Physico-chemical, sensory and microbial characteristics of fruit flavoured milk based beverages during refrigerated storage.

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Abstract

Beverages based on fruit and milk products are currently receiving considerable attention as their market potential is growing. Soft drink industry had made significant progress during recent years in terms of production, but there is only a limited range of flavours available in India. The present study was carried out to develop novel milk based fruit flavoured beverages using 10, 15 and 20% apple juice (v/v) and sodium alginate as stabilizer (0.5%), in the formulation. The beverages were evaluated for their stability and various physico-chemical, sensory and microbial properties during 7 days refrigerated storage. The pH value of the beverages decreased from 6.3 - 6.0, 6.4 - 6.20 and 6.5 - 6.4; ascorbic acid content from 1.550 - 1.503%, 3.172 - 3.166% and 3.760 - 3.360% and total sugar content from 10.83 - 10.80%, 10.77 - 10.75% and 10.75 - 10.73% for T1, T2 and T3, respectively. Whereas acidity increased from 0.117 - 0.282%, 0.225 - 0.290% and 0.273 - 0.295% and reducing sugars content from 4.49 - 4.55%, 4.40 - 4.42% and 4.34 - 4.39% for T1, T2 and T3, respectively. During refrigerated storage no significant difference (p ≤ 0.05) was observed with respect to fat, protein, viscosity and specific gravity but, total plate count showed a slight increase in microbial count. The studies revealed that the milk based fruit flavored beverage prepared with 80% milk and 20% apple juice scored maximum for sensorial quality attributes such as color, flavor and overall acceptability.

Keywords: Apple juice, Milk, Beverage, Stabilizers, Refrigerated storage.

Introduction

Beverages based on fruits and milk products are currently receiving considerable attention as their market potential is growing. Soft drink industry had made significant progress during recent years in terms of production, but there is only a limited range of flavours available in India. Many types of syrups, sherbets and soft drinks containing artificial fruit flavours are well known throughout the world. The basic consideration is the caloric and therapeutic values, which make them popular and acceptable. At present fruit beverages are generally synthetic flavoured, bottled and sold in the market. If this could be substituted with milk/whey, it will be more beneficial to consumers, dairy industries and beverage manufacturers. Beverages based on whey/milk have high nutritional quality and increased caloric value. These could be particularly useful in places where, there is improper food and nutrition leading to the deficiencies of some nutrients [1]. Most of the people do not relish milk and milk products as such, so various flavoured milks have been made by using variety off flavours like chocolate flavoured and fruit flavoured milk drinks.

Fruit and fruit products are rich source of many vitamins, essential minerals, digestible carbohydrates and organic acids that stimulate appetite, help in proper digestion and impart specific flavour of foods. Milk based beverages are functional, in that they provide all essential and non-essential amino acids but, are less acidic than fruit juices [2]. Nowadays new trend in beverage consumption is, increase in per capita carbonated soft drink consumption and a decrease in fluid milk consumption [3, 4]. Mixed fruit juice and milk beverages are
considered among the most functional and nutritional foods [5]. Thus the beverage industry should incorporate new ingredients in milk beverages which will improve their nutritional quality and organoleptic characteristics.

Maharaji apple is one of the low grade apple produced in Jammu and Kashmir, India. Its flesh is crisp, juicy, acidic and aromatic. The variety sweetens on storage and has an excellent shelf life. Juice of the fruit is prepared by mechanically squeezing or macerating fruit flesh without the application of heat or solvents. Apple juices are consumed for their perceived health benefits due to significant amounts of phytochemicals such as carotenoids, flavonoids, isoflavonoids, and phenolics [6]. Since apple juice is rich in antioxidants, a diet with these components prevents oxidative stress, and may therefore reduce chronic diseases and slow aging [6]. The objective of this study was to produce apple juice flavoured milk based beverage to give it apple flavour and to study its stability during refrigerated storage.

Materials and Methods

Materials

Fresh milk and apples were procured from the local market of Awantipora, Jammu and Kashmir, India. The damaged and rotten apples were rejected and only fresh and healthy apples were used for juice extraction. The Stabilizer (sodium alginate) and Sugar (sucrose) and chemicals used in this study were of analytical grade and procured from Himedia Pvt. Ltd, Mumbai, India.

