Development and Quality Evaluation of RTS from Mandarin (Citrus reticulata) and Carrot Blend Flavored with Ginger Extract

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Abstract

The current investigation was carried out to prepare RTS beverage from Mandarin and carrot blend flavored with ginger extract. Five different formulations of Mandarin juice, carrot juice and ginger extract were used to prepare RTS beverage and quality was assessed for a total period of 90 days. Physicochemical and sensory evaluation was carried out. The result of nutritional analysis showed that pH and TSS increase during storage while the declining trend in ascorbic acid content and titratable acidity increased during total period of storage. Sensory analysis showed that there was a declining trend in color, taste, flavor and overall acceptability. Among different treatments, T2 gives highest score for overall acceptability and could be recommended for large scale production in industries.

Keywords: Ready to serve; Ginger extract; Kinnow juice; Carrot juice; Sensory analysis

Introduction

Mandarin (Citrus reticulata) is the most popular citrus fruit having attractive color and pleasing taste and flavor. More than 60 per cent of total citrus production in Pakistan is comprised of mandarin, locally known as ‘Kinnow’. Pakistan is the sixth largest mandarin producer in the world with the total production of 103.410 hectarograms on 196.500 hectares. Kinnow has many uses in industrial and medicinal side. It has striking color, unique flavor and rich in vitamin C, vitamin B, calcium, phosphorous and β-carotene [1]. Various value-added products can be easily made from this fruit. Carrot (Daucus carota L) is an important vegetable grown all over the world. In Pakistan, carrot is produced 192000 metric tons annually in an area of 11000 hectares. Carrots are rich in protein, carbohydrate, minerals and crude fiber. Besides its vitamins and minerals content carrot also contains β-carotene [2]. Consumers prefer carrot juice due to its high nutritive value, fiber, carbohydrates, vitamin A derived from its high a carotene, β-carotene content, colour, aromatic compounds and refreshing characteristics [3].

Ginger scientifically known as Zingiber officinale belongs to the family Zingiberaceae. Ginger has been widely used as spice and flavoring agents in foods and beverages. Ginger contains protein, carbohydrates, fiber, ash, and numbers of antioxidants like beta-carotene, terpenoids, ascorbic acid, alkaloids and polyphenols like flavonoids, flavones, glycosides and rutin [4]. Ginger may help in relieving joint pain from arthritis, and it also has blood thinning and cholesterol lowering effect which is useful for heart patients [5]. The aroma of ginger is pleasurable and highly spiced which make it possible for food technologist to make a number of soft drinks like ginger cocktail, cordials, carbonated drinks, etc. [6].

All the above discussed fruits are valued for their refreshing juice with nutritional, medicinal properties. Therefore, blending them for the preparation of various drinks is economical and easy alternative of utilizing these fruits. Blending of different fruits can improve aroma, taste and make it more nutritious. The current study was conducted to prepare and formulate an acceptable quality RTS from blend of Kinnow, carrot and ginger extract with the aim to increase the nutritional value of drink, and to assess its physicochemical, sensory properties and storage stability.

Research Methodology

The experiment was conducted in the laboratory of food technology section, Agriculture Research Institute Dera Ismail Khan in the month of November 2016. Fully matured Kinnow, good quality fresh ginger and carrots were purchased from the market of Dera Ismail Khan and brought to laboratory for experiments. RTS was prepared according to the plan of study mentioned in Table 1. RTS was prepared by using freshly extracted Kinnow juice, carrot juice, sugar syrup and ginger extract. Carrots were washed; peeled and cut into small pieces, then blend in blender with addition of small amount of hot water to easily extract the nutrients. Kinnow juice was extracted with the help of citrus juice extractor. Ginger juice was obtained according to the method of Sasi et al. [7].

After juice extraction RTS was prepared according to the plan of study and the finished product was poured in 750 ml capacity PET bottles which were sterilized at 110°C for 10 min and capped immediately, leaving 1” head space. After that bottles were pasteurized at 90°C for 30 sec cooled and stored at refrigerated temperature.

| Samples       | Kinnow juice | Carrot juice | Sugar | Ginger extract | Water |
|---------------|--------------|--------------|-------|----------------|-------|
| T0            | 40 ml        | 0 ml         | 40 g  | 10 ml          | 200 ml|
| T1            | 30 ml        | 10 ml        | 40 g  | 10 ml          | 200 ml|
| T2            | 20 ml        | 20 ml        | 40 g  | 10 ml          | 200 ml|
| T3            | 10 ml        | 30 ml        | 40 g  | 10 ml          | 200 ml|
| T4            | 0 ml         | 40 ml        | 40 g  | 10 ml          | 200 ml|

Table 1: Treatments for RTS preparation.

