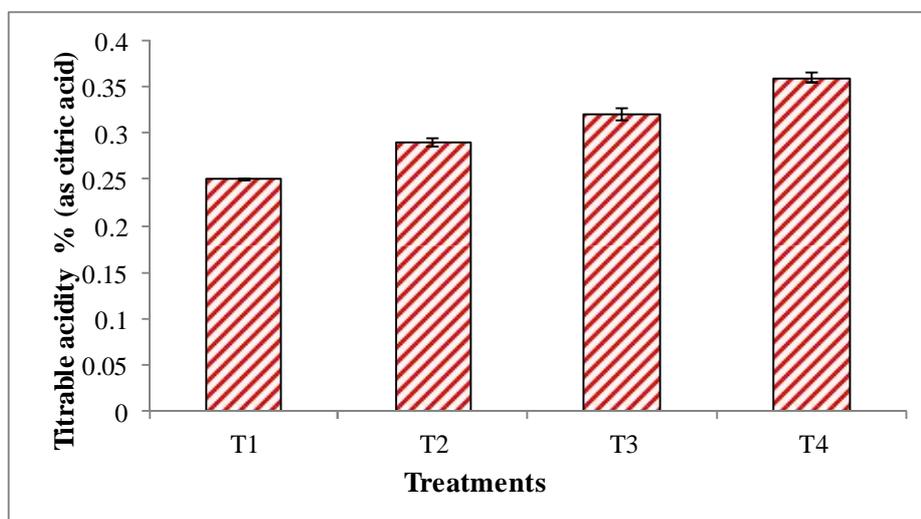
statistical significance of treatments.. Mean separation for chemical tests was done by Duncan Multiple Range Test (DMRT). Results of the sensory evaluation and chemical analysis were analyzed statistically by ANOVA using computer aided SAS statistical analysis package to evaluate the significance at  $P<0.05$ . Standard errors were calculated using MINITAB 14 statistical package. Comparison of means of sensory evaluation was done by Turkey's Studentized Range Test.

### III. RESULTS AND DISCUSSION

#### Nutritional Analysis of Fresh Carrot Juice and Sour Orange Juice Blend RTS

Nutritional parameters titrable acidity, ascorbic acid, TSS, total sugar and pH were analysed for the fresh RTS beverage for each treatment after preparation.

Figure 1 shows the pattern of titrable acidity of fresh carrot juice and sour orange juice blend RTS. There was a significant increase in titrable acidity content from 0.25% to 0.36%. This might be due to the increase in the level of Sour- orange juice from 40 to 60%. According to the Sri Lanka Standard Institute Specifications, the limits of acidity for RTS preparation are 0.3-1% as anhydrous citric acid (SLS 729:1985). This can be partially to the contribution of acid naturally present in the sour orange juice. Sour orange and carrot juices contains 1.12 % and 0.38% respectively [8].



The values are means of triplicates  
The vertical bars indicate the standard errors

**Figure 1: Titrable acidity of Freshly Made RTS Beverages**

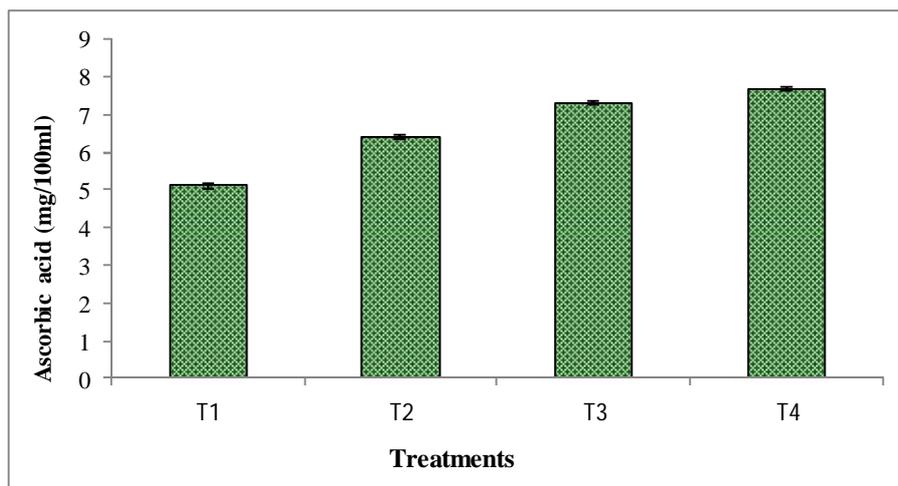
Figure 2 shows the ascorbic acid content of fresh carrot juice and sour orange juice blend RTS. The highest ascorbic acid content was obtained for T<sub>4</sub> (RTS beverage with 40:60 carrot juice and sour orange juice) which is 7.7 mg/100ml. The main source of vitamin C for the consumers is citrus fruit, it is extremely labile, a characteristic that makes the concentration of this vitamin in foods a guarantee that other vitamins and nutritive elements are still present, and it is considered a control parameter for the nutritional quality of the finished product [9]. The ascorbic acid increasing significantly ( $p<0.05$ ) from 5.1 to 7.7mg/100 ml with an increase in the concentration of sour orange juice from 10 to 30% in the RTS beverage formulations. Sour orange and carrot juices contains 78.4 and 16.8 mg/100ml respectively