Extraction of juice

The apples were rinsed under running tap water, cut into small pieces and crushed. The crushed apples were then pressed in hydraulic press (Bajaj Moschinen Pvt. Ltd.) and the juice was extracted and filtered 2 to 3 times through a sterilized muslin cloth and then collected in glass beakers having a capacity of one liter. The juice was then pasteurized in an open pan and was filled in bottles.

Formulation of fruit flavoured milk based beverages

Three types of formulations were used for the preparation of beverages in which the juice percentage varied from 10-20% (Table 1). The milk was filtered through sterilized muslin cloth and was pre-heated to the temperature of 69 – 75°C. The sugar (0.5%) and stabilizer (0.5%) were mixed in a mixer (Philips) and added to milk at the temperature of 69 – 75°C. The milk, stabilizer and sugar mixture was stirred for almost 15 minutes and was kept undisturbed for some time. The mixture was then kept in a chiller (Philips, western), for ageing over night (4°C or below). The juice was then added to the milk at three different concentrations and was stirred in mixer for 10 min and then kept undisturbed for a while. The beverages were then filled in 200 ml capacity bottles which were already sterilized. The bottles were then crown capped by crown capped machine (Bajaj Moschinen Pvt. Ltd.) and were pasteurized at a temperature of 70 – 75°C for 15- 20 min. The beverages were then stored at refrigerated temperature for further analysis.

Table 1: Basic formulation for the beverages with varying apple juice concentrations

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (ml/l)</td>
<td>900</td>
<td>850</td>
<td>800</td>
</tr>
<tr>
<td>Juice (ml/l)</td>
<td>100</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Sugar (g/l)</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Stabilizer (g/l)</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

* Treatments: T1: containing apple juice (10%); T2: containing apple juice (15%); T3: containing apple juice (20%).

Proximate composition

Protein (991.20) and fat (920.85) contents were determined according to Association of Official Analytical Chemists, AOAC [7]. The samples were analyzed in triplicate for each component.

pH and total titratable acidity

The pH was determined with the help of electronic digital pH meter (LABINDIA). Buffer solutions of pH 4 and 7 were used to calibrate the pH meter. Electrode was immersed in sample taken in a beaker, to determine pH. Total acidity was determined by standard method of [8].

Total soluble solids

The total soluble solids were determined by the standard method of [7] using hand refractometer (Atago Japan, DR- A-1) at room temperature with a scale of 0-32°Brix.
Fruit flavoured milk based beverages

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Milk

Preheating (69 – 75°C)

Addition of stabilizer-sugar mixture

Ageing of milk stabilizer-sugar mixture (4°C or below, over night)

Mixing of juice (@ 10, 15, 20%)

Stirring

Bottling

Crown capping

Pasteurization (70 – 75°C)

Storing in refrigerator

Scheme 1: Flow diagram showing the basic steps for the preparation of fruit flavoured milk based beverages.

Ascorbic acid

Ascorbic acid content was determined according to [9]. Hundred milligram of L-Ascorbic acid was taken and the volume was made up to 100ml with 3% hypochloric acid and then 10 ml was diluted to 100ml with 3% hypochloric acid. Dye solution was made by dissolving 50mg of sodium salt of 2, 6-dichlorophenolindophenol in 150ml of hot glass water containing 42 mg of sodium bicarbonate and was diluted to 200 ml. Standardization of dye was done by taking 5ml of standard ascorbic acid solution and 5ml of 3% hypochloric acid. The titration of this solution was done against the dye till pink colour appears.

Dye factor=0.5/titrte used

Ten ml of sample was taken and volume made up to 100ml with 3% hypochloric acid and was then filtered and centrifuged. Finally 5 ml of aliquot was titrated against the dye till pink color appeared.

