Effect of refrigeration storage on the Ascorbic acid (Vitamin C) content of pear-amla based ready-to-serve (RTS) beverages

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Abstract

High ascorbic acid Pear (*Pyrus communis*) and Amla (*Emblica phyllanthus* or *Emblica officinalis*) based RTS beverages were prepared at various combinations (80:20, 75:25 and 50:50). The physicochemical properties like pH, TSS, titratable acidity, reducing sugar and ascorbic acid content were evaluated during a storage period of 0, 7, 15 days. The study revealed that RTS-3 prepared with 50% pear and 50% amla juice scored the maximum amount of ascorbic acid content (322.85 mg/100g). In this study increasing trend was observed in the case of pH, TSS, titratable acidity during the refrigeration storage of pear-amlu based ready-to-serve (RTS) beverages over a period of 15 days but the ascorbic acid content was decreased.

1. Introduction

Now these days Ready-To-Serve (RTS) beverages have been popular throughout the country due to the higher content of nutritional, medicinal and calorific properties over the non-fruit based beverages (Tiwari and Deen, 2015). Fruit based RTS beverages are a rich source of essential minerals and vitamins. RTS also have good taste and flavor. Fruit based Ready-To-Serve (RTS) beverages are commonly acceptable beverages throughout the country.

Pear (*Pyrus communis*) belongs to family *Rosaceae*. It is seasonal fruit and rich in phenolics. The phenolic compounds are useful for preventing some diseases like cardiovascular and inflammatory diseases and carotenoids avoid age-related macular degeneration (Scalbert and Williamson, 2000; Daly et al., 2010). Vitamin C is useful for reducing the risk of several cardiovascular, neurodegenerative diseases (Harrison and May, 2009). Pear is a good source of vitamins, minerals, pectin, dietary fibers, and phytochemicals. Pears juice is beneficial for the people those are suffering from acidity and diabetics.

Tulsi (*Ocimum tenuiflorum*, *Ocimum sanctum*) is an aromatic plant in the family Lamiaceae which is native to the Indian subcontinent and widespread as a cultivated plant throughout the Southeast Asian tropics. (Warrier, 1995). The tulsi leave extracts with methanol, water, and acetone were used to monitor the anti-bacterial property against clinically isolated MDR bacterial strains (Staples et al., 1999). Juice or infusions of tulsi are useful for the treatment of bronchitis, digestive problems, arthritis, hypertension, heart attack, cancer, viral hepatitis, diabetes etc. It is an excellent rejuvenator, which has been known to reduce anxiety, stress and relieves the mind. The tulsi plant is valued for its anti-toxic (Sharma et al., 2002); antitussive (Nadig and Laxmi, 2005); hypoglycaemic and hypolipidemic properties thereby making it useful for diabetic patients (Rai et al., 1997). The aqueous extract of tulsi shows antimicrobial properties (Geeta Vasudevan et al., 2001; Singh et al., 2005) and also helps to reduce blood sugar in normal, glucose fed hyperglycemic and streptozotocin, induced diabetic rats (Chattopadhay, 1993; Pandey and Madhuri, 2010).

Amla (*Emblica phyllanthus* or *Emblica officinalis*) is one of the most medicinal herbs and widely used in Ayurvedic medicines. The Amla acts as antioxidants (Chopra et al., 1956); and protect against oxidative stress in ischemic reperfusion injury (Raja et al., 2004). Amla is one of the richest sources of vitamin C, amino acids,
and minerals (Srivasuki, 2012). Due to high vitamin C content, this is liable for keeping body cells, increases red blood cells and promotes good health (Kapoor, 1990). It also contains several chemicals like tannins, alkaloids, and phenols (Zhang et al., 2003). The fresh juice of amla acts as diuretic and helpful in burning urinary infection and when mixed with other ingredients are used to cure fits and insanity (Jayaweera, 1980).

On the basis of all these fruits health benefits and nutritional values, the present study is focused on the preparation and storage stability of Fruit based Ready-To-Serve (RTS) beverages.

2. Materials and methods

2.1 Raw materials

Fresh and mature fruits were procured from local market of Premnagar, Dehradun, Uttarakhand and were used for the preparation of RTS. All the chemicals used to evaluate the quality parameter were analytical grade.

2.2 Preparation of juices

2.2.1 Preparation of pear juice

Fresh and mature pear fruits were washed in fresh water to remove the surface impurities. After washing, peeling was done by knife and juice were extracted mechanically by using Havells Juicer. After extraction juice is stored at 4 ± 1°C until use.

