Standardization of recipe for sweet orange and kokum blended RTS beverage preparation and storage

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Abstract: Investigation was carried out to standardize the recipe for preparation of sweet orange and kokum blended RTS beverage at processing laboratory in the Division of Post Harvest Technology, Indian Institute of Horticulture Research, Bengaluru from November, 2008 to June, 2009. Six treatments including control viz., sweet orange and kokum juices blended in the ratios of 97:3, 95:5, 92:8, 90:10, 88:12 and 100:0 (Control) respectively. In all the treatments, 15 per cent juice, 15° Brix and 0.3 per cent acidity was maintained and these were stored upto 180 days at ambient conditions. Among treatments, significantly highest TSS of 16.63° Brix, pH 3.24, titratable acidity 0.34 per cent, reducing sugars of 12.27 per cent, non-reducing sugars of 1.57 per cent, total sugars 13.32 per cent, ascorbic acid of 6.17 mg/100 g antioxidant activity of 21.47 mg/100 ml and non-enzymatic browning of 0.192 (at 440 nm) were recorded in RTS beverage of sweet orange and kokum blended juice ratios of 90:10, 97:3, 88:12, 95:5, 90:10, 95:5, 88:12 and 88:12, respectively. During storage period, the TSS, acidity, reducing sugars and non-enzymatic browning were increased while pH, total sugars, non-reducing sugars, ascorbic acid and antioxidant activity were decreased. Sweet orange and kokum at the ratio of 88:12 of 15 per cent juice, 15° Brix and 0.3 per cent acidity was found to be best in sensory evaluation. The colour, consistency, flavour and over all acceptability scores were decreased from 0 days to 180 days of storage. Sweet orange and kokum blended RTS beverage had storage stability upto 6 months.

Key Words: Sweet orange, RTS, Kokum, Storage, Sensory evaluation


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INTRODUCTION

Fruit beverages are important because they are highly refreshing, thirst quenching, appetizing, easily digestible and nutritionally superior to synthetic drinks. If synthetic drinks are replaced by fruit beverages, it would be a boon to the consumers and fruit growers (Giese, 1992). Blending of two or more fruit juices and preparation of their beverages will be a convenient alternative for the utilization of fruits which are not extensively utilized for beverage making due to high acidity, astringency or other undesirable factors. Blending of fruit juices for the preparation of beverages could result in a value added fruit drinks, which would be of high quality in respect of sensory and nutritional aspects (Deka et al., 2002).

Sweet orange fruit juice is rich in vitamin-C, sugars, acids and few minerals, it also contains neutraceuticals like carotenoids, limonoids, flavonones and vitamin-B complex (Ladaniya, 2008) and are having health promoting properties. Kokum fruit rind is a major source of hydroxy citric acid (22.8%) and is a potent inhibitor of obesity, anthelmintic, antidiabetic, cardiotonic. It can be used in treatment against piles, tumours, pains and heart complaints (Sampantu and Krishna Murthy, 1982). Fruit rind also contains carbohydrates (35%), ascorbic acid (0.06%) and minerals (Nageswara Rao and Sakarish, 1988).

Blending of sweet orange and kokum juices for preparation of RTS beverage may improve the nutritional qualities, taste, colour and health promoting properties. Keeping these in view, studies were conducted to standardize the blending ratios of sweet orange and kokum for the preparation of RTS beverage and to assess quality attributes during storage.
MATERIAL AND METHODS

The experiment was conducted in the Processing laboratory of Post Harvest Technology Division, Indian Institute of Horticultural Research, Bengaluru from November, 2008 to June, 2009.

Sweet orange fruits (Var. sathgudi) of optimum maturity and colour were procured from the farmers sweet orange gardens of Anantapur district, Andhra Pradesh and were washed in running potable water. The fruits were peeled using stainless steel knives, albedo portion was removed. The juice sacs were separated from the segments and blended in mixer. The juice obtained was filtered using muslin cloth.

