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# Evaluation of Quality Characteristics of Carrot and Sugarbeet Beverage

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**ABSTRACT**
Beverages is prepared by mixing two or more fruits juices in appropriate quantity. Beverages are more nutritive than synthetic drinks. Fruits beverages are easily digestible, highly refreshing and thirst quenching. The present study was conducted to evaluate the quality characteristics and sensory analysis of carrot (Daucus carota)and sugarbeet (Beta vulgaris) beverages. For these three compositions of sample were taken i.e. Carrot (C) and Sugarbeet (S) juice in ratio 80:20,70:30 and 60:40 respectively and packed in the glass bottles. Physico-chemical parameters viz- acidity, Total Soluble solid (TSS), pH, optical density and ascorbic acid were evaluated during the period of 0,15,30,45 and 60 days. The stored conditions were room temperature (25°C), B.O.D. (15°C) and refrigerated (5°C) conditions. The total plate count (TPC) was also evaluated to see the effect of microbial growth. The TSS content, acidity, optical density and TPC in carrot and sugarbeet beverage showed an increasing trend under all treatments during the study period of 60 days. The highest TSS content and acidity was found to be 16.30° Brix and 0.164% respectively for $C_{80}$ : $S_{20}$ in room temperature condition at 60 days. The highest optical density was found to be 0.066 for $C_{60}$:$S_{40}$ in refrigerated condition at 60 days. The highest TPC or microbial growth was found to be 1.036 x $10^5$ cfu/ml for $C_{60}$ : $S_{40}$ in B.O.D. temperature at 60 days. The pH and Ascorbic acid of the sample was observed to be decreasing during the storage period. The lowest pH was found to be 2.34 for $C_{80}$ : $S_{20}$ in room temperature at 60 days. The lowest ascorbic acid was found to be 2.46 mg/100ml for $C_{60}$ : $S_{40}$ in B.O.D. at 60 days. Sensory analysis of samples was conducted with the help of 9 point hedonic scale from 20 judges' panel. It can be clearly seen that among all the samples a reduction in sensory score was found with the increasement of storage period irrespective of storage conditions. Overall acceptability was found better for sample $C_{80}$ : $S_{20}$ in refrigerated condition followed by B.O.D. and room temperature condition.

**Keywords:**Carrot, Sugarbeet, Beverage, Quality characteristics, Sensory.

## I. INTRODUCTION

Beverage is prepared by mixing two or more fruit juices in appropriate quantity. In tropical countries like India, fruit beverages provide delicious cold drink during the hot summer. Presently beverages have a very large market in our country andbecoming more popular than synthetic drinks. Fruit beverages are easily digestible, highly refreshing, appetizing and thirst quenching and nutritionally superior to many synthetic and aerated drinks(Srivastava and Kumar, 2009). Fruits & some special vegetables are most commonly used for preparing beverages. These products are marketed under variety of name such as fruit drinks, breakfast drink, ready-to-serve (RTS), nectar, ready to drink (RTD) squash etc. (Lal et al., 2009).Carrot(Daucus carota) roots are well known for their nutritional constituents like carotenoids especially B-carotene which act as a precursor of vitamin A. B-Carotenoids also act as antioxidants by quenching singlet oxygen and triplet excited states (Chen et al., 1996).Carrots contain good amount of dietary fiber which has laxative effect and aids in digestion and absorption of nutrients and prevents constipation. Vitamin A also helps to form and maintain healthy teeth, skeletal and soft tissue, mucous membranes and skin. Carrot can improve eye health, increase menstrual flow and regulate blood sugar.Sugar beet(Beta vulgaris) is a plant whose tuber contains a high concentration of sucrose. It contains significant amounts of vitamin-C, one of the powerful natural antioxidant, which helps body scavenge deleterious free radicals, one of the reasons for cancers development.It is a rich source of niacin (vit. B-3), pantothenic acid (vit. B-5),pyridoxine (vit. B-6), carotenoids and minerals such as iron,manganese and magnesium. Therefore, the study was undertaken to evaluate the quality characteristics and sensory attributes of blend carrot and sugarbeet beverage.

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## II. MATERIALS AND METHODS

The study was undertaken to develop beverages using the blend of carrot and sugarbeet juices and its quality characteristics was done during various storage period. Beverages were prepared with various combination of carrot and sugarbeet juices in ratio of 80:20, 70:30 and 60:40respectively. Studies were carried out to evaluate the quality characteristics of prepared beverages after 0, 15, 30, 45 and 60 days of storage. The samples were kept in different storage condition such as room temperature (25°C), B.O.D (15°C) and refrigerator (5°C). Fresh, uniform sizes and mature carrot and sugarbeet were procured from the local market of Etawah (U.P.). Carrot and Sugarbeet free from diseases and insects' infections were selected for the investigation.Carrot and Sugarbeet juice was extracted using electric juicer.

