Development and qualitative evaluation of mixed fruit based RTS beverage

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Abstract: Experimental studies were conducted for the production of Orange and carrot based RTS beverage and its quality evaluation. The quality attributes comprised of acidity, pH, optical density, TSS, ascobic acid, total plate count and sensory quality parameters on 9- point hedonic scale. Evaluation of quality parameters were done for fresh as well as stored RTS samples at 0, 15, 30, 45, 60, 75 and 90 days of storage under different storage conditions. RTS beverage and carrot samples were packed in glass bottles. The TSS and acidity of Orange and carrot RTS beverage increased with increase in the level of Orange juice ratio at different storage condition and the optical density increased with increase in the level of carrot juice ratio. The pH decreased with increase in the level of carrot juice and pH values of the samples composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.88, 1.95 and 2.00 respectively, at refrigeration condition. The total plate count (TPC) of the RTS samples of different Orange and carrot juice ratio of 80:20, 70:30 and 60:40 were observed as 1.055×10^5 cfu/ml, 1.058×10^5 cfu/ml and 1.060×10^5 cfu/ml at refrigerator temperature condition. The microbial growth increased during storage period irrespective of carrot juice ratio at different storage condition. The minimum ascorbic acid of the sample of juice ratio (Orange: carrot) 80:20, 70:30 after 90 days of storage were observed as 1.90, 1.67 and 1.50 respectively, at refrigeration condition. The total plate count (TPC) of the RTS samples of different Orange and carrot juice ratio of 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.90, 1.87 and 1.50 respectively, at refrigeration condition. The higher score of overall acceptability was 7.92 for the fresh samples and the minimum scored awarded for overall acceptability was 6.22 for the RTS sample Orange and carrot juice ratio 80:20 at refrigerator temperature condition. However, the overall acceptability of beverage decreased with increase in storage period. It was concluded that refrigerated storage method was found to be superior over other methods of storage of Orange and carrot based RTS beverage followed by BOD incubator and room temperature conditions.

Keywords: Orange, Carrot, RTS, beverage, Juice, blending, physico-chemical and sensory quality

Introduction

Ready-to-serve (RTS) beverage is a fruit beverage which contains at least 10 percent fruit juice and 10 percent total soluble solids (TSS) besides about 0.3 percent acid. It is not diluted before serving. Production of fruit beverages on a commercial scale was practically unknown till about 1930, but since then it has gradually become an important industry. In tropical countries like India, fruit beverages provide delicious cold drink during the hot summer. Due to their nutritive value they are becoming more popular than synthetic drinks which at present have a very large market in our country. Fruit beverage are easily digestible, highly refreshing, thirst-quenching, appetizing and nutritionally far superior to many synthetic and aerated drinks (Srivastava and Kumar, 2009). Nutritionally fruit beverages have everything that would be desired in the beverages. These products are marketed under variety of name such as fruit drinks, breakfast drink, ready-to-serve (RTS), nectar, RTD (ready to drink), squash etc. (Ial et al., 2009). In India, citrus is grown in 4, 82,720 ha with a production of 42, 58,514 tons with an average productivity of 8.0 t/ha. The most important commercial citrus cultivars in India are the mandarin (Citrus reticulata Blanco) followed by sweet orange (Citrus sinensis Osbeck) and acid lime (Citrus aurantifolia Swingle) sharing 41, 23 and 23 percent, respectively of all citrus fruits produced in the country. India is the sixth largest citrus producing country which contributes 4.8% of the world’s total citrus production. Drinking one glass of 100 percent orange juice provides several important nutrients including folate, flavonoids, vitamin C and vitamin B_6, potassium and magnesium. This “easy peeler” citrus has assumed special economic importance and export demand because of its high juice content, special flavor, delicious taste and nutritional compositions which are equally beneficial for all age groups. Carrot (Daucus carota) belonging to family Apiaceae, is one of the most important cool season root vegetable. It is grown extensively in various countries during winter season in tropical regions while during summer season in temperate countries (Kalra et al., 1987). India has 14th ranked (2006) in the world with a production of 350,000 metric tons of carrot. Carrots roots are well known for their nutritional constituents like carotenoids especially â-carotene which act as a precursor of vitamin A. β-Carotenoids also act as antioxidants by quenching singlet oxygen and triplet excited states (Chen et al., 1998). Carrot can improve eye health, increase menstrual flow and regulate blood sugar. Carrot can promote colon health, because it is rich in fiber. Carrot is also helpful in the following cases as Obesity, poisoning of the blood, gum disease, insomnia, inflamed kidney, liver, gallbladder, alzheimer’s disease, colitis, ulcer and painful