Properly matured ripe fruits of kokum were procured from farmers gardens of Puttur, Dakshina Kannada district, Karnataka and these were washed in running potable water. Fruits were cut into halves and rind and seeds were separated. The rind was made into fine pieces and the juice was extracted by hot break method. The juices of sweet orange and kokum were blended at the ratios of 97:3, 95:5, 92:8, 90:10, 88:12, 100:0 respectively based on preliminary studies. The different ratios of blended juices were analysed for TSS and titratable acidity and then RTS beverages were prepared with fixed juice content of 15 per cent, TSS of 15°Brix and 0.3 per cent acidity. The hot RTS was filled into the presterilised glass bottles of 200 ml capacity, sealed with crown caps using crown corking machine. The bottles were processed in boiling water for 20 minutes and air cooled, labeled and stored at ambient conditions. Chemical analysis and sensory evaluation was carried out at 0, 3 and 6 months of storage. The sensory evaluation was performed by a panel of 10 judges having a maximum score of 30 for colour, 30 for consistency and 40 for flavour with an over all acceptability score of 100. Total soluble solids (TSS) were measured using Refractometer (Erma), pH was determined using Elico digital pH meter. Titratable acidity, ascorbic acid, reducing sugars and total sugars were determined as per the procedure outlined by Ranganna (1979, 1991). Non-reducing sugars were obtained by deducting the value of reducing sugars from the total sugars. Antioxidant activity was estimated using the methodology given by Leong and Shui (2002). The design followed was Factorial Completely Randomised Design with 6 treatments including control replicated thrice and the data were analysed by the procedure suggested by Sundar Raj et al. (1972).

RESULTS AND DISCUSSION

The results of the present study have been presented and discussed under the following headings:

Chemical composition of sweet orange and kokum blended RTS beverage:

Total soluble solids (TSS):

Sweet orange RTS beverage and sweet orange and kokum at the ratio of 95:5 exhibited significantly higher TSS. While least TSS was found in sweet orange and kokum at the ratio of 97:3 blended RTS beverage. Increase of TSS in all the treatments during 180 days of storage might be due to conversion of polysaccharides into simple sugars, which are in accordance with the findings of Nidhi et al. (2008). The blending ratios showed significant effect on TSS. The highest value of TSS (17°Brix) was found in sweet orange and kokum at the ratio of 90:10 blended RTS beverage and also in sweet orange RTS beverage at 180th day of storage (Table 1).

pH:

Sweet orange and kokum at the ratio of 97:3 blended RTS beverage showed highest pH value, while it was least in sweet orange and kokum at the ratio of 88:12 blended RTS beverage. Increase of kokum juice concentration in beverage had decreased the pH. Decrease of pH values in all the treatments during storage was due to simultaneous increase in titratable acidity, which are in agreement with the findings of Sogi and Singh (2001). Sweet orange RTS beverage exhibited highest pH at 0 days, while least was recorded in sweet orange and kokum at the ratio of 88:12 blended RTS beverage at 180th day of storage (Table 1).

Titratable acidity:

Maximum acidity was found in sweet orange and kokum at the ratio of 88:12 blended RTS beverage (Table 1). Increase in titratable acidity in all recipes during storage was due to release of acids from pulp/juice particles due to autolysis of cells and simultaneous decrease of pH. These results are in conformity with the findings of Sogi and Singh (2001).

Reducing sugars:

Maximum reducing sugars were found in sweet orange and kokum at the ratio of 95:5 blended RTS beverage while it was least in sweet orange RTS beverage (Table 2). Increase of reducing sugars in all treatments during storage might be due to the hydrolysis of starch / sucrose into reducing sugars, which are similar to the observations made by Navya Yadav (2006). Highest reducing sugars were found in sweet orange and kokum at the ratio of 95:5 blended RTS beverage at 180th day of storage and it was least in sweet orange RTS beverage at 0 days of storage.

