Effect of different levels of water on qualitative characteristics of Lassi prepared from reconstituted milk

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Abstract

Present research work was designed to develop lassi from reconstituted milk using different levels of water. For this purpose, dahi was prepared from reconstituted milk using traditional starter culture. Four different types of lassi were prepared by mixing dahi with 15, 20, 25 and 30% water and sugar level in all samples were 20%. The quality of lassi from reconstituted milk was evaluated by a panel of expert judges by different physical tests using a score card. There was non-significant difference (p>0.05) among the overall physical score of lassi samples. Result revealed that the highest overall score was recorded in 20% added water lassi sample whereas the lowest score was found in 30% added water lassi sample. In chemical analysis, significant differences (p<0.01) existed among the total solids, carbohydrate, fat, protein, moisture content and pH value but non-significant differences (p>0.05) were seen for ash content and acidity percentage. The total bacteria, coliform, yeast and mold in all samples did not exceed the legal standard. From the findings of this study, it might be concluded that lassi could be prepared successfully from reconstituted and mixing reconstituted milk dahi with 20% water along with 20% sugar will produce better quality lassi.

Key words: dahi, physical, chemical, microbiological qualities, lassi

Introduction

Milk is highly nutritious food containing all nutrients required for normal functioning of the body system. It can be converted into various milk products that are classified into fermented and non-fermented one. The fermented milk products are dahi, yoghurt, lassi, (Ripmed) butter milk and cheese etc. Lassi is a refreshing fermented summer drink originated from the subcontinent of India which gained its popularity worldwide. It is made of sour curd which made by lactic culture and a mixture of different ingredients like desiccated coconut, fruits, spices and sugar etc. It is popular for its health benefits such as ward off the heat in summer, prevents dehydration and also helps indigestion. In a laboratory, lassi drink made using one bowl of yogurt, 1 cup of water, few mints leaves, half tsp of black salt and 1 tsp grinded cumin seeds. Lassi can be made either sweet or savory and sweet lassi is thicker and creamy. Now a day’s people prefer fermented milk beverage because their food habit is changing rapidly in the same time to get various health benefits.

Kumar et al. (1987) developed a lassi-type cultured beverage from cheese whey. Kaic and Antomic (1996) mentioned that cultured dairy products have beneficial therapeutic effects such as in reducing lactose intolerance syndrome, preventing gastro-intestinal infections, cardiovascular disease and improving immune defenses. Fermented drinks are good source of probiotic bacteria which plays vital roles in preventing irritable bowel syndrome and colon cancer. There is also an indication that probiotics may play a role in inhibiting Helicobacter pylorie infections which causes ulcers (Santosa et al., 2006).

The demands of fermented dairy products are increasing day by day in Bangladesh. Although fermented dairy products are very much nutritious for maintaining our normal health but due to deficit of raw milk in our country we cannot prepare enough fermented dairy products. So, we have to give emphasize on alternative sources of liquid milk for the production of fermented dairy products. Hence, milk powder might be an alternative source in this respect and
which can be converted into reconstituted milk for the manufacturing of lassi. Reconstituted milk can easily be prepared by dissolving powdered milk in water. Some research works have been done in the Department of Dairy Science of Bangladesh Agricultural University on lassi preparation by using different concentrations of fat and sugar level from whole milk (Sayed, 2008; Shimu, 2015). No attempts have yet been made to prepare lassi using reconstituted milk. As we have very limited scientific knowledge on different aspects of lassi preparation hence, the present experiment was conducted to monitor the feasibility of using reconstituted milk for preparation of lassi and to get idea about the appropriate level of water to be used for mixing with dahi for the preparation of lassi.

**Materials and Methods**

**Site and period of experiment**

The experiment was conducted at the Dairy Science Laboratory under the Department of Dairy Science, Bangladesh Agricultural University, Mymensingh during the period of September 29 to December 23, 2015. Whole milk powder was collected from Mymensingh town in Bangladesh.

