

Chemical and bacteriological quality of popular *Dahi* available in some selected areas of Bangladesh

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Abstract

The chemical and bacteriological qualities of popular *Dahi* collected from six areas of Bangladesh were evaluated. The areas were Dhaka (Savar), Rajshahi (Bogra), Khulna, Barishal (Gauronadi), Chittagong (Comilla) and Sylhet. Traditionally made 24 *Dahi* samples, 4 in each area, were collected and analyzed for chemical and bacteriological qualities. Acidity, pH, ash and protein content of *Dahi* were found insignificant difference among the samples of different areas. However, significance differences in chemical parameters (fat and sugar) were observed. The higher total viable bacteria and coliform count were found in Bogra region. An overall analysis of the results of this study revealed that the *Dahi* collected from selected areas were of acceptable quality. However, their sugar and ash content were very high.

Key words: *Dahi*, Chemical, Bacteriological, quality, Evaluation

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Introduction

Dahi, a fermented milk product, is the most popular and delicious milk produce in Bangladesh that is consumed by our people either as a part of diet or as a refreshing beverage. It is highly nutritious and easily digestible diet due to the predigested nutrients by bacterial starters (Durga et al. 1986). It is believed that *Dahi* has valuable therapeutic properties and helps curing gastrointestinal disorders like constipation, diarrhea, dysentery, etc (Athar 1986; Gandhi and Nambudripad 1975).

Dahi is a Indian subcontinent milk product equivalent to yogurt prepared from cow or buffalo milk or from a mixture of both (Venamuthu 1982; Oberman 1985) by using a small portion of previously made *Dahi* known as starter culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in a ratio of 1: 1 (Kosikowski 1982 and Kon, 1959). The microorganisms involved in *Dahi* fermentation include *Streptococcus thermophilus*, *S. lactis*, *S. cremoris*, *Lactobacillus bulgaricus*, *L. acidophilus*, *L. plantarum* and lactose fermenting yeasts (Venamuthu 1982; Steinkraus 1983). When culture is undefined and kept in unhygienic condition it contains mixture of various desirable and undesirable strains of bacteria. Thus the quality of *Dahi* may vary with the type of starter culture used (Masud et al. 1991). Other factors associated with low quality

Dahi production are the use of poor quality milk and unhygienic practices during preparation, handling, storage and transportation. In addition, loose packing further deteriorates keeping quality of *Dahi* (Aziz 1986). Furthermore, the storage, availability and transportation of starter culture for commercial use, especially for home consumption, are difficult. So, using starter culture and all factors associated with quality *Dahi* production must be free from all types of undesirable microorganisms. Considering the above stated fact, the study has undertaken to compare the chemical and bacteriological quality of *Dahi* available in some selected areas.

Materials and Methods

The experiment was carried out in the Nutrition laboratory, Department of Animal Production and Research, Bangladesh Livestock Research Institute, Savar, Dhaka and Dairy Technology Laboratory, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh, for the period of February to May 2009.

Collection of Sample

Dahi samples were collected that were produced by traditional methods using previously made *Dahi* as lactic acid bacterial starter. The samples were collected from the six areas namely Dhaka area (Savar), Rajshahi area (Bogra), Khulna area, Barishal area (Gauronadi), Chittagong area

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(Comilla) and Sylhet area. A total of 24 samples were collected from different producers from those areas. The samples were brought to the laboratory in a thermo flask and were maintained at low temperature by use of an ice box until analysis and were analyzed.



Figure 1. Map of Bangladesh showing study areas

- Bogra, ● Savar, ● Sylhet,
- Khulna, ● Gauronadi, ● Comilla

Chemical analysis

The following parameters were analyzed: pH, acidity, total solids, moisture, ash, fat, protein and sugar and solids-not-fat. The pH was determined by electronic digital type pH meter according to method No. 981.12 of AOAC (1990) and acidity was measured by AOAC method No. 947.05 (1990). Total solids and moisture content were determined by the oven drying method at 105° C for 24 hours and ash content was determined by igniting the dried samples (total solids) at 550° C for 5-6 hours in an electronic muffle furnace according to AOAC procedure. Fat was determined by AOAC (1990) procedures i.e. ether extraction methods and protein was determined by the Kjeldahl method. Sugar content was determined by subtracting the sum of protein %, fat% and ash% from total solids% while the solids-not-fat was determined by subtracting fat from total solids.