2.2.2 Preparation of amla juice

Fresh and mature amla fruits were washed in fresh water and any surface defect is removed by a knife. After washing, the stone of amla was removed and the juice was extracted mechanically and stored at 4 ± 1°C until use.

2.2.3 Preparation of tulsi extract

Fresh tulsi leaves were washed properly in fresh water and blended in a laboratory blender. Then, the extract was filtered with water through a muslin cloth to obtain the tulsi Extract.

2.2.4 Preparation of pear - amla based RTS

Pear–amla based RTS were prepared by mixing the previously prepared juices by using various blend combination i.e. RTS-1 [Pear: Amla juice (80:20)], RTS-2 [Pear: Amla juice (75:25)], RTS-3 [Pear: Amla juice (50:50)] with 5ml of tulsi Extract and 5 ml of sugar solution. All the combinations were filled in previously sterilized glass bottles to a volume of 200 ml.

2.3 Physicochemical analysis of raw juices and prepared RTS’s

Raw juices and prepared RTS with different combinations of pear and amla juice (80:20, 75:25 and 50:50) i.e. RTS-1 [Pear: Amla juice (80:20)], RTS-2 [Pear: Amla juice (75:25)], RTS-3 [Pear: Amla juice (50:50)] were analyzed for various physicochemical properties like pH, TSS, titratable acidity, reducing sugar and ascorbic acid content. The pH of all juices was analyzed using a handy pH meter. TSS was measured in °Brix using a handy refractometer (ERMA). Titratable acidity was measured by the standard method of Rangana (2010) by using N/10 NaOH and expressed in terms of percentage of citric acid. Reducing sugars were determined by the method of Lane and Eynon (1923). The ascorbic acid in raw juice as well as the RTS beverages was measured according to the standard method of Sawhney and Singh (2015).

3. Results and discussion

3.1 Physicochemical analysis of pear (Pyrus communis) and amla (Emblica phyllanthus or Emblica officinalis) juice

The pH of pear and amla juice, were reported at 4.6 and 3.0 respectively; TSS of pear and amla juice were recorded at 12.1 and 8.1°Brix respectively; titratable acidity of pear and amla juice were 0.576 and 2.608% citric acid respectively; % reducing sugar of pear and amla juice were 6.9% and 8.33% respectively; ascorbic acid of pear and amla juice was 1.71 and 821.1 mg/100 ml respectively. The moisture content of pear and amla juice were 86.45 and 90.43% respectively while the ash content of pear and amla juice measured was 1.49 and 2.42% respectively as shown in Table 1. The pH, TSS, titratable acidity, % reducing sugar, ascorbic acid, moisture content and ash content of pear juice (Pyrus communis) were similar with Talib et al. (2016) to some extent. The pH, TSS, titratable acidity, % reducing sugar, ascorbic acid, moisture content and ash content of amla juice (Phyllanthus emblica) were similar to some extent as reported by Karpagavalli et al. (2014). The ascorbic acid content of amla juice is also similar with Sasi Kumar et al. (2013).

The physicochemical changes during the refrigeration storage of RTS were presented in Table 2. The pH increased gradually after 7 to 15 days in the case for RTS-1, from 2.9 to 3.4; RTS-2, from 2.8 to 3.2; and RTS-3, from 2.5 to 3.0 as shown in Figure 1. The results were similar to the study conducted by Kayshar et al. (2014).
Table 1. Physicochemical analysis of pear (Pyrus communis) and amla (Emblica phyllanthus or Emblica officinalis) Juice

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>Pear</th>
<th>Amla</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>pH</td>
<td>4.6</td>
<td>3.0</td>
</tr>
<tr>
<td>2.</td>
<td>TSS (°Brix)</td>
<td>12.1</td>
<td>8.1</td>
</tr>
<tr>
<td>3.</td>
<td>Titratable Acidity (% citric acid)</td>
<td>0.576</td>
<td>2.608</td>
</tr>
<tr>
<td>4.</td>
<td>Reducing Sugar (%)</td>
<td>6.9</td>
<td>8.33</td>
</tr>
<tr>
<td>5.</td>
<td>Ascorbic acid (mg/100 ml)</td>
<td>1.71</td>
<td>812.1</td>
</tr>
<tr>
<td>6.</td>
<td>Moisture Content (%)</td>
<td>86.45</td>
<td>90.43</td>
</tr>
<tr>
<td>7.</td>
<td>Ash content (%)</td>
<td>1.49</td>
<td>2.42</td>
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</table>