**Reconstituting of milk**

About 875 gm of slightly boiled water was taken in a beaker and 125 gm of whole milk powder (containing 26% milk fat and 71% milk SNF) was dissolved slowly in water to produce one kg of reconstituted milk. Thus, reconstituted milk was prepared in the laboratory.

**Chemical analysis of reconstituted milk**

Before manufacturing of lassi, reconstituted milk was prepared and analyzed three times in the laboratory. Specific gravity, total solids, fat, protein, lactose and ash content were determined to know the quality of reconstituted milk samples. Among them, specific gravity was determined using Quevenne’s Lactometer and others were determined by using milk analyzer (Lactoscan SLP, MILKOTONIC Ltd., Bulgaria 6000. Stara zagora). The chemical compositions of reconstituted milk are shown in Table 1.

**Preparation of lassi**

Reconstituted milk was heated to boiling and there after milk was cold at 40 to 5°C. At that time, lactic starter culture was added and kept in undisturbed at 37°C until coagulation. The coagulated mass (dahi) was used for lassi preparation. Four different types of lassi were prepared by mixing dahi with different levels of water. The prepared lassi were designated as A for lassi prepared by using 15% water, B for lassi prepared by using 20% water, C for lassi prepared by using 25% water and D for lassi prepared by using 30% water. Sugar level for all lassi samples were similar (20%). After preparation samples were kept at 5°C up to before serving.

**Table 1. Chemical composition of reconstituted milk (g/kg)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Amount (g/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td>1.028</td>
</tr>
<tr>
<td>Correct lactometer reading</td>
<td>28.0</td>
</tr>
<tr>
<td>Total solids</td>
<td>122.8</td>
</tr>
<tr>
<td>Fat</td>
<td>42.0</td>
</tr>
<tr>
<td>Protein</td>
<td>33.0</td>
</tr>
<tr>
<td>Lactose</td>
<td>42.6</td>
</tr>
<tr>
<td>Solids not fat (SNF)</td>
<td>81.1</td>
</tr>
<tr>
<td>Ash</td>
<td>7.1</td>
</tr>
<tr>
<td>pH</td>
<td>6.7</td>
</tr>
</tbody>
</table>

**Physical tests**

Samples were analyzed by a panel of experienced judges for evaluating flavor, color, mouth feel, sweetness and overall physical score.

**Chemical tests**

All the samples were chemically analyzed in the laboratory to know the acidity percentage, pH value, moisture (g/kg), total solids (g/kg), fat (g/kg), protein (g/kg), carbohydrate (g/kg) and ash content (g/kg). The total solids and ash content of the samples were determined by oven drying method according to AOAC (2003). Fat test was performed by Babcock method using the procedure described by Aggarwala and Sharma (1961), protein was determined by Kjeldahal method and pH value was measured with the help of pH meter-215 (Ciba Corning Diagnostic Ltd. Sudhury, Suffolk, England Co. 106). Acidity percentage was determined by titrating with 0.1N sodium hydroxide solution using the procedure of Aggarwala and Sharma (1961).
Microbiological tests
Total viable count (cfu/ml), coliform count (cfu/ml), yeast and mold count were performed in microbiological assay.

Statistical analysis
Data obtained from different parameters were analyzed statistically to find out the statistical difference within the treatment means. Analysis of variance test (ANOVA) was carried out by using completely randomized design (CRD). Least significant difference (LSD) values were also determined to rank the samples.

Results and Discussion
A. Physical parameters

Flavor
The flavor score of A, B, C and D type samples were 4.67 ± 0.58, 5.00 ± 0.00, 4.00 ± 0.00 and 4.00 ± 0.00, respectively (Table 2). Result revealed that there was significant difference (p<0.01) among the flavor score of all samples. The highest flavor score was recorded in lassi with 20% water sample whereas the lowest score was found in lassi with 25% water and 30% water samples. Schlicht (1995) and Ahmed (2004) found that addition of fruit improve the flavor of lassi. In this study, no fruits were added but flavor score of lassi with 20% water was also higher than the other samples which indicate that water level in lassi can influence flavor score.

