Bangladesh Journal of Animal Science
Journal homepage: http://www.banglajol.info/index.php/BJAS

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

Zohra FT, MN Islam*, MSR Siddiki, MR Habib and S Afrin

Department of Dairy Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

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, micobiological 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, l*assi*, (Ripned) 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)

Parameters	Amount (g/Kg)
Specific gravity	1.028
Correct lactometer reading	28.0
Total solids	122.8
Fat	42.0
Protein	33.0
Lactose	42.6
Solids not fat (SNF)	81.1
Ash	7.1
p^H	6.7

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 l*assi* 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.

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.

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.

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

Physical Parameters	A	B	C	D	LSD value	Level of significance
Flavor (5)	4.67^{b} ± 0.58	5.00^{a} ± 0.00	4.00^{c} ± 0.00	4.00^{c} ± 0.00	0.313	**
Color (5)	4.00^{b} ± 0.00	4.67^{a} ± 0.58	3.00^{c} ± 0.00	3.00^{c} ± 0.00	0.313	**
Sweetness (5)	4.00 ± 0.00	5.00 ± 0.00	4.00 ± 0.00	4.00 ± 0.00	-	NS
Mouthfeel (5)	3.67 ± 0.58	4.67 ± 0.58	4.33 ± 0.58	4.00 ± 0.00	-	NS
Overall physical score (5)	4.00 ± 1.00	5.00 ± 0.00	4.33 ± 0.58	4.00 ± 0.00	-	NS

[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.

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 of *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.

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

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

^{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.

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* 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 94.67×10^{4} ± 0.58. Ahmed (2004) found 87.00×10^{4} to 89.66×10^{4} 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* 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 4. Microbiological qualities (mean ± SD) of *lassi* containing different levels of water

Parameters	A	B	C	D	LSD value	Level of significance
Total viable count (×10⁴)	94.67[a] ± 0.58	90.33[b] ± 1.53	86.00[c] ± 5.57	82.33[d] ± 2.08	3.351	**
Coliform count (×10)	1.33 ± 0.58	1.33 ± 0.58	0.33 ± 0.58	0.33 ± 0.58	-	NS
Yeast count (×10)	1.67 ± 0.58	1.33 ± 1.15	1.00 ± 0.00	1.00 ± 0.0	-	NS
Mold count (×10)	1.00 ± 0.0	0.33 ± 0.58	0.33 ± 0.58	0.33 ± 0.58	-	NS

[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

Aggarwala AC and RM Sharma (1961). A Laboratory Manual of Milk Inspection. 4th edition. Asia Publishing House. Bombay, Kolkata, New Delhi, India.

Ahmed S (2004). Studies on the manufacture of flavored yoghurt drinks from skim milk. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

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, Bangladesh.

AOAC (2003). Official Methods of Analysis. 15th edition. Association of Official Analytical Chemists, Arlington,Virginia, USA.

Begal SG, KD Chavan and MB Kalkarni (2007). Studies on preparation of *lassi* from high acid cow milk. Journal of Dairying, Foods and Home Sciences, 26(2): 80-84.

Desai SR, VA Toro and SV Joshi (1994). Utilization of different fruits in the manufacture of yoghurt. Indian Journal of Dairy Science, 47(10)**:** 870-874.

Kaic RA and D Antonic (1996). Nutritional and Biological value of cultured milk products. Mijekarstovo, 46(4): 285-290.

Kumar R, GR Patil and RB Rajor (1987). Development of *lassi*-type cultured beverage from cheese whey. Asian journal of Dairy Research, 6(3): 121-124.

Santosa S, E Farnworth and PJH Jones (2006). Probiotics and their potential health claims. Nutrition Reviews, 64: 265-274.

Sayed MS (2008). Preparation of yoghurt drinks with different fat level of dahi. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

Schlicht R (1995). New yoghurt drink in a new packaging concept. ZFL Internationale Zeitschrift Fur Lebensmittel Technik, Marketing. Verpackung and Analystik, 46(10): 60-62.

Shimu SN (2015). Comparative study of yoghurt drinks prepared from skim milk and whole milk. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.