

CHEMICAL AND MICROBIOLOGICAL EVALUATION OF YOGHURT AVAILABLE IN THE MARKET OF BANGLADESH

Md. Saiful Bari¹, Shariful Islam², Md. Hasan Mahmud¹, Mohammad Shaokat Ali¹,
Md. Sahidul Islam Khan¹

¹Department of Dairy and Poultry Science, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University, Khulshi, Chittagong – 4225, Bangladesh

²Department of Medicine and Surgery, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University, Khulshi, Chittagong – 4225, Bangladesh

Corresponding author:- drmsb09@gmail.com

The study was undertaken to evaluate the quality of market 'Yoghurt' available in different sweetmeat shops of Bangladesh. Yoghurt samples from four different Brands were collected and analyzed for chemical (moisture, fat, protein, sugar and ash) and microbiological (TVC, coliform and salmonella count) parameters. In chemical analysis fat, moisture and acidity percentage was higher in Brand 3 (3.75 ± 0.19), Brand 4 (60.83 ± 0.98) and Brand 3 (1.18 ± 0.06) 'Yoghurt', respectively, whereas lowest fat, moisture and acidity percentage was in Brand 1 (3.43 ± 0.18), Brand 2 (3.43 ± 0.18) and Brand 4 (0.75 ± 0.03) made Yoghurt, respectively. *Salmonella* count was 2.00 for Brand 3 Yoghurt while other brands were *Salmonella* free. Coliform count per ml. was the highest (54.66 ± 6.82) in Brand 3 Yoghurt and lowest (6.66 ± 1.99) in Brand 1 Yoghurt. Significant differences ($P < 0.05$) were in moisture and acidity percentage, *Salmonella* count and Coliform count. Moreover, the Yoghurt available in markets of Bangladesh is not in satisfactory quality, even contaminated with pathogenic *Salmonella*.

Key words: Microbiological count, Chemical quality, Yoghurt, Evaluation

'Yoghurt' is the most popular and delicious fermented milk product available in Bangladesh. People consume this food item, either as a part of palatable dish or as a refreshing beverage. Yoghurt is a very nutritious and easily digestible food item, as because pre-digested nutrients are used by bacterial starter cultures [8]. It is believed that 'Yoghurt' has a good therapeutic value, which helps curing gastrointestinal disorders

like constipation, diarrhoea, dysentery, etc [5 and 9].

Yoghurt is also found effective in lowering blood cholesterol. Yoghurt is not only popular for its therapeutic value but its nutritive value is also unique. It contains all the nutrients present in milk except a little variation in lactose content. Lactose content of Yoghurt is about 30 % (per cent) lower than milk as because some portion of lactose is fermented for the formation of lactic acid [2]. People who has lactose intolerance syndrome can easily digest Yoghurt. Yoghurt has also a special social value as being served and consumed in all festival and occasions in Bangladesh and in neighbouring countries.

About 4% of the milk produced in Bangladesh is used for Yoghurt preparation [13]. Mainly two types of Yoghurt are available in local markets say sweetened /misti Yoghurt (sugar added) and sour Yoghurt, and both are prepared by a traditional method using previously made starter culture. Traditional method invariably involves production on a small scale, either in the consumer's household or in the sweetmeat-maker's shop in the urban areas. In the household, milk is heated to boiling temperature until volume is reduced up to 15-20%, and 8-10% sugar added (sweetened Yoghurt), cooled down to body temperature, inoculated 2-3% starter and poured into earthenware and kept for curd formation overnight by wrapping woollen cloth or straw or jute bag to maintain warmth. In the shops, the method is more or less the same and Yoghurt is usually set in suitable containers (earthenware/ glass

bottles/plastic cups) of the required capacity [7]. Most of the producers are used earthenware for setting Yoghurt to firmness rather than glass bottles/ plastic cups. Earthenware is assisting to absorb and evaporate a little amount of moisture from the Yoghurt resulted more firmness. The quality and colour of Yoghurt are varies from shop to shop and area to area depending by using the different proportions and compositional milk and color improving agents. Various means and methods are adopted in its preparation so there can be seen a lot of variations among the quality of products. Though, Yoghurt is prepared without any care of quality control and hygienic conditions and contains a lot of contaminants, which may be health hazardous spontaneously. In Bangladesh, Yoghurt are sold almost in open markets and kept on shelf at ambient temperature without cover on products. A few sellers of city areas are kept their products in refrigerators for prolonging storage and other kept their products at room temperature which is prone to deterioration of both chemical and microbial quality of Yoghurt. A few literatures are available regarding evaluation of quality of market Yoghurt.