Calculations:

\[
\text{Mg of ascorbic acid/100g or ml} = \frac{\text{Titrte} \times \text{Dye factor} \times \text{Vol. made up}}{\text{Aliquot of extraction} \times \text{Wt. or Vol. of sample taken}} \times 100
\]

Specific gravity and viscosity

The specific gravity of the beverages was determined by relative density bottle method. The empty relative density bottle was weighed and filled with beverage (at 298K) and weighed again (m). The procedure was then repeated for water (m_s) at 298K and specific gravity was calculated by the following formula:

\[
\rho/\rho_s = \frac{m}{m_s} \times \frac{V}{V_s}
\]

The viscosity of the beverages was determined by Ostwald viscometer. The beverages were introduced into bulb A up to mark, then forced under pressure into the bulb B. The beverages were then allowed to fall freely back into the bulb A and the time interval was recorded on stop watch (θ). The procedure was repeated for the water and time was recorded on stop watch (θ_s). The values for the fluid viscosity were determined by following relationship.

\[
\mu = \mu_s \times \theta / \theta_s \times \rho / \rho_s
\]

Reducing sugars

The reducing sugars were determined by the standard method of [10]. The results were expressed as per cent on pulp weight basis.

Microbial analysis

Total plate count was determined on nutrient agar media according to [11]. Samples were prepared under aseptic conditions. Ten ml from each sample was aseptically weighed into sterile tubes and blended for 2 min at high speed after addition of 90 ml sterile 0.1% peptone water. Sevenfold serial dilution was carried out. Each dilution was spread-plated, in duplicate, on plate count agar (Hi Media Pvt. Ltd., Mumbai) for enumeration. The inoculated petriplates were incubated at 37 °C for 24 hour. Cfu/ml was calculated by taking average number of colonies which was multiplied by reciprocal of dilution factor and expressed as Cfu/ml.
Sensory evaluation

The beverages were evaluated for different sensory parameters (colour, flavour, and overall acceptability) using 9-point hedonic scale [12]. A selected ten member panel consisting of researchers and faculty members from the Department of Food Science and Technology, Islamic University of Science and Technology, Awantipora. They were asked to express their opinion of the product. Samples were evaluated for colour (9 = extremely desirable, 1 = extremely undesirable), flavour intensity (9 = extremely strong, 1 = extremely week to unpleasant) and overall palatability (9 = palatable, 1 = unpalatable) using a 9-point hedonic scale. Each attribute was discussed and tests were initiated after panelists were familiarized with the scales. Each sample was coded with a randomly selected 3-digit number and served in white cups. Panelists were instructed to cleanse their palates between samples using cold water.

Statistical analysis

The data obtained was analyzed according to statistical procedure of Analysis of Variance (ANOVA) using SAS 9.1 software for Windows and the treatment means were computed using Least Significant Difference (LSD) at 5% level of probability.

Results and Discussion

Physico-chemical parameters

The physico-chemical parameters of fruit flavoured milk based beverages with varying fruit juice levels (10%, 15% & 20%) during refrigerated storage are presented in Table 2. During refrigerated storage the mean protein content of beverages (T1, T2 & T3) ranged from 3.45-3.69%, 3.50-3.55% and 3.70-3.20% respectively. The T1 showed slight increase, T2 did not show any change and T3 showed slight decrease in protein content, but the difference was not significant (p > 0.05). The fat content of the beverages ranged from 1.53-1.45%, 1.60-1.55% and 1.80-1.79% respectively, and increased from treatment T1 to T3. There was slight non-significant decrease in fat content during refrigerated storage (p > 0.05) and the decrease in fat content could be due to the increase in juice percentage. Similar results were reported by [13] in whey-based banana herbal (Mentha arvensis) beverage during storage.

As indicated in Table 2, acidity of the beverages ranged from 0.117-0.282%, 0.225-0.290% and 0.273-0.295%, respectively and overall mean acidity value was found to be 0.205% and 0.289% during refrigerated storage. Increase in titratable acidity might be due to the growth of micro-organisms in beverages during storage or due to the conversion of lactose into lactic acid by ascorbic acid present in juice. The conversion of proteins into amino acids could also be the reason for increased acidity during storage. The increase in acidity from treatment T1 to T3 could be due to higher percentage of juice content used in the basic formulation (Table 1). The results obtained are conformity with those of earlier studies of [1], who worked on the development and storage studies of whey based RTS beverage from mango cv. kesar. Also similar results were found by [14] in studies on development and storage of whey based pineapple (Ananascomosus) and bottle gourd (Langenarbiasceraria) mixed herbal beverage.