Color
The color score of A, B, C and D type samples were 4.00 ± 0.00, 4.67 ± 0.58, 3.00 ± 0.00 and 3.00 ± 0.00, respectively (Table 2). The result showed that significant difference (p<0.01) existed among the color score of all samples. The highest color score was recorded in case of lassi with 20% water sample and lowest score was found in lassi with 25% water and 30% water samples. This result supported by Begal et al. (2007) and reported that the normal color of lassi varies from yellow to whitish color and which gives good color score.

Table 2. Comparison of physical parameters scores (mean ± SD) of lassi containing different levels of water

<table>
<thead>
<tr>
<th>Physical Parameters</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>LSD value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavor (5)</td>
<td>4.67±0.58</td>
<td>5.00±0.00</td>
<td>4.00±0.00</td>
<td>4.00±0.00</td>
<td>0.313</td>
<td>**</td>
</tr>
<tr>
<td>Color (5)</td>
<td>4.00±0.00</td>
<td>4.67±0.58</td>
<td>3.00±0.00</td>
<td>3.00±0.00</td>
<td>0.313</td>
<td>**</td>
</tr>
<tr>
<td>Sweetness (5)</td>
<td>4.00±0.00</td>
<td>5.00±0.00</td>
<td>4.00±0.00</td>
<td>4.00±0.00</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>Mouthfeel (5)</td>
<td>3.67±0.58</td>
<td>4.67±0.58</td>
<td>4.33±0.58</td>
<td>4.00±0.00</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>Overall physical score (5)</td>
<td>4.00±1.00</td>
<td>5.00±0.00</td>
<td>4.33±0.58</td>
<td>4.00±0.00</td>
<td>-</td>
<td>NS</td>
</tr>
</tbody>
</table>

The highest sweetness score was recorded in lassi with 10% water and 15% sugar levels but in this study, 20% sugar and 20% water combined with reconstituted milk lassi was better than other combinations.

Mouth feel
Mouth feel score of lassi samples A, B, C and D were 3.67 ± 0.58, 4.67 ± 0.58, 4.33 ± 0.58 and 4.00 ± 0.00, respectively (Table 2). Statistical analysis showed that there was non-significant difference within mouth feel score of all samples. The highest mouth feel score was recorded in lassi with 20% water sample and the lowest score was seen in case of lassi with 15% water sample. Desai et al. (1994) found that mouth feel of yoghurt drink improved due to the addition of fruit juice. In this study, it was found that addition of 20% water with dahi during lassi preparation improved the mouthfeel score.

Sweetness
Average sweetness score for A, B, C and D type lassi samples were 4.00± 0.00, 5.00 ± 0.00, 4.00 ± 0.00 and 4.00 ± 0.00, respectively (Table 2). From the study of sweetness score of all samples, it was found that there was no significant difference (p>0.05) among the all samples. The highest sweetness score was recorded in lassi with 20% water sample whereas the lowest score was found in lassi with 25% water and 30% water samples. Begal et al. (2007) reported that sweetness score of lassi was satisfactory through preparing with 10% water and 15% sugar levels but in this study, 20% sugar and 20% water combined with reconstituted milk lassi was better than other combinations.
Overall physical score

Overall physical score of A, B, C and D type lassi were 4.00 ± 1.00, 5.00 ± 0.00, 4.33 ± 0.58 and 4.00 ± 0.00, respectively (Table 2). Results indicated that non-significant difference (p>0.05) existed among the overall score of all samples. The highest overall score was recorded in lassi with 20% water sample whereas the lowest score was found in lassi with 30% water sample. This result indicated that lassi prepared by using dahi from reconstituted milk with a combination of 20% water and 20% sugar of the weight of the dahi would produce better quality lassi.

