Evaluation of Physio-Chemical Properties of Locally Produced Raw Milk in Sylhet City Corporation Area, Bangladesh

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Authors' contributions

Article Information

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ABSTRACT

Aims: This study was conducted to investigate the physical and chemical quality of raw milk.
Place and Duration of Study: Raw milk available was collected during the period of August to November 2017 from Sylhet City Corporation area and then immediately sent to Dairy Technology Laboratory under Sylhet Agricultural University for laboratory examination.
Methodology: Physical analysis was performed through organoleptic test and chemical analysis was done by Lactoscan milk analyzer. The data was analyzed by one way ANOVA using SPSS at

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95% confidence interval. Then the composition of milk was compared to the standards of BDS and FAO.

Results: The flavor was normal and color was yellowish white. Taste of all samples was slightly sweet and mean specific gravity (1.027 ± 0.0046 to 1.031 ± 0.0068) was within standard range. Proximate composition of the samples revealed that fat % (3.70±1.058), protein % (3.15±0.265), SNF % (7.76±0.642), Lactose % (4.61±0.418) and Acidity % (0.189± 0.02) were highly significant ($P<0.01$) except protein content. Physical parameters of all samples were almost correlated with the BDS and FAO standards

Conclusion: The observation may be helpful for the Bangladesh Standards and Testing Institute (BSTI) to monitor the quality of milk sold to the public.

1. INTRODUCTION

Milk plays an important contribution to our daily routine diet by fulfilling the minimum requirement of nutrition [1]. Milk contains all essential body building proteins, bone-forming minerals, health providing vitamins, energy providing lactose and milk fat [2]. So, milk is called nature's most complete food [3].

In Bangladesh, 2.28, 4.2 and 4.78 million tons of milk were produced between 2006-07, 2011-12 and 2012-13 fiscal year respectively [4]. About 90% of the total whole milk produced was from dairy cows and the remaining were from buffalos, goats and sheeps. The total milk production of Bangladesh is gradually increasing day by day. It is due to the implementation of some new innovative projects which were initiated by the Bangladesh government, private organizations and NGOs. Breed development, rearing of high yielding dairy cows, good management as well as marketing facilities are some of the prime factors for the development of the dairy sector. At present per capita, milk intake is only 91ml/day while the required amount is 250ml/day [4]. Consequently, the Bangladesh government is targeting to achieve 150ml/day consumption of milk for her citizens [4].

Cow's milk contains 3.8% fat, 3.1% protein, 4.6% lactose, 8.7% Solid Non Fat (SNF), 12.5% total Solid (TS) and 87.5% water [5]. Among these constituents, milk fat is a key component which ranges from 2.8% to 8.1% due to variation in breed, lactation, nutrition, hygiene and season [6]. Milk fat is easily digestible and serves as the concentrated source of energy for the vital organ such as heart, kidney, liver and muscles [7]. Milk also has preventive function against ulcerative colitis and colorectal cancer [7]. On the other hand, the biological function of milk protein is to carry calcium and phosphate and helps in digestion [8,9].

Consumers always go for the best quality milk. They prefer packaged milk from different companies which are processed by either Pasteurization or Ultra High Temperature (UHT) at international standard level [10]. Also involved in milk production are lots of local companies (small or medium-scale dairy farmers) which produce milk and supply to consumers in raw form. Few studies have been carried out on a quality assessment conducted to assess the quality of locally produced milk in Sylhet City Corporation area. Therefore, this study was carried out to investigate the physio-chemical properties of raw milk in Sylhet City Corporation area.

2. MATERIALS AND METHODS

2.1 Place of Study and Collection of Sample

Analyses of the samples were performed in Dairy Technology Laboratory under the Department of Dairy Science, Faculty of Veterinary, Animal and Biomedical Sciences, Sylhet Agricultural University, Sylhet, Bangladesh. Five different dairy farms from a different location under Sylhet City Corporation area were selected for milk sample collection (Table1) between August and October, 2017.

2.2 Sampling

Prior to collection of samples, the bulk milk in the container was stirred thoroughly for proper mixing. From each farm approximately 50 ml of raw milk were collected five times in five different weeks. Milk samples were taken into plastic bottle aseptically just after milking and kept in ice

Table 1. Selected farms

Sample	Farm Name	Location
Sample 1 (A)	Maisa dairy farm	Akhalia
Sample 2 (B)	Bismillah dairy	Duski, Kalibari
Sample 3 (C)	Dulavai dairy farm	Bagbari
Sample 4 (D)	Haque dairy farm	Shagorghigirpar
Sample 5 (E)	Abul dairy farm	Tilagorh

cool air tight container. Samples were examined quickly after arrival at the laboratory (Dairy Technology Laboratory, Sylhet Agricultural University, Sylhet).