Bacteriological analysis

Bacteriological parameters (viable bacteria and Coliform) were determined by the methods as

described in the "Standard Methods for examination of Dairy Products" by APHA (1967). Plate count agar and Violet Red Bile (VRB) agar were used for viable bacteria count and coli form respectively. The samples (1g) were measured by using electric balance and then transferred into buffer solution pH 7.0, and each dilutions, then put into plate and poured agar (10-15ml) and observed for solidification. After solidification, the plates were kept in incubator at 32° C for 48 hours. The colonies were enumerated which plate having within 30-300 colonies and counted the number of total viable bacterial colonies. Serial dilutions were prepared by Violet Red Bile agar media and after then followed the same procedure of plate count agar. In this case plates were incubated at 32° C for 24 hours. After incubation, the colonies having colonies of 0.5mm diameter were enumerated and then the total numbers of bacterial colonies (only the dark red one) were counted as coliform bacteria.

Statistical analysis

All experimental materials were completely homogenous and the statistical analysis was done by using Completely Randomized Design (CRD). The Statistical software packages MSTATC was carried out to determine the significant difference.

Results and Discussion

Chemical analysis

The results of chemical analyses (Acidity, pH, total solids, moisture, ash, fat, protein, sugar and solids-not-fat) of samples from study areas are shown in Table 1.

Acidity: There was no significant difference among the acidity of all samples. The highest acidity was that of 1.11±0.22 % found in the sample of Savar, Dhaka and lowest acidity was that of 0.92±0.08 % found in the sample of Khulna. The highest acidity is similar at the acidity of 1.12±0.21% at 1 day's storage of yoghurt reported by Haj et al. (2007) and slightly lower than that of 1.16±0.32% found by Davis and Mclachlan (1974). The lowest acidity is similar with the results of 0.92±0.0.23 % but highest the results of 0.63±0.0.10 % reported by Rashid and Miyamoto (2005) and more or less similar with the acidity of other areas and all of results are in range of 0.95-0.99% observed by Kim et al. 1998. The sample of Savar area showed highest acidity, it might be uncontrolled

Quality of Dahi

incubation, postproduction handling and prolonging storage cause increased in acidity while other samples were showed lower acidity may be controlled incubation time and temperature or maintained at low temperature after coagulation.

pH: There was no significant difference among the pH value of all samples. It was observed from the results that the highest pH value of 6.23 ± 0.07 found in the sample of Barisal areas and lowest value of 5.447 ± 0.26 found in the sample of Comilla areas. Both values are higher than the pH value range of 5.00 ± 0.07 to 4.38 ± 0.32 reported by Rashid and Miyamoto (2005) and range of 5.06-4.60 observed by Ali et al. (2002) but the values fall in the range of 5.30-5.50 found by Khan et al. (2008). The highest pH value was that of sample of Barisal areas due to improper fermentation whereas sample of Comilla, Bogra, Khulna, Sylhet and Savar were lower pH value (5.447 ± 0.26 , 5.933 ± 0.06 , 5.97 ± 0.17 , 5.80 ± 0.27 , 5.970 ± 0.70 , respectively) and all values are more or less similar due to time interval of storage that occurred further microbial fermentation. So, in traditional *Dahi*, proper fermentation conditions are not fully controlled, hence a large variation of pH value in the end product is obviously. An increase in the amount of protein resulted in a slight increase in pH (Modler et al. 1983).

