Development of herbal nectar prepared from a blend of bottle gourd, mint and lime

Smita Majumder, Prafull Kumar, Blessy Sagar Seelam and Shanta Peter

Abstract
Nectar is a type of fruit beverage which contains at least 20% fruit juice or pulp and 15% total soluble solids and is preserved by heat processing. The acidity in fruit nectars shall not exceed 1.5% as citric acid. No class II preservative like SO₂ or benzoic acid is permitted in fruit nectar as per Indian Food Laws. It is not diluted before serving. Fruit and vegetable nectars are beverages produced from purees, juices, or concentrates of either, blended with water and sugar, honey, syrups, or sweeteners. In this study blended nectar prepared by different ratios by using Bottle gourd juice, Mint leaf extract and Lime juice. Among them blend of (Bottle gourd juice (60): Mint leaf extract (15): Lime juice (5): Sugar Syrup Solution (20)) noted as (T3) contain more antioxidant activity (53.58%) which was assay by DPPH method and it also rich in vitamin-C (14.30%) & protein (1.40%) as compared with control (T0) (Bottle gourd juice (75): Mint leaf extract (0): Lime juice (5): Sugar Syrup Solution (20)). As per the sensory evaluation T1 (Bottle gourd juice (70): Mint leaf extract (5): Lime juice (5): Sugar Syrup Solution (20)) has choosen as the best product in their sensory attributes like colour & appearance, consistency, flavour & taste, overall acceptability. The microbial load is less on T3 (Bottle gourd juice (60): Mint leaf extract (15): Lime juice (5): Sugar Syrup Solution (20)). This nutritive vegetable juice was utilized after blending with lime juice and mint leaf extract to adjust the acidity and increase the palatability. Thus, such kind of blended herbal nectar has potential application in enhancing health benefits and therapeutic applications.

Keywords: Bottle gourd, mint, lime, sugar, juice, nectar.

Introduction
Fruits & vegetable species represented an enormous wealth of agricultural biodiversity with potential to contribute to improved incomes, food security and nutrition as well as to combat micronutrient (vitamin & mineral) deficiencies. Fruits and vegetables have conferred on them the status of functional foods (Hasler, 1998) [7]. They seem to be capable of delivering health benefits besides fulfilling physiological needs. Routine or habitual consumption of fruits and vegetables confers significant benefits to human health (Steinmetz and Potter, 1996) [13]. Plant food, especially vegetables and fruits, have been given great attention due to their health benefits now a days. In the past decade, numbers of studies have found that they are the great source of natural antioxidant (Tezcan et al., 2009) [14]. The bottle gourd (Lagenaria siceraria) is greenish in color, bottle shaped or round shaped vegetable. Bottle gourd (Lagenaria siceraria) is 96.1% water, so is light on the stomach and aids digestion. It is beneficial for health in many ways. The pulp of the fruit is considered cool, diuretic, antibilious, and useful in coughs and as antidote to certain poisons (Duke, 1992; Ghule et al., 2006; Ghule et al., 2007) [4, 5, 6]. Decoction of leaves mixed with sugar is considered beneficial in jaundice and fruit is also used in cholera (Rahman et al., 2008) [12]. Botanically, the herb belongs to the Lamiaceae family, in the genus; Mentha, and botanically named as Mentha piperita. Mint is packed with antioxidants and phytonutrients that can work wonders for our stomach. The menthol present in pudina helps the enzymes necessary for digestion. Mint leaves are packed with anti-bacterial and anti-inflammatory properties. Lime is very well-known as a cure for scurvy, the disease which is caused from a deficiency of vitamin-C. Scientifically lime is known as Citrus aurantifolia. Lime juice and its natural oils are very beneficial for skin when consumed orally or applied externally. It rejuvenates the skin, keeps it shining, protects it from infections and reduces body odor due to the presence of a large amount of vitamin-C and Flavonoids. Those are both class-1 antioxidants, and have antibiotic and disinfectant properties.

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References
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Materials and Method
Preparation of blended nectar
Bottle Gourd, Mint, Lime and sugar were procured from the local market of Allahabad. Bottle Gourd was washed, de-skinned, cut into pieces and extracted the juice by juicer and filtered through two layers of muslin cloth. Mint leaves were separated from stalk, cleaned, cut into small pieces, kept the leaves in the muslin cloth, blanched in boiling water for 2 mins and the juice was extracted by mechanical juicer and filtered. Lime juice was extracted by the mechanical juice extractor. These juice blends were optimized by keeping the quantity of lime juice constant and varying the quantity of bottle gourd juice and mint leaf extract. 50% sugar syrup solution used for the blended nectar.