Table 2. Effect of refrigeration storage on physicochemical parameters of pear-mla based ready-to-serve (RTS) beverages

<table>
<thead>
<tr>
<th>RTS (Pear-Amla Juice)</th>
<th>Refrigeration Storage Period (Days)</th>
<th>pH</th>
<th>TSS (°Brix)</th>
<th>Titratable Acidity (% citric acid)</th>
<th>Reducing Sugar (%)</th>
<th>Ascorbic acid (mg/100 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTS-1 (80:20)</td>
<td>0</td>
<td>2.9</td>
<td>11.3</td>
<td>0.59</td>
<td>14.71</td>
<td>154.85</td>
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<tr>
<td></td>
<td>7</td>
<td>3.3</td>
<td>11.4</td>
<td>0.60</td>
<td>15.2</td>
<td>134.00</td>
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<tr>
<td></td>
<td>15</td>
<td>3.4</td>
<td>11.9</td>
<td>0.64</td>
<td>16.0</td>
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<td></td>
<td>0</td>
<td>2.8</td>
<td>12.0</td>
<td>0.48</td>
<td>12.1</td>
<td>231.43</td>
</tr>
<tr>
<td>RTS-2 (75:25)</td>
<td>7</td>
<td>3.2</td>
<td>12.5</td>
<td>0.59</td>
<td>14.80</td>
<td>165.71</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>3.2</td>
<td>12.8</td>
<td>0.72</td>
<td>15.30</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2.5</td>
<td>12.4</td>
<td>0.84</td>
<td>13.15</td>
<td>423.71</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>3.0</td>
<td>13.2</td>
<td>1.26</td>
<td>15.30</td>
<td>322.85</td>
</tr>
</tbody>
</table>

The physicochemical changes during the refrigeration storage of RTS were presented in Table 2. The pH increased gradually after 7 to 15 days in the case for RTS-1, from 2.9 to 3.4; RTS-2, from 2.8 to 3.2; and RTS-3, from 2.5 to 3.0 as shown in Figure 1. The results were similar to the study conducted by Kayshar et al. (2014).

The TSS increased gradually after 7 to 15 days in the case for RTS-1, from 11.3 to 11.9°Brix; RTS-2, from 12.0 to 12.8°Brix and; RTS-3, from 12.4 to 13.2°Brix as shown in Figure 2. The changes in TSS may be due to the conversion of polysaccharides into sugars. The similar trend of increasing TSS during storage was also reported for aloe-vera based RTS soft drink (Talib et al., 2016) and in bael and Aloe-vera blended RTS beverage (Tiwari and Deen, 2015).

The titratable acidity of RTS also increased gradually during the refrigeration storage. The titratable acidity increased gradually after 7 to 15 days in the case for RTS-1, from 0.59 to 0.64% citric acid; RTS-2, from 0.48 to 0.72% citric acid and; RTS-3, from 0.84 to 1.26% citric acid as shown in Figure 3. The changes in titratable acidity may be due to the degradation of pectic substances that increased the acidity of processed fruit products (Conn and Stumf, 1976).

The reducing sugar increased continuously during the refrigeration storage period of 7 to 15 days in the case for RTS-1, from 14.71 to 16.0%; RTS-2, from 12.1 to 14.0% and; RTS-3, from 13.15 to 15.30% as shown in Figure 4. This increasing trend may be due to inversion of non-reducing sugars into reducing sugars. This result in this present study was similar to Nidhi et al. (2007).

The ascorbic acid content decreased continuously from the first day to the last day of refrigeration storage of 7 to 15 days in the case for RTS-1, from 154.85 to 88.57 mg/100g; RTS-2, from 231.43 to 116.0 mg/100g and; RTS-3, from 423.71 to 322.85 mg/100g as shown in...
Figure 5. The oxidation of ascorbic acid into dehydroascorbic acid may be the reason for the decreasing trend of ascorbic acid content. The similar trend of decreasing Ascorbic acid (Vitamin C) content was also observed in Mandal’s (2003) study on fruit based beverages.

4. Conclusion

In this study, similar trends of ascorbic acid decrement have been found in the case for RTS-1, RTS-2, and RTS-3. The study revealed that RTS-3 prepared with 50% pear and 50% amla juice scored the maximum retained amount of ascorbic acid content (322.85 mg/100g). An increasing trend was observed in the case for pH, TSS, titratable acidity during the refrigeration storage of pear-amlabased ready-to-serve (RTS) beverages over a period of 15 Days.
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References