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Physicochemical qualities

Physicochemical qualities of RTS beverage were analyzed using recommended standards of AOAC methods. Total soluble solids were analyzed using hand refractrometer. TSS was recorded as °Brix. For titratable acidity 10 gm juice was diluted to 250 ml with boiled water. Titration was done with 1 N NaOH and 0.3 ml phenolphthalein for each 100 ml of the solution till pink. pH was determined using pH meter. The Ascorbic acid was determined by using spectrophotometer according to the method of Ruck [8] by using 2, 6 dichlorophenol indophenol dye.

Sensory analysis

Sensory analysis was performed by panel of 9 judges. The 9-point hedonic scale was used to carry out sensory analysis. Judges assess RTS in term of color, taste and flavor. Overall acceptability score was calculated as average of whole sensory attribute.

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 statistical significance of treatments.

Research Findings and Discussion

Physicochemical analysis

The pH of Kinnow and carrot blend RTS decreased during total period of storage in all treatments which may be attributed due to increase in acidity during storage and can also due to formation of acidic compounds by degradation of sugars. pH greatly affects shelf life stability. Highest pH was observed in sample T4 (4.12) followed by T3 (3.99) while lowest pH was recorded in T0 (3.34) i.e. with 40% Kinnow juice, followed by T1 (3.54). For treatments highest mean was recorded in T3 (3.9) while minimum mean was recorded in T0 (3.1). Treatments had significant effect on pH of Kinnow and carrot blend RTS. Saleem [9] also reported a decreasing trend in pH during storage while preparing a citrus fruit base beverage (Table 2).

The TSS increased during total period of storage. The increase in TSS during storage may be possibly due to hydrolysis of starch into sugar. For RTS a slightly increase during in TSS during storage is desirable for better quality. Highest mean for treatment was recorded in T0 (12.8) while minimum was recorded in T4 (11.2). The results are in line with Deka and Sethi [10] as they also found an decreasing trend in TSS during storage while preparing lime-aonla, and mango pineapple spiced RTS. Acidity is an important parameter because tartness is major a factor in acceptability of Kinnow drink. Major acid in Kinnow is citric acid which enhances the flavor of Kinnow drink. Titratable acidity increased during total period of storage. For treatment highest mean value was observed for T3 (0.40) followed by T4 (0.38), while the lowest value was recorded for T1 (0.31) followed by T0 (0.32). Conn and Stumpf [11] reported that pectin may increase the acidity of fruit products; hence the increase in acidity during storage might be contributed to degradation of pectin substances.

With the advancement of storage, ascorbic acid content of beverages decreased due to the fact that ascorbic acid is sensitive to heat, light and oxygen and can be easily oxidized by enzymatic and non-enzymatic catalyst. For treatments maximum mean value for ascorbic acid was found in T0 (26.6) while the minimum value was recorded in T0 (23.8). At the end of storage period maximum ascorbic acid content was found in T4 which was 26.5 mg/100 ml while the lower value was recorded to be 23.7 mg/100 ml in T0. Decline in ascorbic acid content during storage was also observed by Smooth and Negy [12] in grape fruits juice and Sharma et al. [13] in Kinnow mandarin juice stored at room temperature for period of 28 weeks.

Sensory analysis

The results of sensory analysis of RTS from Kinnow and carrot blend flavored with ginger extract are presented in Table 3. Sensory qualities of beverage were determined using 9-point hedonic scale. The color of treatment T1 with 10 ml Kinnow juice and 30 ml carrot juice liked by judges with mean value of 8.2. The decrease in color during storage may be due to oxidative loss of pigments, degradation of color pigments, and may also be contributed to change in pH. Barwal et al. [14] also find a decreasing trend in color of plum squash. Taste is an important factor in sensory analysis after color and flavor. Treatment and storage has significant effect on taste of RTS beverage. Initially the treatment T4 (8.8) gives highest value in term of taste followed by T1 (8.5) which gradually decreased to 7.3 and 7.7 respectively. The highest mean for treatment was observed in T2 (8.2) while the lowest was observed in T0 (7.0). The results are in line with Jain et al. [15] who observed a decreasing trend in taste of orange drink. Flavor of RTS was significantly affected by treatments. Treatment T3 gives maximum score in term of flavor, while lower score was recorded in treatment T1 which was 8.1 and 8.2 respectively. Freshly prepared RTS gives maximum score in term of flavor which gradually decrease during total period of storage. The decrease may be due to changes in volatile compounds of RTS. Jain et al. [15] also reported that flavor deteriorates in beverage product. The data on overall acceptability revealed that it decreased during total period of storage. The decline in overall acceptability was significantly affected by treatments and storage interval. The highest mean value for treatments was observed in T2 (7.55) followed by T4 (7.3), while the lowest was observed in