The beverage was prepared from the extracted carrot and sugarbeet juice, adjusting its total soluble solid and acidity by mixing the juice with required quantity of sugar syrup prepared from sugar, citric acid, preservative (KMS) and mixed water.The final beverage was processed using three differentproportions (80:20, 70:30 and 60:40) ofcarrot juice and sugarbeet juice respectively. The beverage thus prepared was packed in autoclaved glass bottles of capacity 250 ml. Beverage in the glass bottles were pasteurized by the method of pasteurization in boiling water bath (65-70°C) for 5 min. After that cooled beverage samples of treatments ($T_1$, $T_2$, $T_3$) were stored at room temperature, B.O.D temperature and refrigerated conditions.

**Physico-chemical Analysis:**Total soluble solids (TSS) of the beverages were estimated at room temperature using a hand refractometer having a range of 0–32%. Total acids were extracted in water and were determined using the titration method described by A.O.A.C. (2005). Total acids were extracted and titrated against 0.1 N NaOH using a few drops of phenolphthalein as an indicator.The pH of fresh juice was determined by a digital pH meter at all storage conditions. Before estimation, pH meter was calibrated using a pH buffer solution of pH 4.0, 7.0, and 10.2.The ascorbic acid content was determined using a 2-6 Dichlorophenol-indophenol (dye) visual titration method (Ranganna, 2014). Optical density was determined using the method as recommended by Srivastava and Kumar (2009).

**Sensory Evaluation**: The carrot and sugarbeet beverage sample of treatments ($T_1$, $T_2$, $T_3$) were subjected to sensory evaluation such as colour, flavor, taste, texture and overall acceptability . The sensory qualities evaluated were: Taste, flavour, color, texture and overall acceptability. The beverage samples were served in clear glasses to individual panelist. The order of presentation of samples to the panel was randomized, potable water was provided to rinse the mouth between evaluations to avoid transfer of sensory attributes from one sample to the other. Each sensory attribute was scored on a 9 point Hedonic Scale which ranged from 9 – 1 (liked extremely and disliked extremely), respectively as described byIwe (2010) and Ranganna (2014).

**Microbiological analysis:** The microbiological analysis of the beverages was estimated by the total plate count method using nutrient agar mediaas described byAneja et al. (2014).

## III. RESULTS AND DISCUSSION

Experiments were carried out to develop carrot and sugarbeet beverage and it's qualitative evaluation of the product. Several physico-chemical parameters viz. acidity, TSS, pH, optical density, ascorbic acid and microbial growth (total plate count, TPC) were evaluated during different periods of storage. The beverage samples were stored at room temperature (25°C), B.O.D. temperature (15°C) and refrigerated conditions (5°C) for 0, 15, 30, 45 and 60 days. Sensory quality attributes (colour, flavor,taste, texture and overall acceptability) of carrot and sugarbeet beverage were also carried out for the samples during storage.On the basis of results, following conclusions were drawn. Results of changes in Physico-chemical characteristics and microbial growth on carrot and sugarbeet beverage at room temperature (25°C), B.O.D. incubator (15°C) and refrigerator storage condition are table 1,2 and 3 respectively.The acidity of carrot and sugarbeet beverage increased either with increase in the ratio of carrot juice or decrease in the ratio of sugarbeet juice in developed beverage. During storage, acidity of samples increased with increase in the storage period. The highest quality of 0.164% was found of sample $C_{80}$:$S_{20}$at room temperature storage after 60 days.The pH of carrot and sugarbeet beverage decreased during storage period. The lowest pH (2.34) was found of the sample $C_{80}$:$S_{20}$at room temperature storage after 60 days (table-1).TSS of carrot and sugarbeet beverage increased slightly with increase in carrot