In this context, the present study was conducted to assess the chemical and microbiological status (the abundance of representative food-borne pathogens such as *E. coli* and *Salmonella sp.*) in Yoghurt.

MATERIALS AND METHODS

Study area and duration

One year durated study was performed from July, 2013 to June, 2014 was made to evaluate the quality of Yoghurt available at local market of different upazilas in Bangladesh.

Collection of sample

We have collected the Yoghurt sample round the year from different local market of Sadar Upazilla under sixty four Districts of Bangladesh. Fifty-two out of sixty four districts was randomly selected to collect sample, and in each week we collected the sample from single sadar Upazila. Shops in the local market of Sadar Upazila was the source of Yoghurt sample. From different Yoghurt by different brand name, we

selected the four brand namely Yoghurt (Brand-1, Brand-2, Brand-3 and Brand-4) that's frequently available all over the country. A total of 208 Yoghurt (52 Sadar Upazila × 4 Brand) samples were collected during the study period. Samples were brought to experimental site with the help of a large wide mouthed ice-pot, maintaining the temperature 4-5°C. The size of the samples ranged from 100-200g packet in small size plastic pots. After collection, samples were stored in refrigerator at 4°C until analyzing.

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 (DPH 2, China) 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.

Microbiological analysis

Bacteriological parameters (*Salmonella* and *E. coli*) were determined by the methods as described in the "Standard Methods for examination of Dairy Products" by American Public Health Association (APHA) (1967). Brilliant Green Agar (BGA) and Violet Red Bile (VRB) agar were used for *Salmonella* and *E. coli* count, respectively. Firstly, both agars were autoclaved by autoclave machine (Model-STURDY, SA-300VP) then the samples (1g) were measured by using electronic balance (Model-SHIMADZU CORPORATION, AY-220), and then put into plate and poured agar (10-15ml) and

observed for solidification. After solidification, the plates were kept in incubator at 39 °C for 48 hours. The colonies were enumerated by using colony counter (Model-STUART, SC-5) and counted the number of total viable bacterial colonies.

Statistical analysis

A descriptive statistics was performed for chemical and microbial parameters according to different samples. One-way ANOVA was also used for comparing the categories. The result was presented as mean with the standard error and variable given p-value ≤ 0.05 was considered as significant factors.

RESULTS & DISCUSSION

Chemical analyses (moisture, fat, acidity, pH, sugar, total solids, protein, ash) of different brands of yoghurt available in Bangladesh

The results of moisture content of different samples of Yoghurt collected from different districts of Bangladesh are shown in Table 1. There are significant difference ($P < 0.05$) in moisture percentage of Brand-1, Brand-2, Brand-3 and Brand-4 sweetmeat shops made Yoghurt (Table 1). Maximum moisture percentage was seen in Brand-4 (60.83 ± 0.98) and minimum moisture percent was found in Brand-2 sweetmeat shop made Yoghurt (55.88 ± 0.75). The moisture

percentage should be 85-88% for whole milk Yoghurt[12], but during production of Yoghurt producers added milk powder to increase the concentration of Yoghurt which gives more firmness in Yoghurt. The variation in moisture content between different Yoghurt samples might be caused by over ripening and using more cultures than required. Statistically analysis showed that fat content of different Yoghurt samples differ significantly ($p < 0.05$). Maximum fat percentage was in Brand-3 Yoghurt (3.75 ± 0.19) and minimum fat percent was in Brand-1 sweetmeat shop made Yoghurt (3.43 ± 0.18) as presented in table 1. The current finding is agreed by [14] who stated that the fat percentage of Yoghurt of Bangladesh was ranged from 3.00 to 4.75%. Acidity percentage for Yoghurt samples of Brand-1, Brand-2, Brand-3 and Brand-4 Yoghurt were 0.87 ± 0.02 , 1.02 ± 0.03 , 1.18 ± 0.06 , 0.75 ± 0.03 respectively (Table 1). Significant differences were found ($p < 0.05$) in respect of acidity content of the samples. The Highest acidity of Brand-3 Yoghurt might be due to uncontrolled incubation and prolonged storage while the lowest Brand-4 Yoghurt samples might be produced under controlled incubation and temperature. There was no significant difference among the pH value of all samples ($p > 0.05$). It was observed from the results that the highest pH