Non-reducing sugars:

Among blends, maximum non-reducing sugars were found in sweet orange and kokum at the ratio of 90:10 blended RTS beverage and minimum in sweet orange and kokum at the ratio of 92:8 blended RTS beverage (Table 2). Decrease of non-reducing sugars in all the treatments during storage was due to inversion of non-reducing sugars to reducing sugars, which are similar to the findings of Navya Yadav (2006). Sweet orange RTS beverage showed higher non-
### Table 1: TSS, pH and titratable acidity of sweet orange and kokum blended RTS beverage during storage

<table>
<thead>
<tr>
<th>Treatments</th>
<th>TSS (B)</th>
<th>pH</th>
<th>Titratable acidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>90</td>
<td>180</td>
</tr>
<tr>
<td>SO: KK (57:3)</td>
<td>15.20</td>
<td>15.70</td>
<td>16.13</td>
</tr>
<tr>
<td>SO: KK (65.5)</td>
<td>16.00</td>
<td>16.40</td>
<td>16.70</td>
</tr>
<tr>
<td>SO: KK (62.8)</td>
<td>16.00</td>
<td>16.43</td>
<td>16.83</td>
</tr>
<tr>
<td>SO: KK (80:10)</td>
<td>16.20</td>
<td>16.70</td>
<td>17.00</td>
</tr>
<tr>
<td>SO: KK (88:12)</td>
<td>16.00</td>
<td>16.23</td>
<td>16.43</td>
</tr>
<tr>
<td>Sweet orange RTS 15% juice, ST</td>
<td>16.50</td>
<td>16.70</td>
<td>17.00</td>
</tr>
<tr>
<td>ST, 0.3% acidity</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>15.98</td>
<td>16.36</td>
<td>16.68</td>
</tr>
<tr>
<td>FT Test</td>
<td>S.E. ±</td>
<td>C.D. (P=0.05)</td>
<td>-</td>
</tr>
<tr>
<td>Treatments (A)</td>
<td>*</td>
<td>0.015</td>
<td>0.043</td>
</tr>
<tr>
<td>Storage (B)</td>
<td>*</td>
<td>0.011</td>
<td>0.031</td>
</tr>
<tr>
<td>AB</td>
<td>*</td>
<td>0.026</td>
<td>0.075</td>
</tr>
</tbody>
</table>

* Significant, NS = Non-significant

### Table 2: Reducing sugars, non-reducing sugars and total sugars of sweet orange and kokum blended RTS beverage during storage

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Reducing sugars (%)</th>
<th>Non-reducing sugars (%)</th>
<th>Total sugars (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>90</td>
<td>180</td>
</tr>
<tr>
<td>SO: KK (57:3)</td>
<td>11.62</td>
<td>11.70</td>
<td>11.82</td>
</tr>
<tr>
<td>SO: KK (65.5)</td>
<td>12.00</td>
<td>12.30</td>
<td>12.50</td>
</tr>
<tr>
<td>SO: KK (62.8)</td>
<td>12.05</td>
<td>12.25</td>
<td>12.45</td>
</tr>
<tr>
<td>SO: KK (80:10)</td>
<td>11.21</td>
<td>11.50</td>
<td>11.80</td>
</tr>
<tr>
<td>SO: KK (88:12)</td>
<td>11.50</td>
<td>11.75</td>
<td>12.00</td>
</tr>
<tr>
<td>Sweet orange, RTS 15% juice, ST</td>
<td>10.00</td>
<td>11.05</td>
<td>11.58</td>
</tr>
<tr>
<td>ST, 0.3% acidity</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>11.40</td>
<td>11.76</td>
<td>12.03</td>
</tr>
<tr>
<td>FT Test</td>
<td>S.E. ±</td>
<td>C.D. (P=0.05)</td>
<td>-</td>
</tr>
<tr>
<td>Treatments (A)</td>
<td>*</td>
<td>0.021</td>
<td>0.059</td>
</tr>
<tr>
<td>Storage (B)</td>
<td>*</td>
<td>0.015</td>
<td>0.042</td>
</tr>
<tr>
<td>AB</td>
<td>*</td>
<td>0.036</td>
<td>0.103</td>
</tr>
</tbody>
</table>

SO: Sweet orange; KK: kokum

* Significant
reducing sugars at 0, 90th day and 180th day of storage.

Total sugars:

Sweet orange RTS showed higher total sugars, while they were least in sweet orange and kokum at the ratio of 97:3 blended RTS beverage. Storage of sweet orange and kokum blended RTS beverage for 180 days resulted in reduction of total sugars which might be due to reaction of sugars with amino acids for their involvement in non-enzymatic browning (Sharma et al., 2001). Sweet orange RTS beverage (Control) exhibited higher total sugars at 0, 90th and 180th day of storage due to interaction effects (Table 2).