B. Chemical parameters

**Moisture content (g/Kg)**

The average moisture content of samples A, B, C and D type lassi were 805.03 ± 0.55, 836.17 ± 0.51, 838.50 ± 0.26 and 845.53 ± 0.21 g/Kg, respectively (Table 3). Result implied that significant difference (p<0.01) among the moisture content of all samples. The highest moisture value was found in case of lassi with 30% water sample whereas the lowest value was found in lassi with 15% water sample. This finding was supported by Sayed (2008) who reported that moisture content of lassi depends on total solids content.

**Total solids content (g/Kg)**

The total solids content of samples A, B, C and D type of lassi were 194.97 ± 0.55, 163.83 ± 0.51, 161.50 ± 0.26 and 154.50 ± 0.21 g/Kg, respectively (Table 3). From the study of total solids content of all samples, it was found that there was significant difference (p<0.01) among all the samples. The highest TS recorded in lassi with 15% water sample and the lowest was found in lassi with 30% water sample (Table 2). This result was quite similar with Shimu (2015) who conducted an experiment on lassi preparation and found that total solids of lassi were 109.10 to 149.90 g/kg.

**Fat content (g/Kg)**

The average fat content of A, B, C and D type lassi samples were 35.37 ± 0.15, 34.13 ± 0.12, 33.00 ± 0.00 and 32.13 ± 0.00 g/Kg, respectively (Table 3). Result revealed that significant difference (p<0.01) among the fat content of lassi samples. The highest value was recorded in lassi with 15% water sample followed by lassi with 20% water and lassi with 25% water whereas the lowest value was found in lassi with 30% water sample. This finding was supported by Sayed (2008) who conducted an experiment based on yoghurt drinks with dahi using different fat levels and reported that when water percentage increases then fat content decreases.

**Carbohydrate content (g/Kg)**

The carbohydrate content of A, B, C and D type lassi were 129.30 ± 0.30, 100.20 ± 0.26, 100.57 ± 0.38, 94.30 ± 0.20 g/Kg, respectively (Table 3). Statistical analysis showed that there was significant difference (p<0.01) among the carbohydrate content of all lassi samples. The carbohydrate content was higher in lassi with 15% water sample and the lowest in lassi with 30% water sample. Higher level of carbohydrate in lassi with 15% water sample was due to high TS content of that sample. Akhter (2004) reported that carbohydrate content of fermented dairy products influenced by addition of sugar. In this experiment although sugar level was same for all treatments but variations in carbohydrate content was mainly influenced by different water levels of lassi.

**Protein content (g/Kg)**

Protein content of A, B, C and D type lassi were 24.70 ± 0.10, 23.73 ± 0.15, 22.20 ± 0.10 and 22.33 ± 0.12 g/Kg, respectively (Table 3). There was also significant difference (p<0.01) existed among the protein content of all samples. The highest protein was recorded in lassi with 15% water sample followed lassi with 20% water and lassi with 25% water whereas the lowest value was found in lassi with 30% water sample. This variation in protein content of lassi samples might be due to addition of different levels of water during lassi preparation.
The pH value of A, B, C and D type lassi research findings. 0.47% which was quite similar with the present due to dilution effect of water in variation in acidity level of different samples was among the samples (Table 3). This slight non-water sample than other samples but there was percentage was slightly lower in (Table 3).

Average acidity percentage for A, B, C and D type lassi samples were 5.77 ± 0.06, 5.73 ± 0.32, 5.70 ± 0.12 and 5.60 ± 0.10 g/Kg, respectively (Table 3). Ash content of all the samples differed non-significantly (p>0.05) and average ash content of lassi with 15% water sample was slightly higher than other samples. Ash content of lassi of this experiment was nearly similar to the findings of Sayed (2008) who reported that ash content varied from 6.4-7.0 g/kg.