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juice ratio as well as with increase in the storage period. The highest TSS (16.30°Brix) was found of the sample $C_{80}$:$S_{20}$at room temperature storage after 60 days (table-1). The increase in optical density was observed with increase in carrot juice ratio in beverage samples during storage period. The highest optical density 0.066 was observed of sample $C_{60}$:$S_{40}$ at refrigerator temperature storage after 60 days (table-1).The TSS, acidity and optical density of carrot and sugarbeet beverage increased with increase in the storage period irrespective of storage conditions, same as reported byHumaran and Amuth (2007) for banana and sapota beverage and reported by Yadav et al. (2013) for banana pulp based RTS. The vitamin-C (ascorbic acid) of the beverage samples were decreased during storage period. It might be due to the oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles. The lowest ascorbic acid 2.46 mg/100ml was obtained in the sample $C_{60}$:$S_{40}$ at B.O.D. temperature storage after 60 days (table-1).The microbial growth increased during storage period irrespective of carrot juice ratio at different storage condition. The pH and ascorbic acid of carrot and sugarbeet beverage decreased with increase in the storage period. Similartrend was reported by Humaran and Amuth (2007) and Baramanray et al. (1995) for banana and sapota beverage.The highest microbial growth was obtained as $1.036x10^5$cfu/ml in the sample $C_{60}$:$S_{40}$ at B.O.D. temperature condition after 60 days storage.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 fresh carrot and sugarbeet juice ratio $C_{80}$:$S_{20}$at refrigerator condition. Best score of Flavor (8.5) was found for the juice ratio sample $C_{80}$:$S_{20}$at refrigerator temperature condition. The highest score for texture (7.7) was awarded for the sample having carrot and sugarbeet juice ratio $C_{80}$:$S_{20}$at refrigerator condition. Best score of taste (8.1) was found to the juice ratio sample $C_{80}$:$S_{20}$at refrigerator condition. Sensory panel recommended best sample containing $C_{80}$:$S_{20}$ as taste, color and texture points of view. Decline in sensory scores were observed during storage, in general. However, in few cases, increases in scores were also observed.

The samples of carrot and sugarbeet based beverage $C_{80}$:$S_{20}$, $C_{70}$:$S_{30}$ and $C_{60}$:$S_{40}$ at room temperature, B.O.D incubator, and refrigerator storage condition were acceptable up to 60 days. However, the beverage samples stored at refrigerated condition was found superior over other storage condition followed by B.O.D. incubator and room temperature conditions.

## IV. CONCLUSION

The carrot and sugarbeet based beverage 80:20, 70:30 and 60:40 at room temperature, B.O.D. incubator and refrigerated storage conditions were acceptable up to 60days. The acidity of carrot and sugarbeet beverage increased either with increase in the ratio of carrot juice or decrease in the ratio sugarbeet juice in developed beverage. During storage, sugarbeet acidity of sample increased with increase in storage period. The pH of carrot and sugarbeet beverage decreased during storage period. TSS of carrot and sugarbeet beverage increased slightly with increase in carrot juice ratio as well as with increase in storage period. The vitamin C (ascorbic acid) of the samples was decreased during storage period. The increase in optical density was observed with increase in carrot juice ratio in sample during storage period. The microbial growth increased during storage period irrespective of carrot juice ratio at different storage conditions. It was concluded that sample $C_{80}$ : $S_{20}$ was found superior than $C_{70}$ : $S_{30}$ and $C_{60}$ : $S_{40}$ beverages as colour, flavour, taste and texture point of view at refrigerated condition during storage period irrespective of carrot juice ratio at different storage conditions.

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**Table 1. Changes in Physico-chemical composition and microbial growth on carrot and sugar beet beverage at room temperature (25° C) storage conditions.**

| Storage period (days) | Parameters | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TSS (°Brix) | | | Acidity (%) | | | pH | | | Ascorbic acid (gm/100 ml) | | | Optical Density | | | Microbial Growth ($\times 10^5$cfu/ml) | | |
| | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ |
| 0 | 12.00 | 11.00 | 10.00 | 0.117 | 0.115 | 0.114 | 2.88 | 2.90 | 2.93 | 5.81 | 5.70 | 5.50 | 0.034 | 0.037 | 0.040 | * | * | * |
| 15 | 12.30 | 11.60 | 10.30 | 0.116 | 0.114 | 0.113 | 2.78 | 2.88 | 2.90 | 5.55 | 5.58 | 5.38 | 0.038 | 0.040 | 0.048 | 1.008 | 1.010 | 1.011 |
| 30 | 13.90 | 13.00 | 12.50 | 0.125 | 0.120 | 0.118 | 2.67 | 2.70 | 2.76 | 5.04 | 4.49 | 4.04 | 0.043 | 0.047 | 0.051 | 1.014 | 1.016 | 1.018 |
| 45 | 14.50 | 14.10 | 13.60 | 0.137 | 0.130 | 0.128 | 2.54 | 2.57 | 2.60 | 4.15 | 3.80 | 3.32 | 0.054 | 0.057 | 0.061 | 1.018 | 1.020 | 1.022 |
| 60 | 16.30 | 15.00 | 14.30 | 0.164 | 0.156 | 0.151 | 2.34 | 2.38 | 2.40 | 3.38 | 2.48 | 2.48 | 0.061 | 0.064 | 0.066 | 1.025 | 1.026 | 1.028 |

$T_1$ = **$C_{80}$:$S_{20}$ = (**Carrot juice level as 80% of total juice extract: Sugarbeet juice level as 20% of total juice extract)
$T_2$ = **$C_{70}$:$S_{30}$ = (**Carrot juice level as 70% of total juice extract: Sugarbeet juice level as 30% of total juice extract)
$T_3$ = **$C_{60}$:$S_{40}$ = (**Carrot juice level as 60% of total juice extract: Sugarbeet juice level as 40% of total juice extract)
(*) Not determined