Ascorbic acid:

Sweet orange RTS beverage showed significantly higher ascorbic acid, while it was least in sweet orange and kokum at the ratio of 90:10 and 88:12 blended RTS beverage (Table 3). Storage of blended RTS beverage for 180 days resulted in loss of ascorbic acid due to oxidation and storage temperature. Similar observations were made by Tripathi et al. (1992).

Sweet orange RTS beverage showed higher ascorbic acid at all storage intervals due to more amount of ascorbic acid present in sweet orange juice than kokum juice.

Antioxidant activity:

Maximum antioxidant activity was found in sweet orange and kokum at the ratio of 88:12 blended RTS beverage, while it was least in sweet orange RTS beverage. Higher amount of kokum juice in treatments increased antioxidant activity. Since kokum juice is rich in antioxidants.

Antioxidant activity increased from 0 to 90th day of storage and then decline thereafter (Table 3). Similar observation was made by Arena et al. (1999) in reconstituted orange juice from concentrate showed an increase in antioxidant activity after two months of storage due to increased amount of antioxidants compounds.

Higher antioxidants activity was found in sweet orange and kokum at the ratio of 88:12 blended RTS beverage on 0, 90th and 180th day of storage.

Non-enzymatic browning (NEB):

Among the blends, minimum NEB was found in sweet orange and kokum at the ratio of 97:3 blended RTS beverage, which are similar to the observations made by Tandon et al. (2007).

NEB increased in all the treatments during storage which could be attributed to formation of furfural and hydroxy methyl furfural in the products during storage (Woolfe, 1979; Tandon et al., 2007).

Least NEB was found in sweet orange and kokum at the ratio of 97:3 blended RTS beverage at all storage intervals (Table 3).
Organoleptic qualities of sweet orange and kokum blended RTS beverage:

The results of organoleptic qualities of sweet orange and kokum blended RTS beverage are presented in the following sub-heads:

**Colour:**

Colour scores were significantly better in sweet orange and kokum at the ratio of 88:12 blended RTS beverage, while they were least in sweet orange and kokum at the ratio of 97:3 blended RTS beverage. Increased proportion of kokum juice enhanced the eye appeal and improved the colour because of anthocyanin pigments. Colour scores decreased during 180 days of storage because of degradation of pigments due to oxidative loss and non-enzymatic browning, which were similar to the finding of Tandon et al. (2007).

**Consistency:**

Maximum consistency scores were found in sweet orange and kokum at the ratio of 88:12 blended RTS beverage, while least scores were noted in sweet orange and kokum at the ratio of 97:3 blended RTS beverage due to increased cloudiness in juice since sweet orange juice is thin compared to kokum juice. Decrease in consistency scores in all the treatments during storage was due to break down of pigment (Mainly anthocyanins) during storage (Joshi, 1994).

**Flavour:**

Sweet orange and kokum at the ratio of 88:12 blended RTS beverage had better flavour scores while least flavour scores were recorded in sweet orange- kokum at the ratio of 97:3 blended RTS beverage. Flavour scores were found to increase with increased proportion of kokum juice in the product. This might be attributed to the presence of more appealing flavour compounds in kokum juice.

Decrease of flavour scores during storage was due to loss of volatile flavouring compounds (Sogi and Singh, 2001).

**Over all acceptability:**

Sweet orange and kokum at the ratio of 88:12 blended RTS beverage had better overall acceptability scores, while least was found in sweet orange and kokum at the ratio of 97:3 blended RTS beverage. Higher overall acceptability scores in sweet orange and kokum at the ratio of 88:12 blended RTS beverage was due to higher colour, consistency and flavour scores.

Decrease of overall acceptability scores from 0 days to 180 days of storage was due to corresponding decline of colour, consistency and flavour scores during storage, which are in accordance with the findings of Sogi and Singh (2001).

**Conclusion:**

Sweet orange and kokum(88:12) blended RTS beverage with 15 per cent juice, 15°Brix and 0.3 per cent acidity was found to have highest sensory scores and over all acceptability and rated the best recipe. TSS, titratable acidity, reducing sugars and non-enzymatic browning increased while pH, total sugars, non-reducing sugars, ascorbic acid and antioxidant activity were decreased during storage.

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