Table 2: Effect of refrigerated storage on physico-chemical composition of fruit flavoured milk based beverages

<table>
<thead>
<tr>
<th>Storage Period</th>
<th>*Treatments</th>
<th>Acidity (%)</th>
<th>pH</th>
<th>Protein (%)</th>
<th>Fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 days</td>
<td>T1</td>
<td>0.117±0.14</td>
<td>6.3±0.11</td>
<td>3.45±0.06</td>
<td>1.53±0.11</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>0.225±0.29</td>
<td>6.4±0.29</td>
<td>3.50±0.08</td>
<td>1.60±0.09</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.273±0.18</td>
<td>6.4±0.07</td>
<td>3.70±0.06</td>
<td>1.80±0.13</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>0.205±0.23</td>
<td>6.36±0.20</td>
<td>3.55±0.10</td>
<td>1.64±0.12</td>
</tr>
<tr>
<td>7 days</td>
<td>T1</td>
<td>0.282±0.23</td>
<td>6.0±0.14</td>
<td>3.69±0.11</td>
<td>1.45±0.07</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>0.290±0.16</td>
<td>6.2±0.18</td>
<td>3.50±0.09</td>
<td>1.55±0.11</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.295±0.12</td>
<td>6.5±0.12</td>
<td>3.20±0.06</td>
<td>1.79±0.11</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>0.289±0.21</td>
<td>6.20±0.19</td>
<td>3.46±0.10</td>
<td>1.60±0.09</td>
</tr>
<tr>
<td>LSD(P≤0.05)</td>
<td>0.002</td>
<td>0.11</td>
<td>N.S</td>
<td>N.S</td>
<td></td>
</tr>
</tbody>
</table>

*Treatments: T1: containing apple juice (10%); T2: containing apple juice (15%); T3: containing apple juice (20%).
The pH values of the beverages ranged from 6.3-6.0, 6.4-6.2 and 6.4-6.5, respectively and overall mean pH value was found to be 6.36 and 6.20 during refrigerated storage. During refrigerated storage there was significant decrease in pH value of the beverages ranged from 6.3 - 6.0, 6.4 - 6.2 and 6.5 - 6.4 respectively and overall mean pH value was found to be 6.36 and 6.20 during refrigerated storage. During refrigerated storage there was significant decrease in pH value and the decrease in pH might be due to slight growth of micro-organisms and their metabolites. Decrease in the pH may also be due to production of organic acids and amino acids due to the action of ascorbic acid on sugar and protein content of the beverages. Similar results were reported by [15], in shelf life study of an orange juice and milk based beverage after PEF and thermal processing and [14], in studies on development and storage of whey based pine apple (Ananascomosus) and bottle gourd (Lagenariasiceraria) mixed beverages. Also similar results were found by [16], in milk drink prepared by UHT technique.

**Total soluble solids**

The mean TSS of 10%, 15% and 20% fruit flavoured milk based beverages ranged from 14.8 – 15 Brix, 14.0-14.2 Brix and 14.0-14.5 Brix, respectively (Figure 1). During storage increase in TSS (%Brix) content was found and might be due to the solubilization of insoluble proteins due to presence of acids (ascorbic acid). Similar results were reported by [14], who studied on development and storage of whey based pineapple (Ananascomosus) and bottle gourd (Lagenariasiceraria) mixed beverages. Also similar results were found by [16], in milk drink prepared by UHT technique.

**Ascorbic acid**

The ascorbic acid content of the fruit flavoured milk based beverages ranged from 1.503-1.550 mg/100ml, 3.172-3.166 mg/100ml and 3.760-3.360mg/100ml and overall mean ascorbic acid content during refrigerated storage period was 2.811mg/100ml and 2.692mg/100ml (Figure 2). Decreasing trend was found in ascorbic acid content and could be due to the auto-oxidation and light during refrigerated storage,[1], also reported decline in ascorbic acid content in whey based RTS beverage from mango cv. kesar during storage, also similar results were found by [14], in studies on development and storage of whey-based pineapple (Ananascomosus) and bottle gourd (Lagenariasiceraria) mixed herbal beverage.