**Table 2. Changes in Physico-chemical composition and microbial growth on carrot and sugar beet beverage at B.O.D. ( 15° C) storage conditions**

| Storage period (days) | Parameters | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TSS (°Brix) | | | Acidity (%) | | | pH | | | Ascorbic acid (gm/100 ml) | | | Optical Density | | | Microbial Growth ($\times 10^5$cfu/ml) | | |
| | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ |
| 0 | 12.00 | 11.33 | 11.00 | 0.116 | 0.117 | 0.115 | 2.78 | 2.84 | 2.88 | 5.81 | 5.69 | 5.59 | 0.032 | 0.036 | 0.039 | * | * | * |
| 15 | 12.20 | 11.43 | 11.40 | 0.117 | 0.114 | 0.112 | 2.71 | 2.75 | 2.82 | 5.35 | 5.51 | 5.28 | 0.041 | 0.047 | 0.050 | 1.010 | 1.012 | 1.014 |
| 30 | 13.83 | 13.33 | 13.00 | 0.126 | 0.124 | 0.122 | 2.62 | 2.65 | 2.68 | 5.09 | 4.49 | 4.02 | 0.049 | 0.053 | 0.057 | 1.016 | 1.018 | 1.020 |
| 45 | 15.33 | 14.33 | 13.83 | 0.138 | 0.136 | 0.134 | 2.50 | 2.54 | 2.57 | 4.13 | 3.90 | 3.32 | 0.054 | 0.056 | 0.059 | 1.023 | 1.025 | 1.027 |
| 60 | 16.00 | 15.50 | 14.66 | 0.160 | 0.158 | 0.154 | 2.36 | 2.37 | 2.38 | 3.33 | 2.83 | 2.46 | 0.057 | 0.061 | 0.065 | 1.030 | 1.032 | 1.036 |

$T_1$ = **$C_{80}$:$S_{20}$ = (**Carrot juice level as 80% of total juice extract: Sugarbeet juice level as 20% of total juice extract)
$T_2$ = **$C_{70}$:$S_{30}$ = (**Carrot juice level as 70% of total juice extract: Sugarbeet juice level as 30% of total juice extract)
$T_3$ = **$C_{60}$:$S_{40}$ = (**Carrot juice level as 60% of total juice extract: Sugarbeet juice level as 40% of total juice extract)
(*) Not determine

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Table 3. Changes in Physico-chemical composition and microbial growth on carrot and sugar beet beverage at Refrigerated ( 5° C) storage conditions

| Storage period (days) | Parameters | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TSS (°Brix) | | | Acidity (%) | | | pH | | | Ascorbic acid (gm/100 ml) | | | Optical Density | | | Microbial Growth ( $\times 10^5$ cfu/ml) | | |
| | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ | $T_1$ | $T_2$ | $T_3$ |
| 0 | 12.20 | 11.00 | 10.00 | 0.120 | 0.118 | 0.116 | 2.73 | 2.78 | 2.82 | 5.82 | 5.70 | 5.52 | 0.035 | 0.037 | 0.040 | * | * | * |
| 15 | 12.30 | 11.60 | 10.30 | 0.119 | 0.115 | 0.113 | 2.64 | 2.66 | 2.72 | 5.67 | 5.58 | 5.21 | 0.039 | 0.042 | 0.046 | 1.007 | 1.009 | 1.011 |
| 30 | 13.90 | 13.00 | 12.50 | 0.128 | 0.125 | 0.118 | 2.58 | 2.63 | 2.68 | 5.07 | 4.79 | 3.09 | 0.044 | 0.047 | 0.050 | 1.014 | 1.016 | 1.018 |
| 45 | 14.50 | 14.10 | 13.60 | 0.140 | 0.137 | 0.128 | 2.44 | 2.47 | 2.47 | 4.16 | 3.90 | 3.35 | 0.049 | 0.057 | 0.060 | 1.020 | 1.024 | 1.028 |
| 60 | 16.30 | 15.00 | 14.30 | 0.158 | 0.154 | 0.150 | 2.35 | 2.37 | 2.38 | 3.31 | 2.95 | 2.49 | 0.061 | 0.063 | 0.066 | 1.026 | 1.029 | 1.032 |

$T_1$ = **$C_{80}$:$S_{20}$ = (**Carrot juice level as 80% of total juice extract: Sugarbeet juice level as 20% of total juice extract)
$T_2$ = **$C_{70}$:$S_{30}$ = (**Carrot juice level as 70% of total juice extract: Sugarbeet juice level as 30% of total juice extract)
$T_3$ = **$C_{60}$:$S_{40}$ = (**Carrot juice level as 60% of total juice extract: Sugarbeet juice level as 40% of total juice extract)
(*) Not determined

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