The total viable count of A, B, C and D type lassi are shown in Table 4. Research findings showed that there was significant difference (p<0.01) among the different lassi samples. The highest total viable count was found in lassi prepared by using 15% water sample and which was 94.67×10⁴ ± 0.58. Ahmed (2004) found 87.00×10⁴ to 89.66×10⁴ cfu/mL total viable bacteria in yoghurt drink samples and which was quite similar with these findings.

The coliform bacterial count of A, B, C and D type lassi are shown in Table 4 and which indicated that coliform bacterial count was very low in all types of lassi samples. Result showed that there was no significant difference (p>0.05) among the different lassi samples. Lower coliform count indicates that the quality of lassi was maintained hygienically and sanitation condition was good. This finding was similar with Ahmed (2004) who found that there were no coliform bacteria in yoghurt drink samples.

### Table 3. Chemical composition (mean ± SD) of lassi containing different levels of water

<table>
<thead>
<tr>
<th>Chemical parameters</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>LSD value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (g/Kg)</td>
<td>805.03±0.55</td>
<td>836.17±0.51</td>
<td>838.50±0.26</td>
<td>835.53±0.21</td>
<td>0.448</td>
<td>**</td>
</tr>
<tr>
<td>Total solids (g/Kg)</td>
<td>194.97±0.55</td>
<td>163.83±0.51</td>
<td>161.50±0.26</td>
<td>154.50±0.21</td>
<td>0.448</td>
<td>**</td>
</tr>
<tr>
<td>Fat (g/Kg)</td>
<td>35.37±0.15</td>
<td>34.13±0.12</td>
<td>33.00±0.00</td>
<td>32.13±0.00</td>
<td>0.133</td>
<td>**</td>
</tr>
<tr>
<td>Protein (g/Kg)</td>
<td>24.70±0.10</td>
<td>23.73±0.15</td>
<td>22.20±0.10</td>
<td>22.33±0.12</td>
<td>0.129</td>
<td>**</td>
</tr>
<tr>
<td>Carbohydrate (g/Kg)</td>
<td>129.30±0.30</td>
<td>100.20±0.26</td>
<td>100.57±0.38</td>
<td>94.30±0.20</td>
<td>0.319</td>
<td>**</td>
</tr>
<tr>
<td>Ash (g/Kg)</td>
<td>5.77±0.06</td>
<td>5.37±0.32</td>
<td>5.70±0.12</td>
<td>5.60±0.10</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>Acidity (%)</td>
<td>0.48±0.01</td>
<td>0.48±0.01</td>
<td>0.47±0.01</td>
<td>0.47±0.01</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>pH</td>
<td>5.63±0.01</td>
<td>5.70±0.01</td>
<td>5.71±0.01</td>
<td>5.67±0.01</td>
<td>0.011</td>
<td>**</td>
</tr>
</tbody>
</table>

a,b Mean values within a row having different superscripts differ significantly. **Significant at p<0.01; NS=non-significant (p>0.05). Here, A, lassi prepared by using 15% water; B, lassi prepared by using 20% water; C, lassi prepared by using 25% water and D, lassi prepared by using 30% water.

### Ash content (g/Kg)

The ash content of A, B, C and D type samples were 5.77 ± 0.06, 5.73 ± 0.32, 5.70 ± 0.12 and 5.60 ± 0.10 g/Kg, respectively (Table 3). Ash content of all the samples differed non-significantly (p>0.05) and average ash content of lassi with 15% water sample was slightly higher than other samples. Ash content of lassi of this experiment was nearly similar to the findings of Sayed (2008) who reported that ash content varied from 6.4-7.0 g/kg.

### Acidity percentage

Average acidity percentage for A, B, C and D type lassi samples were 0.48 ± 0.01, 0.48 ± 0.01, 0.47 ± 0.01 and 0.47 ± 0.01%, respectively (Table 3). Research result showed that acidity percentage was slightly lower in lassi with 30% water sample than other samples but there was non-significant difference (p>0.05) existed among the samples (Table 3). This slight variation in acidity level of different samples was due to dilution effect of water in lassi. Also, Shimu (2015) found the acidity of lassi was 0.45-0.47% which was quite similar with the present research findings.