Total solids: A statistically significant difference ($p < 0.01$) was observed among the total solids content in samples from six areas. The total solids content in the sample of Khulna area was highest ($58.457 \pm 4.73\%$) due to the higher sugar content and sample of Savar was the lowest ($40.843 \pm 7.63\%$) due to the lower sugar content. The result ($41.173 \pm 6.13\%$) of sample of Comilla area was slightly higher and the results ($42.997 \pm 1.41\%$) of sample of Barisal area were higher than lowest value ($40.843 \pm 7.63\%$) of sample of Savar area. The result of other two areas namely Bogra and Sylhet were 53.280 ± 4.24 and $48.083 \pm 3.87\%$ respectively. These results are higher than the result of Comilla and Barisal area but lower than the results of Khulna area. Ali et al. (2002) and Rashid and Miyamoto (2005) reported that the average total solids content of the *Dahi* are 25.16 to 39.43% and 29.82 to 38.24%, respectively

which are lower than the results obtained in this study.

Ash: Statistical analysis showed that there was no significant difference among the samples examined. The highest ash content was that of Sylhet's sample ($3.05 \pm 0.50\%$) and lowest ash content was that of Bogra's sample ($1.83 \pm 0.35\%$) and ash content of Khulna, Comilla, Barisal and Savar were 1.85 ± 0.11 , 2.27 ± 0.31 , 2.29 ± 1.02 and $1.79 \pm 0.73\%$, respectively. These results are not in within the range of 1.08 ± 0.01 to $1.08 \pm 0.09\%$, 0.93 ± 0.15 to $1.50 \pm 0.10\%$ and 0.73 ± 0.06 to $0.92 \pm 0.06\%$ reported by Rashid and Miyamoto (2005), Ali et al. (2002) and Haj et al. (2007), respectively.

Fat: A significant difference ($p < 0.05$) was found in the fat content of all samples. The highest fat content was that of Comilla's sample at $3.60 \pm 1.43\%$. This result is slightly lower than that of $3.75 \pm 0.76\%$ found by Younus et al. (2002). The lowest fat content was that of Sylhet's sample at $1.36 \pm 0.22\%$ and this result is more or less similar with the results of Barisal's sample at $1.39 \pm 0.17\%$. The fat content of Bogra and Khulna were 2.96 ± 0.58 and $2.96 \pm 0.88\%$, respectively. These results are slightly lower than that of $2.99 \pm 0.02\%$ reported by Younus et al. (2002). The fat contents of all samples were in a range from 0.96 to 4.3% and 1.1 to 11.5% found by Ali et al. (2002) and Sarker et al. (1996) respectively but not in line with the findings of Rashid and Miyamoto (2005) and Ghosh and Rajorhia (1987). The reasons for lower fat content may be used of cross-bred cow's milk or low fat content milk and most important reason is used of skim milk powder for preparation of *Dahi* because skim milk powder contain less than 1% fat.

Protein: Protein analysis revealed that all the samples showed no statistically significant difference. The highest protein content of $3.98 \pm 0.20\%$ was observed in the sample of Sylhet area and lowest protein content of $3.36 \pm 0.42\%$ found in the sample of Bogra area. The highest protein content of sample of Sylhet area and protein content of sample of Khulan area of are slightly lower than that of 3.99 ± 0.99 reported by Rashid and Miyamoto (2005) but higher than that of 3.89% observed by Desai et al. (1994). Protein content of all samples is not in the findings of

Cardoso et al. (1991), Ali et al. (2002) and Chakraborty et al. (2000).

Sugar: Sugar indicates lactose plus the extra table sugar which added in preparing *Dahi*. The sugar content of all sample showed statistically significant difference ($p < 0.01$). The samples of Khulna area had highest sugar ($49.71 \pm 4.96\%$) content due to added higher amount of sugar and sample of Comilla area had the lowest sugar content ($31.53 \pm 5.94\%$). Sugar content of other four areas namely Bogra, Sylhet, Barisal and Savar were 45.45 ± 4.60 , 39.683 ± 3.73 , 35.52 ± 2.28 and $33.64 \pm 7.23\%$, respectively. Sugar content of all samples is not in a range of 19.27% to 28.33% found by Rashid and Miyamoto (2005). The sugar contents in *Dahi* were markedly differing because nobody strictly followed added sugar (8-14%) with milk during *Dahi* preparation. Most of the *Dahi* manufacturer added sugar in *Dahi* according to consumer's demand which varies region to region.