**Reducing sugars and total sugars**

The results of the reducing sugar content of the beverages are shown in Figure 3. The reducing sugar content of the beverages ranged from 4.49-4.55%, 4.40-4.42% and 4.34-4.39%, respectively. Increasing trend in reducing sugar content was observed during refrigerated storage. Increase in reducing sugar content might be due to the conversion of sugar into reducing sugars in presence of citric acid. The results are in agreement with those of [1], who worked on the development and storage studies of whey based RTS beverage from mango cv. Kesar.

The total sugar content of the beverages is presented in Figure 4. The data revealed that total sugar content of fruit flavoured milk based beverages ranged from 10.83-10.80%, 10.77-10.75% and 10.75-10.73%, respectively. During storage the total sugar content decreased and it might be due to the conversion and breakdown of high molecular weight polysaccharides. Similar results were obtained by [1], who worked on the development and storage studies of whey based RTS beverage from mango cv. kesar.
Specific gravity and viscosity

The results of the viscosity and specific gravity are presented in Table 3. The mean viscosity values of fruit flavoured milk based beverages ranged from 1.138-1.140 Pa s, 1.260-1.280 Pa s and 1.020-1.024 Pa s, respectively and overall mean viscosity values were 1.130 and 1.183 Pa s. During storage the change in viscosity was not significant (p > 0.05). The mean specific gravity values of beverages ranged from 0.00760-0.00790, 0.00278-0.00289 and 0.00126-0.00127, respectively. Overall mean specific gravity was 0.00380 and 0.00392. During storage the change in specific gravity was not significant (p > 0.05). The results of the specific gravity and viscosity are in agreement with those of [17], in case of development of beverages using fruit juice pulp, separated milk and reconstituted skim milk.

Sensory analysis

The results obtained in the sensory analysis are presented in Table 4. The apple juice addition at different levels was found to affect the sensory properties of fruit flavoured milk based beverages. The results indicated that mean colour score of the beverages during refrigerated storage ranged from 7.35-7.00, 7.27-7.10 and 7.55-7.30, respectively. Overall mean colour score of the beverages was 7.39 and 7.13. The colour score decreased with increase in storage period. The colour deterioration might be due to the auto-oxidation by light, browning and degradation of ascorbic acid. Mean flavour score of the beverages ranged from 7.45-7.10, 7.35-7.21 and 7.40-7.00, respectively and overall mean flavour score was 7.40 and 7.10. Decrease in flavour was observed in beverages during refrigerated storage. The overall acceptability score of the beverages ranged from 7.12-7.00, 7.30-7.20 and 7.77-7.00, respectively and overall mean acceptability was 7.40 and 7.06. Decreasing trend in overall acceptability was found during refrigerated storage. Decreasing trend in overall acceptability might be due to the decrease in all other sensory parameters (colour, flavour, taste and aroma) during storage. The results of the sensory analysis are in agreement with those of [14] who worked on development and storage of whey based pine apple (Ananascomosus) and bottle gourd (Langenariasiceraria) mixed herbal beverage.

Table 3: Effect of storage on Specific gravity and viscosity of fruit flavoured milk based beverages.

<table>
<thead>
<tr>
<th>Storage Period</th>
<th>Treatments</th>
<th>Specific Gravity</th>
<th>Viscosity (Pa s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 days</td>
<td>T1</td>
<td>1.138±0.04</td>
<td>0.0076±0.03</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>1.26±0.11</td>
<td>0.00278±0.02</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>1.020±0.09</td>
<td>0.00126±0.02</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>1.130±0.10</td>
<td>0.0038±0.05</td>
</tr>
<tr>
<td>7 days</td>
<td>T1</td>
<td>1.140±0.13</td>
<td>0.0079±0.07</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>1.28±0.11</td>
<td>0.00289±0.09</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>1.024±0.10</td>
<td>0.00127±0.10</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>1.183±0.14</td>
<td>0.00392±0.07</td>
</tr>
</tbody>
</table>

LSD(P≤0) N.S N.S

\(^a\)Treatments: T1: containing apple juice (10%); T2: containing apple juice (15%); T3: containing apple juice (20%).
Table 4: Effect of refrigerated storage on Sensory attributes of beverages.