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urination. Carrot contain good amount of dietary fiber which has laxative effect and aids in digestion and absorption of nutrients and prevents constipation. In the present study Orange was blended with carrot with the objectives to standardization of the methodology for the preparation of mixed fruit RTS beverages and to evaluate the physico-chemical, microbial and sensory qualities during storage at different temperature conditions.

Materials and Methods

Ready-to-serve beverages consist essentially of an amount of 10 to 15 % fruit juice. They are sweetened at least 10 °Brix with a maximum acidity of .3 %. Fresh Orange and carrot were procured from local market in Meerut. Orange and carrot were washed to potable water and remove of the dust, dirty particles and some bacteria. Peeling was done manually. Juice of carrot was extracted by Electric Juicer mixer and strained through muslin cloth. Orange juice was extracted by hand driven screw press. The RTS beverage is prepared from the extracted Orange and carrot juice, adjusting its soluble solid and acidity as per FPO specification for RTS beverage by mixing the juice with required quantity of sugar syrup prepared from sugar, citric acid, preservative (KMS) and mixed water. The beverage filled in to bottle leaving a head space of 2.5 to 3.0 cm, crown corked and processed in water for 4 to 6 minute at 85 °C for pasteurization and then air cooled. Labelled bottles were stored at different temperature in different condition. Sample containing different fruit juices ratio viz. 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80 of Orange and carrot, were prepared and evaluated by sensory panel. Panel recommended three compositions viz. 80:20, 70:30, 60:40 of Orange and carrot. The samples of selected composition were prepared and storage studies were conducted. Bottled sample are stored for further storage studies.

Results and Discussion

Effect on acidity: The acidity of Orange and carrot RTS beverage showed an increasing trend under all the treatments with increasing period’s upto 90 days (fig.1.1). The acidity of samples having Orange and carrot ratio ratio 80:20, 70:30 and 60:40 were measured as 0.118, 0.116 and 0.115 respectively, in the fresh samples. The increase in the value of acidity was observed with either increase in the ratio of Orange juice or decrease in the ratio of carrot juice in the developed RTS. During storage, it was observed that acidity of all the samples were increased at 0, 15, 30, 45, 60, 75 and 90 days of storage. The acidity values of the samples with 80:20, 70:30 and 60:40 after 90 days of storage were observed 0.174, 0.170, and 0.166 at refrigeration condition. The acidity values of the samples composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 0.178, 0.174 and 0.170 at room temperature and 0.174, 0.172 and 0.170 at B.O.D. temperature condition. The highest acidity 0.178 of the sample having 80:20 was observed at room temperature storage after 90 days. However, in general lower value of acidity was found after 90 days in each case of storage conditions.

Effect on pH: The pH of the samples of different Orange and carrot juice ratio of 80:20, 70:30 and 60:40 were measured as 2.90, 2.92 and 0.2.95 respectively, in the fresh samples. The decrease in the value of pH was observed with either increase in the ratio of Orange juice or decrease in the ratio of carrot juice in the fresh samples. During storage, it was observed that pH of all the samples were decreased at 0, 15, 30, 45, 60, 75 and 90 days of storage. The pH values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.88, 1.95 and 2.00 at refrigeration condition. The pH values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.85, 1.95 and 2.00 at room temperature and 1.88, 1.90 and 1.95 at B.O.D. temperature condition. The lowest pH (1.85) of the sample having 80:20 was observed in room temperature storage after 90 days. However, in general lower value of pH was found after 90 days in each case of storage conditions.