Bacteriological analysis

The results of bacteriological analyses (Total viable bacteria and Coliform) are shown in Table 2.

Total Viable bacterial count: Statistical analysis showed no significant difference ($p > 0.05$) among the total viable counts of the *Dahi* samples from the six areas. The samples of Bogra areas had mathematically higher TVC (8.03 log cfu/g) which is slightly higher than that of 7.68 reported by Haj et al., (2007) and the samples of Barisal areas had lower TVC (5.76 log cfu/g). The variation of total Viable bacterial counts of all samples might be used the undefined wild type traditional starter culture improper ration and amount for *Dahi* making and *Dahi* preparation and storage in unhygienic conditions and prolong storage time.

Coliform count: The data for coliform count has not statistically tested as because the sample of Comilla and Sylhet had Nil count and other groups raw data also possess some Nil figure. However, the count for Bogra, Khulna, Barisal and Savar were 2.01, 0.76, 1.20 and 0.76 logcfu/g, respectively.

Table 1: Chemical analysis of *Dahi* samples collected from selected six areas

Parameters	Areas (Mean \pm SD)						Sig. level
	Bogra	Khulna	Comilla	Sylhet	Barisal	Savar	
Acidity (%)	0.983 ± 0.12	0.927 ± 0.08	0.957 ± 0.07	0.950 ± 0.10	1.050 ± 0.08	1.110 ± 0.22	NS
pH	5.933 ± 0.06	5.977 ± 0.17	5.447 ± 0.26	5.800 ± 0.27	6.230 ± 0.07	5.970 ± 0.70	NS
Total solids (%)	53.280 ^{ab} ± 4.24	58.457 ^a ± 4.73	41.173 ^b ± 6.13	48.083 ^{ab} ± 3.87	42.997 ^b ± 1.41	40.843 ^b ± 7.63	**
Ash (%)	1.837 ± 0.35	1.857 ± 0.11	2.270 ± 0.31	3.057 ± 0.50	2.290 ± 1.02	1.797 ± 0.73	NS
Fat (%)	2.963 ^{ab} ± 0.58	2.967 ^{ab} ± 0.88	3.600 ^a ± 1.43	1.363 ^c ± 0.22	1.390 ^c ± 0.17	1.803 ^{bc} ± 0.70	*
Protein (%)	3.363 ± 0.42	3.923 ± 0.31	3.770 ± 0.25	3.980 ± 0.20	3.790 ± 0.09	3.600 ± 0.50	NS
Sugar (%)	45.450 ^{ab} ± 4.60	49.710 ^a ± 4.96	31.533 ^c ± 5.94	39.683 ^{abc} ± 3.73	35.527 ^{bc} ± 2.28	33.643 ^{bc} ± 7.23	**

NS, non significant, *, $p < 0.05$, **, $p < 0.01$

Table 2: Bacteriological analysis of *Dahi* samples collected from selected six areas

Parameters	Bogra	Khulna	Comilla	Sylhet	Barisal	Savar	Sig. level
Total viable bacteria (log cfu/g)	8.03 \pm 1.04	7.46 \pm 0.50	6.97 \pm 0.07	7.13 \pm 1.45	5.76 \pm 0.06	6.45 \pm 0.53	NS
Coliform	2.01	0.76	0.00	0.00	1.20	0.76	-

(log cfu/g)

LS, level of significant, NS, non significant

Conclusion

An overall analysis of the results of this study revealed that the *Dahi* collected from selected areas were of acceptable quality, though their sugar and ash content were very high, fat content was poor in some areas indicating the possibilities of malpractices during manufacturing of the product.

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