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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[8]. The extracted juice of cashew apple when blended with various proportions of sweet orange juice, their ascorbic acid losses decreased after mixing of juice as compared to the juice of cashew apple alone [10].



The values are means of triplicates  
The vertical bars indicate the standard errors

**Figure 2: Ascorbic acid Content of Freshly Made RTS Beverages**

pH and TSS content of fresh carrot juice and sour orange juice blend RTS is shown in Table 1. pH plays an important role in the flavour of the juice product, also it plays a vital role in the preservation of fruit juice. There was a significant ( $p < 0.05$ ) when increasing the concentration of sour orange juice. This might be due to increase in titrable acidity, as acidity and pH are inversely proportional to each other [11]. Table 1 shows the level of pH of fresh carrot juice and sour orange juice blend RTS. The highest pH value 3.25 was obtained in the treatment T<sub>1</sub> (RTS beverage with 100:0 carrot juice and sour orange juice) and T<sub>4</sub> (RTS beverage with 40:60 carrot juice and sour orange juice) had the least mean value 3.03). The results generally showed that the higher acidity, lower pH of pineapple RTS beverages.

**Table 1: The pH and TSS of Freshly Made RTS Beverages**

Treatment	pH	TSS (°Brix)
T1	3.25 ± 0.006 <sup>a</sup>	14.2 ± 0.02 <sup>b</sup>
T2	3.23 ± 0.004 <sup>a</sup>	15.7 ± 0.02 <sup>b</sup>
T3	3.07 ± 0.005 <sup>b</sup>	16.1 ± 0.05 <sup>a</sup>
T4	3.03 ± 0.006 <sup>b</sup>	16.6 ± 0.03 <sup>a</sup>

The values are means of triplicates ± standard error

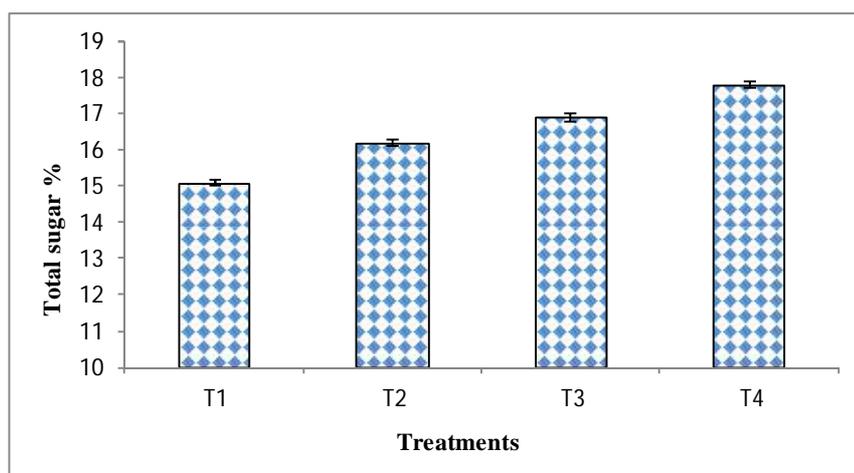
The recommended TSS for commercial RTS production is 15° Brix (SLS 729: 1985). According to the DMRT, the TSS increased significantly ( $p < 0.05$ ) when increasing the concentration of sour orange juice in RTS beverages is shown in the Table 1. The highest TSS value 16.6 was obtained in the treatment T<sub>4</sub> (RTS beverage with 40:60 carrot juice and sour orange juice). Similar trend of increase in total soluble solids with advancement of storage period were

## International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 5, Issue 2, Februray 2016

observed in mandarin, sweet orange and lemon juice. The minimum increase in total soluble solids (12.50 to 13.380 Brix), when juice was blended with kinnow juice (87%) pomegranate juice (10%) + ginger juice (3%) as compared to (12.00 to 13.670 Brix) kinnow juice (100%) [11].