| Parameters | Storage period (days) | Treatments | Storage Mean |
|------------|-----------------------|------------|--------------|
| pH         | 0                     | 3.34       | 3.54         | 3.79         | 3.99         | 4.12         | 3.7a         |
|            | 3                     | 3.23       | 3.47         | 3.67         | 3.82         | 3.98         | 3.6b         |
|            | 60                    | 3.11       | 3.26         | 3.48         | 3.68         | 3.85         | 3.4c         |
|            | 90                    | 3.03       | 3.26         | 3.31         | 3.56         | 3.67         | 3.3d         |
| Treat Mean | 3.1e                  | 3.4d       | 3.5c         | 3.7b         | 3.9a         | -            |             |
| TSS(°Brix) | 0                     | 10.2       | 10.7         | 11.2         | 11.8         | 12.1         | 11.1d        |
|            | 30                    | 11.0       | 11.1         | 11.9         | 12.2         | 12.7         | 11.7c        |
|            | 60                    | 11.6       | 11.1         | 12.1         | 12.6         | 13.1         | 12.0b        |
|            | 90                    | 12.1       | 11.8         | 12.5         | 13.1         | 13.7         | 12.6a        |
| Treat Mean | 11.2d                 | 11.1e      | 11.8c        | 12.4b        | 12.8a        | -            |             |
| Titratable acidity % | 0 | 0.32       | 0.34         | 0.26         | 0.27         | 0.29         | 0.2d         |
|            | 30                    | 0.36       | 0.38         | 0.29         | 0.31         | 0.31         | 0.3c         |
|            | 60                    | 0.41       | 0.43         | 0.31         | 0.33         | 0.36         | 0.3b         |
|            | 90                    | 0.45       | 0.47         | 0.39         | 0.39         | 0.41         | 0.4a         |
| Treat Mean | 0.38b                 | 0.40a      | 0.31e        | 0.32d        | 0.34c        | -            |             |
| Ascorbic acid (mg) | 0 | 26.7       | 26.1         | 25.8         | 24.0         | 24.3         | 25.3a        |
|            | 30                    | 26.7       | 25.9         | 25.7         | 23.9         | 24.01        | 25.2b        |
|            | 60                    | 26.6       | 25.8         | 25.5         | 23.6         | 23.86        | 25.1c        |
|            | 90                    | 26.5       | 25.7         | 25.4         | 23.7         | 23.91        | 25.0d        |
| Treat Mean | 26.6a                 | 25.9b      | 25.6c        | 24.0d        | 24.0e        | -            |             |

Means followed by different letters are significant (p<0.05)
Each value is average of minimum three determinations
ml Kinnow and 20 ml carrot juice blend was found appreciable and effective.

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Table 3: Sensory analysis of RTS from Kinnow and carrot blend flavored with ginger extract.

| Parameters          | Treatments Storage Mean | Storage period (days) | T0 | T1 | T2 | T3 | T4 |
|---------------------|-------------------------|-----------------------|----|----|----|----|----|
| pH                  |                         |                       | 8.50 | 8.50 | 8.00 | 9.00 | 7.50 | 8.3a |
|                     |                         |                       | 8.23 | 8.30 | 7.50 | 8.55 | 7.30 | 7.97b |
|                     |                         |                       | 8.00 | 8.00 | 7.00 | 8.12 | 7.03 | 7.6c  |
|                     |                         |                       | 7.70 | 7.80 | 6.50 | 7.53 | 6.50 | 7.2d  |
|                     |                         | Treatment Mean        | 8.1c |             |     |     |     |
| TSS(°Brix)          |                         |                       | 8.53 | 8.5 | 8.19 | 8.5 | 8.00 | 8.4a  |
|                     |                         |                       | 8.10 | 8.50 | 7.60 | 8.53 | 7.53 | 7.9b  |
|                     |                         |                       | 7.60 | 7.80 | 7.20 | 8.00 | 7.00 | 7.5c  |
|                     |                         |                       | 7.00 | 7.10 | 6.70 | 7.40 | 6.50 | 6.9d  |
|                     |                         | Treatment Mean        | 7.8c | 8.2a | 7.4d | 8b  | 7.2e  |
| Titratable acidity  |                         |                       | 7.80 | 8.00 | 8.80 | 8.50 | 7.50 | 8.1a  |
| %                   |                         |                       | 7.00 | 7.60 | 8.50 | 8.40 | 7.20 | 7.7b  |
| Ascorbic acid (mg)  |                         |                       | 6.80 | 7.33 | 8.00 | 8.00 | 6.80 | 7.4c  |
|                     |                         |                       | 6.50 | 7.00 | 7.50 | 7.70 | 6.50 | 7.0d  |
|                     |                         | Treatment Mean        | 7.00d | 7.4c | 8.2a | 7.15 | 7.00e |
| Means followed by different letters are significant (p<0.05) Each value is average of minimum three determinations