Effect on TSS (°Brix): The TSS content in Orange and carrot RTS beverage showed an increasing trend under all the treatments with increasing periods of up to 90 days (fig.1.3). The TSS of the samples having Orange and carrot juice ratio 80:20, 70:30 and 60:40 were measured as 12.33, 11.66 and 11.00 °Brix, respectively in the fresh samples. During storage, it was observed that TSS of all the samples was increased at 0, 15, 30, 45, 60, 75 and 90 days of storage. The TSS values of the sample 80:30, 70:30 and 60:40 were measured as 12.33, 11.66 and 11.00 °Brix, respectively in the fresh samples.
after 90 days of storage were observed as 18.33, 17.0, and 16.66 \(^\circ\)Brix at refrigeration condition. The TSS values of the sample 80:30, 70:30 and 60:40 after 90 days of storage were observed as 20.33, 19.66 and 18.0 \(^\circ\)Brix at room temperature and 18.5, 17.66 and 16.83 \(^\circ\)Brix at B.O.D. temperature condition. This increase in the TSS may be due to the fact that the Orange juice contains more TSS in comparison to juice obtained from carrot. Baramanray et al., (1995) and Pandey, (2004) observed the increase in TSS value of RTS beverages during storage were probably due to conversion of polysaccharides in to soluble sugars. In conformity of this, similar results were also observed in the present study.

**Effect on ascorbic acid:** The ascorbic acid of the samples of different Orange and carrot juice ratio of 80:20, 70:30 and 60:40 were measured as 5.82, 5.71 and 5.51 respectively in the fresh
samples. During storage, it was observed that ascorbic acids of all the samples were decreased at 0, 15, 30, 45, 60, 75 and 90 days of storage (fig.1,4). The ascorbic acid values of the samples of the ratio (Orange and carrot) 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.90, 1.67 and 1.50 at refrigerator condition. The ascorbic acid values of the samples 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.92, 1.66 and 1.60 at room temperature condition and the ascorbic acid values of the samples 80:20, 70:30 and 60:40 after 90 days of storage were observed as 1.94, 1.68 and 1.63 at B.O.D. temperature condition. The lowest ascorbic acid 1.50 of the sample having 60:40 was observed in refrigerator temperature storage after 90 days. However, in general lower values of ascorbic acid for different samples were found lowest after 90 days of storage conditions.
Effect on optical density: The optical density of Orange the samples of different Orange and carrot juice ratio 80:20, 70:30 and 60:40 were measured as 0.035, 0.038 and 0.041 respectively, in the fresh samples. During storage, it was observed that optical density of all the samples was increased at 0, 15, 30, 45, 60, 75 and 90 days of storage (fig.1.5). The optical density values of the sample composition 80:20, 70:30 and 60:40 after 90 days of storage were observed as 0.072, 0.075 and 0.077 at room temperature and 0.072, 0.074 and 0.079 at B.O.D. temperature condition. It was observed from the data that with increase in the level of carrot juice in RTS, the optical density of the products increased. The highest optical density 0.079 of the sample having 60:40 was observed at B.O.D. temperature storage after 90 days.