### pH value

The pH value of A, B, C and D type lassi were 5.63 ± 0.01, 5.70 ± 0.01, 5.71 ± 0.01 and 5.67 ± 0.01, respectively (Table 3). Statistical analysis revealed that there was significant difference (p<0.01) among the pH content of all lassi samples. It also evidenced that pH content was higher in lassi with 25% water sample whereas lower in lassi with 15% water sample. The result of this present investigation agreed with the findings of Sayed (2008) and Shimu (2015).

### C. Microbiological parameters

#### Total viable count (cfu/mL)

The total viable count of A, B, C and D type lassi were shown in Table 4. Research findings showed that there was significant difference (p<0.01) among the different lassi samples. The highest total viable count was found in lassi prepared by using 15% water sample and which was 94.67×10⁴ ± 0.58. Ahmed (2004) found 87.00×10⁴ to 89.66×10⁴ cfu/mL total viable bacteria in yoghurt drink samples and which was quite similar with these findings.

#### Coliform count (cfu/mL)

The coliform bacterial count of A, B, C and D type lassi were shown in Table 4 and which indicated that coliform bacterial count was very low in all types of lassi samples. Result showed that there was no significant difference (p>0.05) among the different lassi samples. Lower coliform count indicates that the quality of lassi was maintained hygienically and sanitation condition was good. This finding was similar with Ahmed (2004) who found that there were no coliform bacteria in yoghurt drink samples.
Table 4. Microbiological qualities (mean ± SD) of lassi containing different levels of water

<table>
<thead>
<tr>
<th>Parameters</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>LSD value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total viable count (×10⁴)</td>
<td>94.67 ± 0.58</td>
<td>90.33 ± 1.53</td>
<td>86.00 ± 5.57</td>
<td>82.33 ± 2.08</td>
<td>3.351</td>
<td>**</td>
</tr>
<tr>
<td>Coliform count (×10)</td>
<td>1.33 ± 0.58</td>
<td>1.33 ± 0.58</td>
<td>0.33 ± 0.58</td>
<td>0.33 ± 0.58</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>Yeast count (×10)</td>
<td>1.00 ± 0.00</td>
<td>0.33 ± 0.58</td>
<td>0.33 ± 0.58</td>
<td>0.33 ± 0.58</td>
<td>-</td>
<td>NS</td>
</tr>
</tbody>
</table>

a,b,c Mean values within a row having different superscripts differ significantly. **Significant at p<0.01; NS=non-significant (p>0.05). Here, A, lassi prepared by using 15% water; B, lassi prepared by using 20% water; C, lassi prepared by using 25% water and D, lassi prepared by using 30% water.

**Yeast count**

Average yeast count of A, B, C and D type lassi are shown in Table 4 and statistical analysis showed that there was no significant difference (p>0.05) among the different lassi samples. The yeast count was very few due to maintaining of good sanitary condition as well as using of good bacterial starter culture and the result agreed with the findings of Ahmed (2004).

**Mold count**

The mold count of A, B, C and D type lassi are shown in Table 4 and statistically there was no significant difference (p>0.05) among the mold content of different lassi samples. The mold count was also very few like viable and coliform count due to maintaining of good sanitary condition and this result was nearly similar with the result of Ahmed (2004).

**Conclusion**

From the findings of this study, it might be concluded that lassi could be prepared successfully from reconstituted milk. Although some parameters values were slightly higher in lassi with 15% water but judges prefer lassi with 20% water. Therefore, in respect of physical, chemical and microbiological qualities 20% water along with 20% sugar was better than others for manufacturing of lassi from reconstituted milk when there is shortage of whole liquid milk.

**References**


Akter N (2004). The effect of different levels of starter culture and sugar on fermentation characteristics of Misti Dahi. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.