Flow chart for the preparation of blended nectar

Bottle gourd, Mint, Lime
↓ Sorting and washing
↓ Juice Extraction
Preparation of Sugar Syrup Solution (50%) (sugar + water)
↓ Blending of juices (Bottle gourd, Mint & Lime) & Sugar syrup solution
↓
↓ Hot filling
↓ Corking
↓ Pasteurization (at 77 ± 2 ºC for 30 min)
↓ Cooling
↓ Storage

Treatment Combination
T0 - Blended Nectar (control) prepared from 75% Bottle gourd juice + 5% lime juice + 20% sugar syrup solution.
T1 - Blended Nectar prepared from 70% Bottle gourd juice + 5% Mint leaf extract + 5% Lime juice + 20% sugar syrup solution.
T2 - Blended Nectar prepared from 65% Bottle gourd juice + 10% Mint leaf extract + 5% Lime juice + 20% sugar syrup solution.
T3 - Blended Nectar prepared from 60% Bottle gourd juice + 15% Mint leaf extract + 5% Lime juice + 20% sugar syrup solution.

Sensory analysis
The Blended Nectar samples of different treatments prepared under this study were evaluated sensorily by the panel of 5 experienced staff members adopting 9-point hedonic scale as described by Nelson and Trout (1981) [10].

Physico-chemical analysis
The blended nectar samples of different treatments were analyzed for their different analytical methods. Total soluble solids were determined with refractometer (0-32 °Brix) at temperature 28°C and the values were expressed as °Brix. Titratable acidity was calculated in terms of citric acid percentage was recorded in the juice samples and blended nectar samples by titrating against 0.1N NaOH according to AOAC (2000) [2] method. The total sugar content, reducing sugar and ash content was determined by the method as described by Ranganna (1986) [11]. Protein content was determined by Kjeldahl method for nitrogen estimation, using factor of 6.38 for conversion of nitrogen into protein AOAC (2000) [3]. Ascorbic acid (Vitamin-C) was determined by the method as described by AOAC (2000) [3], pH with Digital pH meter and antioxidant activity estimation by method of Dorman et al; (2004) [3] DPPH (2, 2-diphenyl-l-picrylhydrazyl) was used as a source of free radical.

Microbial analysis
The blended nectar samples of different samples were analyzed for different microbial parameters such as standard plate count, yeast and mould count and coliform count. Standard Plate Count (SPC) was determined by adopting standard procedure using Standard Plate Count Agar (SPCA) media as mentioned by Amin (1997) [1]. The yeast and mould count of blended nectar sample were taken as per described in IS: 5403 (1969) [8] using Potato Dextrose Agar (PDA). The coliform count of blended nectar samples was determined as per procedure described in IS: 5550 (1970) [9] using Mc Conkey’s Agar.

Statistical analysis
Data obtained from the organoleptic, physico-chemical and microbial analysis were statistically analyzed by using analysis of variance-two way classification, critical difference. The significant effect of treatment was judged with the help of F’ (Variance Ratio). F-cal values were compared with the table value of F at 5% level of significance. If calculated value exceeds the table value, the affect is considered to be significant. The significance was tested at 5% level.
Cost estimation of manufacturing Blended Nectar
The cost estimation (Rs./Liter) of the product was worked out by taking into account the prevailing market rates of the ingredients used for preparation of Blended Nectar.

Results and Discussion

Sensory Evaluation of Blended Nectar
The score of colour & appearance, consistency, flavour & taste as well as the overall acceptability of different types of Blended Nectar were compiled in Table 1. It was observed that the colour and appearance score of T0, T1, T2 and T3 sample of blended nectar was 6.58, 8.30, 7.68 and 7.02 percent respectively. The consistency score of T0, T1, T2 and T3 was 6.61, 8.02, 7.68 and 7.48 percent respectively. The flavour and taste score of T0, T1, T2 and T3 was 6.68, 8.36, 7.62 and 7.30 percent respectively. The overall acceptability score of T0, T1, T2 and T3 blended nectar was 6.65, 8.34, 7.74 and 7.21 percent respectively.

Table 1: Summary of the results of sensory evaluation of different blended nectar samples (Mean)*.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Types of Blended Nectar</th>
<th>S.Ed ±</th>
<th>C.D. at 5%</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>Colour &amp; Appearance</td>
<td>6.58</td>
<td>8.30</td>
<td>7.68</td>
<td>7.02</td>
</tr>
<tr>
<td>Consistency</td>
<td>6.61</td>
<td>8.02</td>
<td>7.68</td>
<td>7.48</td>
</tr>
<tr>
<td>Flavour &amp; Taste</td>
<td>6.68</td>
<td>8.36</td>
<td>7.62</td>
<td>7.30</td>
</tr>
<tr>
<td>Overall Acceptability</td>
<td>6.65</td>
<td>8.34</td>
<td>7.74</td>
<td>7.21</td>
</tr>
</tbody>
</table>

*Average of five trials.