Effect on microbial growth: The microbial growth (TPC values) of the samples of different Orange and carrot based RTS beverage were observed as $1.008 \times 10^5$ cfu/ml, $1.010 \times 10^5$ cfu/ml and $1.008 \times 10^5$ cfu/ml respectively.
1.011×10^5 cfu/ml of 80:20, 70:30 and 60:40 at room temperature after 15 days. The microbial growth of the samples of different Orange and carrot RTS beverage were observed as 1.007×10^5 cfu/ml, 1.009×10^5 cfu/ml and 1.011×10^5 cfu/ml of 80:20, 70:30 and 60:40 at refrigeration temperature condition after 15 days and microbial growth value of Orange and carrot RTS beverage were observed as 1.010×10^5 cfu/ml, 1.012×10^5 cfu/ml and 1.014×10^5 cfu/ml of 80:20, 70:30 and 60:40 at B.O.D. temperature condition after of 15 days. The microbial growth value after 90 days of storage were observed as 1.038×10^5 cfu/ml, 1.039×10^5 cfu/ml and 1.040×10^5 cfu/ml for the sample stored at room temperature condition. The study also revealed that as microbial growth increased with increase of storage period irrespective of storage conditions. The highest microbial growth was observed as 1.048×10^5 cfu/ml in case of sample having Orange and carrot juice ratio 60:40 at B.O.D. temperature condition after 90 days of storage.

**Effect on sensory quality:** Sensory qualities were evaluated for all fresh as well as stored samples after 0, 30, 60 and 90 days. The samples were served to panelists. Colour, flavours, texture and taste were selected as sensory attributes on 9-point Hedonic scale. In general no definite trend of sensory score for individual attributes were observed for fresh samples. The highest score awarded for colour was 8.0 to the sample having fruit juice composition 80:20 at room refrigerator temperature. Whereas, the lowest score 5.6 of the sample 60:40 at B.O.D. temperature. Except one sample 60:40, all other samples were rated between “Like extremely” and "Like slightly”. The best score for flavour was 8.0 to the sample having fruit juice composition 70:30 at room temperature and the lowest score 5.7 of the sample 80:20 at B.O.D. temperature. The highest score awarded for texture was 7.8 of the sample having juice ratio 80:20 at refrigeration temperature condition and the lowest score 5.6 of the sample 80:20 at B.O.D. temperature. All other samples were rated between “Like very much” and “Like slightly”. The highest score awarded for taste was 8.2 of the sample 80:20 at refrigeration condition. Whereas, the lowest score was 5.7 of the sample 60:40 at B.O.D. temperature condition. Overall sensory scores after 90 days of storage were lowest (5.6) "Like slightly and highest (7.9) "Like very much. Sensory evaluation could not be conducted after 90 days of storage due to visible microbial growth in all the stored samples. Sharma Indu et. al. (2008) studies of sensory evaluation of RTS beverages revealed that the highest score was 7.55 recorded in (15% juice of 80:20; guava: papaya) and the lowest was 6.15 in (10% juice of 50:50; guava: papaya).

The sample of Orange and carrot based RTS beverage 80:20, 70:30 and 60:40 stored at room temperature, B.O.D incubator, and refrigerator storage condition were acceptable up to 90 days. However, the RTS samples stored at refrigerated condition was found superior over other storage condition followed by BOD incubator and room temperature conditions. The acidity of Orange and carrot based RTS beverage increased either with increase in the ratio of Orange juice or decrease in the ratio of carrot juice in developed RTS. During storage, acidity of samples increased with increase in the storage period. The pH of Orange and carrot based RTS beverage decreased during storage period. TSS of Orange and carrot based RTS beverage increased slightly with increase in Orange juice ratio as well as with increase in the storage period. The increase in optical density was observed with increase in carrot juice ratio in RTS samples during storage period. The vitamin-C (ascorbic acid) of the RTS samples was decreased during storage period. The microbial growth increased during storage period irrespective of Orange juice ratio at different storage condition. In general, no definite trend of sensory attributes was observed for the samples which were served to panel. The highest score for colour (8.0) was awarded to samples of Orange and carrot juice ratio 80:20 at refrigerator condition. Best score of Flavour (8.0) was found of the juice ratio sample 70:30 at room temperature condition. The highest score for texture (7.8) was awarded for the sample having Orange and carrot juice ratio 80:20 at refrigerator condition. Best score of taste (8.2) was found to the juice ratio sample 80:20 at refrigerator condition. Sensory panel recommended best sample containing 80:20 ratio of Orange and carrot juice as taste, colour and texture points of view.

**Reference**