Table 1: Chemical analyses of Yoghurt

Parameters	Brand (Mean \pm SE)				P-value
	Brand-1	Brand-2	Brand-3	Brand-4	
Moisture (%)	57.87 ± 1.34	55.88 ± 0.75	57.22 ± 1.03	60.83 ± 0.98	*
Acidity (%)	0.87 ± 0.02	1.02 ± 0.03	1.18 ± 0.06	0.75 ± 0.03	**
pH	5.85 ± 0.01	5.53 ± 0.06	5.98 ± 0.03	5.75 ± 0.02	**
Protein %	3.98 ± 0.31	3.91 ± 0.28	3.79 ± 0.30	3.36 ± 0.32	-
Fat %	3.43 ± 0.18	3.55 ± 0.20	3.75 ± 0.19	3.58 ± 0.11	-
Sugar %	35.29 ± 2.18	37.42 ± 1.43	36.25 ± 1.38	33.71 ± 1.61	-
Total Solis %	41.50 ± 2.57	44.01 ± 1.69	42.63 ± 1.63	39.65 ± 1.90	-
Ash %	2.01 ± 0.16	3.07 ± 0.28	2.56 ± 0.25	1.85 ± 0.35	*

- Indicates insignificant, * significance at 5% level whereas ** significant at 1% level of significance

Table 2: Microbiological status of Yoghurt

Parameters	Brand cfu/ml (Mean \pm SE)				P
	Brand-1	Brand-2	Brand-3	Brand-4	
<i>Salmonella</i>	0.00	0.00	2.00	0.00	**
Coliform	6.66 ± 1.99	7.50 ± 2.59	54.66 ± 6.82	20.33 ± 3.40	**

** indicates significant at 1% level of significance

value (5.98 ± 0.5) found in the sample of Brand-3 and lowest value of 5.53 ± 0.06 found in the sample of Brand-2. Both values are higher than the pH value range of 5.00 ± 0.07 to 4.38 ± 0.32 reported by [14 and 4]. The highest pH value was that of sample of Brand-3 might be due to improper fermentation and all values are more or less similar due to time interval of storage that occurred further microbial fermentation.

Sugar indicates lactose plus the extra table sugar which added in preparing Yoghurt. The sugar content of all sample showed statistically significant difference ($p < 0.05$). The samples of Brand-2 had highest sugar ($37.43 \pm 2.48\%$) content due to added higher amount of sugar and sample of Brand-4 had the lowest sugar content ($33.72 \pm 2.81\%$). Sugar content of other two samples namely Brand-1 and Brand-3 were 35.29 ± 3.78 , and $36.25 \pm 2.40\%$ respectively. Sugar content of all samples is not in a range of 19.27% to 28.33% found by [14]. The sugar contents in Yoghurt were markedly differing because nobody strictly followed the standard of adding sugar (8-14%) with milk during Yoghurt preparation. Most of the Yoghurt manufacturer added sugar in Yoghurt according to consumers' demand which varies region to region.

Insignificant difference ($P > 0.05$) was found in the percentage of total solids content in among different sampled Yoghurt. The percentage of total solids content of Brand-2 was highest ($44.01 \pm 2.91\%$) and sample of Brand-4 was the lowest ($39.65 \pm 3.30\%$). The result ($42.63 \pm 2.82\%$) of Brand-3 was slightly higher than the result ($41.50 \pm 4.45\%$) of brand-1. [4] And [14] reported lower total solids content of the Yoghurt obtained in this study. It might be caused due to the variation in sugar content.

The highest protein percentage (3.98 ± 0.31) was observed in Brand-1 and lowest ($3.36 \pm 0.32\%$) in Brand-4 sweetmeat shop. Significant difference ($P > 0.05$) was not found in protein percentage of different Yoghurt samples. The results in the study are slightly lower than that of [14] but higher than that of [6].

The highest percentage of ash content was in Brand-2 (3.07 ± 0.50) and the lowest percentage of ash was in the sample of

Brand-4 ($1.85 \pm 0.35\%$) yoghurt. There was no significant ($P > 0.05$) difference among ash content the samples examined. These results are not within the range reported by [4; 10 and 14].

Microbial status of yoghurt available in the different market of Bangladesh

Salmonella Count

Salmonella organism was found only in brand-3 Yoghurt (2.00 cfu/ml) whereas the Yoghurt samples of other brands were *salmonella* free (Table 2). *Salmonella* organisms can occur in Yoghurt due to the use of undefined wild starter culture in improper ratio and amount. The possible sources of contamination of product are uncleaned hands of manufacturers, poor quality milk, poor quality of water used to clean earthen pots and exposure of the product to open air during setting of curd.