Physico-Chemical Properties of Blended Nectar
The total soluble solids (%), vitamin-C (%), pH, acidity (%), antioxidant activity, protein (%), total sugar (%), reducing sugar (%) and ash (%) of different types of blended nectar were compiled in Table 2. Total soluble solids (%) of T0, T1, T2 and T3 blended nectar was 15.80, 15.60, 15.41 and 15.20 respectively. Vitamin-C (% ascorbic acid) of T0, T1, T2 and T3 was 10.15, 12.62, 14.08 and 14.30 respectively. pH of T0, T1, T2 and T3 was 4.51, 4.55, 4.61 and 4.67 respectively. Acidity (%) of T0, T1, T2 and T3 was 0.56, 0.54, 0.52 and 0.49 respectively. Antioxidant activity of T0, T1, T2 and T3 was 49.77, 51.03, 52.30 and 53.58 respectively. Protein (%) of T0, T1, T2 and T3 was 0.59, 0.83, 1.14 and 1.40 respectively. Total sugar (%) of T0, T1, T2 and T3 was 12.63, 12.11, 11.97 and 10.58 respectively. Reducing sugar (%) of T0, T1, T2 and T3 was 2.39, 2.10, 1.70 and 1.20 respectively. Ash (%) of T0, T1, T2 and T3 was 0.84, 0.79, 0.75 and 0.69 respectively. It was observed that the vitamin-C, pH, antioxidant activity and protein of blended nectar were significantly increased but a significantly decreasing trend was observed in the total soluble solids, acidity, total sugar and ash content of blended nectar with increasing level of the mint combination.

Table 2: Summary of the results of physico-chemical evaluation of different blended nectar samples (Mean)*.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Types of Blended Nectar</th>
<th>S. Ed ±</th>
<th>C.D. at 5%</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total soluble solids (%)</td>
<td>T0</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td></td>
<td>15.80</td>
<td>15.60</td>
<td>15.41</td>
<td>15.20</td>
</tr>
<tr>
<td>Vitamin-C (% ascorbic acid)</td>
<td>10.15</td>
<td>12.62</td>
<td>14.08</td>
<td>14.30</td>
</tr>
<tr>
<td>pH</td>
<td>4.51</td>
<td>4.55</td>
<td>4.61</td>
<td>4.67</td>
</tr>
<tr>
<td>Acidity (%)</td>
<td>0.56</td>
<td>0.54</td>
<td>0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>Antioxidant activity (%)</td>
<td>49.77</td>
<td>51.03</td>
<td>52.30</td>
<td>53.58</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>0.59</td>
<td>0.83</td>
<td>1.14</td>
<td>1.40</td>
</tr>
<tr>
<td>Total sugar (%)</td>
<td>12.63</td>
<td>12.11</td>
<td>11.97</td>
<td>10.58</td>
</tr>
<tr>
<td>Reducing sugar (%)</td>
<td>2.39</td>
<td>2.10</td>
<td>1.70</td>
<td>1.20</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>0.84</td>
<td>0.79</td>
<td>0.75</td>
<td>0.69</td>
</tr>
</tbody>
</table>

*Average of five trials.

Microbial evaluation of Blended Nectar
The standard plate count (×10³ cfu/ml), yeast and mould (cfu/ml) and coliform of different types of blended nectar were compiled in Table 3. SPC of T0, T1, T2 and T3 blended nectar was 20.60, 17.00, 16.80 and 16.40 respectively. Yeast and mould of T0, T1, T2 and T3 was 4.20, 3.60, 3.40 and 3.20 respectively. Coliform were not detected in any of the blended nectar samples, which is an indicative that the blended nectar samples were free from coliform and hence, safe for consumption.

Table 3: Summary of the results of microbial evaluation of different blended nectar samples (Mean)*.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Types of Blended Nectar</th>
<th>S. Ed ±</th>
<th>C.D. at 5%</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPC (×10³ cfu/ml)</td>
<td>T0</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td></td>
<td>20.60</td>
<td>17.00</td>
<td>16.80</td>
<td>16.40</td>
</tr>
<tr>
<td>Yeast &amp; Mould (cfu/ml)</td>
<td>4.20</td>
<td>3.60</td>
<td>3.40</td>
<td>3.20</td>
</tr>
<tr>
<td>Coliform (cfu/ml)</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

*Average of five trials.
Cost structure of Blended Nectar

All the ingredients required for preparation of Blended Nectar were rated as per prevailing market prices (2015-2016). The cost of one liter Blended Nectar of treatments T₀, T₁, T₂, T₃ was Rs. 49.50, 57.00, 64.50 and 72.00 respectively.

Conclusion

In consideration of the experimental results obtained during the present analysis, it may be concluded that the Blended Nectar can be successfully prepared by using Bottle gourd juice, Mint leaf extract, Lime Juice and Sugar. Blended Nectar along with Bottle gourd juice, Mint leaf extract, Lime Juice and Sugar of treatment T₁ (Bottle gourd juice (70): Mint leaf extract (5): Lime juice (5): Sugar Syrup Solution(20)) is best in organoleptic characteristics among all treatments and received highest score in organoleptic evaluation (colour & appearance, consistency, flavour & taste, overall acceptability). In T₂ (Bottle gourd juice (65): Mint leaf extract (10): Lime juice (5): Sugar Syrup Solution(20)) has moderate amount of antioxidant activity (52.30%), vitamin-C (14.08%) & protein (1.14%). The order of the cost is as follows T₃>T₂ >T₁>T₀. The cost affordable estimation for the sample is as follows T₀ (49.50 Rupees/lit), T₁ (57.00 Rupees/lit), T₂ (64.50 Rupees/lit), T₃ (72.00 Rupees/lit).

References