The values are means of triplicates  
The vertical bars indicate the standard errors

**Figure 3: Total sugar Content of Freshly Made RTS Beverages**

Figure 3 shows the amount of total sugar present in the fresh carrot juice and sour orange juice blend RTS. Sugars, acids and their interactions are important to sweetness, sourness and overall acceptability in RTS beverages. According to DMRT, the total sugar significantly ( $p < 0.05$ ) differed between each treatment. The minimum total sugar content (as sucrose) for RTS preparation is 5% (SLS 729:1985). The total sugar content increasing significantly ( $p < 0.05$ ) from 15.1 to 17.8% with an increase in the concentration of sour orange juice from 10 to 30% in the RTS beverage formulations.

**Table 2: Sensory Analysis of Fresh Carrot Juice and Sour Orange Juice Blend RTS**

Treatments	Colour	Taste	Aroma	Consistency	Overall acceptability
T <sub>1</sub>	6.66±0.08 <sup>a</sup>	5.40±0.141 <sup>b</sup>	4.76±0.184 <sup>c</sup>	6.33±0.12 <sup>a</sup>	6.36±0.112 <sup>a</sup>
T <sub>2</sub>	6.16±0.12 <sup>b</sup>	4.33±0.161 <sup>c</sup>	4.33±0.14 <sup>d</sup>	4.63±0.089 <sup>c</sup>	4.40±0.113 <sup>c</sup>
T <sub>3</sub>	5.63±0.13 <sup>c</sup>	6.6±0.091 <sup>a</sup>	6.66±0.087 <sup>a</sup>	5.30±0.12 <sup>b</sup>	6.66±0.087 <sup>a</sup>
T <sub>4</sub>	4.73±0.14 <sup>d</sup>	5.50±0.11 <sup>b</sup>	5.36±0.112 <sup>b</sup>	4.20±0.16 <sup>d</sup>	4.80±0.162 <sup>b</sup>

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

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 5, Issue 2, Februray 2016

Table 2 shows the mean scores for the sensory attributes of fresh carrot juice and sour orange juice blend RTS. The flavour, colour, and taste of fruit juice are very important because it determines the acceptability and marketability of juice. Sensory qualities colour, Taste, aroma, consistency and overall acceptability were analysed using 30 panelists.

The sensory attributes differed significantly ( $p < 0.05$ ) between treatment. According to Turkey's Studentized Range Test the treatment  $T_1$  (RTS beverage with 100:0 carrot juice and sour orange juice) receives high scores of  $6.66 \pm 0.08$  for colour and this could be due to the colour of carrot juice. The mean values of taste and aroma of  $T_3$  (RTS beverage with 50:50 carrot juice and sour orange juice) were highest compare to other treatments. The fresh orange juice flavour is due to the complex combination of several odours components that include alcohols, aldehydes, esters, ketones and hydrocarbons has been extensively investigated. On the other hand, the characteristic flavour of carrots is mainly due to the volatile constituents which are mostly made up of terpenes and sesquiterpenes [12]. Consistency was higher for  $T_1$  (RTS beverage with 100:0 carrot juice and sour orange juice). The overall acceptability of the different RTS beverages were high and  $T_3$  (RTS beverage with 50:50 carrot juice and sour orange juice) had the highest overall acceptability of  $6.66 \pm 0.087$  among other treatments.

### Microbial Test of Fresh Carrot Juice and Sour Orange Juice Blend RTS

No bacterial growth was observed in the freshly made RTS beverage samples. Therefore, there was no total plate count in these samples. Many products that could safely be maintained sterile by pasteurization process alone could be doubly preserved by the addition of potassium metabisulphite [13]. The sulphite inhibits yeasts, moulds and bacteria [14].

### IV. CONCLUSION

The RTS beverages prepared by using Sour-Orange juice and carrot juice was nutritious and also safe for consumption since there is no addition of artificial colour, flavour, and artificial preservative. It was accomplished that the RTS beverage with 50:50 carrot juice and sour orange juice ( $T_3$ ) was most effective beverages with high nutritional qualities. Sensory scores of RTS beverage with 50:50 carrot juice and sour orange juice ( $T_3$ ) also higher than other formulation. Carrot juice and sour orange juice blend RTS beverages were free from any microbial contamination. Therefore, RTS beverage with 50:50 carrot juice and sour orange juice ( $T_3$ ) was the best combination for the commercial preparation of based on the nutritional and sensory evaluations.

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*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

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