Coliform count

The average *E. coli* count per ml. of Brand-1, Brand-2, Brand-3 and Brand-4 Yoghurt were 6.66 ± 1.99 , 7.50 ± 2.59 , 54.66 ± 6.82 and 20.33 ± 3.40 , respectively (Table -2). There was significant difference ($P < 0.05$) among the coliform count of the brands. Average highest coliform count per ml (54.66 ± 6.82) was in Brand-3 Yoghurt and lowest coliform count per ml (6.66 ± 1.99) was in Brand-1 Yoghurt. The existence of coliform bacteria is the indication of pathogenic bacterial contamination in Yoghurt. The findings of this experiment partially support the findings of [3 and 11].

CONCLUSION

From the present study it can be concluded that the Yoghurt available in Bangladesh is not maintained the proper nutrient level that is recommended by BSTI. Products might be prepared by poor quality milk, contaminated water and utensils; adulteration and high temperature during storage period. A comprehensive research work is still required to set a standard for commercial production of Yoghurt in Bangladesh to have uniformity and superiority in its organoleptic, chemical and microbiological quality. Also, Government should take proper step with the help of BSTI to increase

the quality of Yoghurt all over the Bangladesh.

REFERENCES

1. A.O.A.C. (2003) Official methods of analysis of the Association of Official Analytical Chemists. 15th edition. Washington, DC, Association of Official Analytical Chemists.
2. Akter, N., Nahar, A., Islam, M.N. & Al-Amin, M. (2010) Effects of different level of starter culture and sugar on manufacturing characteristics of *Misti Yoghurt* (Sweet Yoghurt). *Journal of Bangladesh Agriculture University*, 8(2), 245–252.
3. Alam K. (1999) Quality evaluation of Yoghurt made from cow, goat and buffalo milk. M.S. Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.
4. Ali, M.Y., Islam, M.A., Alam, M.J. & Islam, M.N. (2002) Quality evaluation of laboratory made Yoghurt and Yoghurt available in local market in Mymensingh of Bangladesh. *Pak. J. Biol. Sci.* 5(3), 343-345.
5. Athar, I.H. (1986) Preparation of Cheese and Yoghurt (*Yoghurt*) at Household Level. *Pak AgriRes Council*, Islamabad.
6. Desai, S.R., Toro, V.A. & Joshi, S.V. (1994) Utilization of different fruit in the manufacture of yogurt. *Int J Dairy Sci*, 47, 870-874.
7. Dey, S., Iqbal, A., Ara, A. & Rashid, M.H. (2011) Evaluation of the quality of Yoghurt available in Sylhet Metropolitan City. *J Bang AgriUni*, 9(1), 79–83.
8. Durga, L.C., Sharda, D. & Sastry, M.P. (1986) Effect of storage conditions on keeping quality, riboflavin and niacin of plain and fruit yoghurts. *Ind J Dairy Sci*, 39, 404-409.
9. Gandhi, D.N. & Nambudripad, V.K.N. (1975) Implantation of *Lactobacillus acidophilus* in the intestine of adult suffering from gastrointestinal disorders. *Ind J Dairy Sci*, 28, 72.
10. Haj, H.M., Osman, A.O., Owni, El. & Ibtisam, E.M.E. (2007) Assessment of Chemical and Microbiological Quality of Stirred Yoghurt in Khartoum State, Sudan. *Research, J Anim Vet Sci*, 2, 56-60.
11. Islam, M.D.S. (1999) A comparative study on the quality of Laboratory prepared and Local Village Market Yoghurt. A M.S. Thesis, Dept. of Dairy Science, Bangladesh Agricultural University, Mymensingh.
12. Laxminarayana, H., Nambadripad, V.K.N., Lakshmi, N.V., Nantaramiah, S.N. & Sreenivasamurthy, V. (1952) Studies on Yoghurt II. General Survey of the quality of market Yoghurt. *Ind J Vet Sci*, 22(1), 13-17.
13. Mostafa, M.D. (1997) A study on the preparation of fruit Yoghurt (yogurt). A M.S. Thesis. Dept. of Dairy Science, Mymensingh Agricultural University, Mymensingh. Bangladesh.
14. Rashid, M.H. & Miyamoto, T. (2005) Quality evaluation of traditional fermented milk “Yoghurt” in Bangladesh. *Milk Sci*, 54(1), 29-36.