<table>
<thead>
<tr>
<th>Storage Period</th>
<th>Treatments</th>
<th>Colour</th>
<th>Flavour</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 days</td>
<td>T1:</td>
<td>7.35±0.54</td>
<td>7.45±0.98</td>
<td>7.12±0.46</td>
</tr>
<tr>
<td></td>
<td>T2:</td>
<td>7.27±0.44</td>
<td>7.35±0.54</td>
<td>7.30±0.67</td>
</tr>
<tr>
<td></td>
<td>T3:</td>
<td>7.55±0.29</td>
<td>7.42±0.59</td>
<td>7.77±0.35</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>7.39±0.39</td>
<td>7.40±0.58</td>
<td>7.40±0.64</td>
</tr>
<tr>
<td>7 days</td>
<td>T1:</td>
<td>7.00±0.21</td>
<td>7.10±0.65</td>
<td>7.00±0.27</td>
</tr>
<tr>
<td></td>
<td>T2:</td>
<td>7.10±0.43</td>
<td>7.21±0.92</td>
<td>7.20±0.38</td>
</tr>
<tr>
<td></td>
<td>T3:</td>
<td>7.30±0.33</td>
<td>7.00±0.28</td>
<td>7.00±0.49</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>7.13±0.47</td>
<td>7.10±0.31</td>
<td>7.06±0.4</td>
</tr>
<tr>
<td>LSD(P ≤ 0.05)</td>
<td></td>
<td>0.09</td>
<td>0.07</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*Treatments: T1: containing apple juice (10%); T2: containing apple juice (15%); T3: containing apple juice (20%).

Microbial analysis

The results obtained with respect to total plate count of the beverages are shown in Table 5. Total plate count of the beverages during refrigerated storage ranged from $1.91 \times 10^4$ to $2.30 \times 10^4$, $2.00 \times 10^4$ to $2.15 \times 10^4$ and $2.09 \times 10^4$ to $2.35 \times 10^4$, respectively and overall means values were $2.00 \times 10^4$ and $2.26 \times 10^4$. The microbial count of the beverages incorporated with 10%, 15% & 20% apple juice did not differ significantly from 0 to 7 days during refrigerated storage (p > 0.05). The microbial level detected ($10^6$ cfu/ml) is within the normal range observed in this type of product during 0 day to 7 days refrigerated storage. The results obtained are in agreement with those of [1], who worked on the development and storage studies of whey based RTS beverage from mango cv. Kesar, also similar results were found by [15], in shelf life study of an orange juice and milk based beverage after PEF and thermal processing.

Table 5: Effect of refrigerated storage on total plate count of beverages.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Storage Period</th>
<th>Samples</th>
<th>Mean</th>
<th>LSD (P ≤ 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Plate Count (Cfu/ml)</td>
<td>0 days</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td></td>
<td>7 days</td>
<td>2.30×10^4</td>
<td>2.15×10^4</td>
<td>2.35×10^4</td>
</tr>
</tbody>
</table>

*Treatments: T1: containing apple juice (10%); T2: containing apple juice (15%); T3: containing apple juice (20%).

Conclusion

The results of this investigation revealed that apple juice can be used as flavouring agent for the production of flavoured milk based beverages. Fruit flavoured milk based beverages were analyzed for acidity, pH, ascorbic acid, TSS, protein, fat, specific gravity, viscosity, reducing sugars and total sugars. During refrigerated storage the beverages exhibited increasing trend in acidity, TSS and reducing sugar contents while as, decreasing trend was observed in pH, ascorbic acid content and total sugars. The parameters like fat, protein, viscosity and specific gravity did not show any significant change during refrigerated storage. The microbial analysis showed non-significant change in total plate count during refrigerated storage. The studies revealed that fruit flavored milk based beverage prepared with 80% milk and 20% apple juice scored maximum for sensorial quality attributes such as colour, flavor and overall acceptability. Thus apple juice at 20% concentration can be used as a substitute for synthetic flavours in milk beverages without any detrimental effects to the quality of the product as perceived by the consumer.

Conflict of interest

The authors declare that there is no conflict of interest related with this publication.
References