2.3 Physical Analysis

During collection, several organoleptic tests were done. They are colour, taste, odour and flavour according to the standard ISO score of the samples [11]. The Specific gravity (SG) of milk was analysed by lactometer [12].

2.4 Chemical Analysis

Chemical properties (fat, protein, lactose, SNF, TS) were analysed by Lactoscan Milk Analyser which was manufactured by Milkotronic Ltd, Bulgaria [13].

2.4.1 Milk acidity

10 ml of fresh milk sample was taken into a beaker immediately after collection and then 3-5 drops of 0.5% phenolphthalein indicator was added into the milk [14]. Then the sample was titrated with 0.1 N NaOH solution until specific pink colour persists [15]. Then the percentage of milk acidity was calculated by using the formula

$$\text{Milk Acidity (\%)} = \left(\frac{\text{ml of 0.1N Alkali} \times 0.009}{\text{ml of Sample}} \right) \times 100$$

2.5 Statistical Analysis

The data was recorded at Microsoft office excel sheet and was analysed by one way ANOVA using Statistical Package for the Social Sciences (SPSS) software version 21. Descriptive

statistics including mean (M), Standard Deviation (SD), upper bound, lower bound were calculated at 95% confidence interval.

3. RESULTS AND DISCUSSION

3.1 Physical Analysis

The flavour of the milk samples were normal aromatic as standard level in agreement with [16]. The taste of every sample was slightly sweet without any deviation from standard (Table 2). The colour of all samples was yellowish white except in single farm which was whitish in appearance. The Specific Gravity varied from 1.027 to 1.031 with an average of 1.029 (Table 2) is similar with the findings of [1,7].

3.2 Chemical Analysis

Result obtained from chemical analysis of the milk samples is presented in table (Table 3, Table 4). The values for fat content ranged between 3.263-4.137% which is 3.70% on average is similar with FAO standard but lower than that of BDS ideals (Fig. 1) and findings of [10]. In contrary, the results was higher than [1]. Fat percentage is not a point of consideration for farmers in this area due to weight based marketing instead of fat percentage. But the overall milk fat percentages were highly significant ($P<0.01$) which supported the observation of [7,10].

The average protein content of all sample was 3.15%, lower than the standards of BDS and FAO but higher than [17]. Protein level of cow

Table 2. Physical properties of collected milk samples

	Physical properties parameters			
Farm	Colour	Flavour	Taste	Specific gravity (Mean ± SD)
A	Yellowish white	Normal	Slightly sweet	1.027 ± 0.0046
B	Yellowish white	Normal	Slightly sweet	1.030 ± 0.0037
C	Yellowish white	Normal	Slightly sweet	1.029 ± 0.0028
D	Whitish	Normal	Slightly sweet	1.031 ± 0.0068
E	Yellowish white	Normal	Slightly sweet	1.030 ± 0.0015

milk has been reported to vary from 3.07% to 3.57% according to [18] which supported observation made from this study except farm E. Conversely, the findings of this study were lower than that of [19,20]. Overall, the protein content of the samples were not significantly different (*P*>0.05) support the results obtained by [17] but contradicts that of [7].

The average SNF content of milk samples was 7.76%, slightly lower than the BDS and FAO ideals and observation of [7] except in single farm which was 6.95% that the value is surprisingly lower than the ideals value. The milk sugar (lactose) content of all samples was 4.61%. This result supports the findings of [17,19] and BDS ideals but slightly lower than the FAO ideals. The mean total solid (TS) of collected samples was 11.47% of which the values range between 9.81% to 12.77%. This result is lower than BDS and FAO ideals and reports [1,7]. The acidity percentage was 0.189% (Table 3) of which the values range from 0.180% to 0.198% at 95% confidence interval. The acidity of all samples was slightly higher than the findings of [10] and standards of BDS and FAO. The overall significance level of lactose, acidity and total solid were significant (*P*<0.01) (Table 4) support the findings of [10,17].

Table 3. Chemical properties of collected milk samples

	N	Mean	SD	95% Confidence interval for mean		Minimum	Maximum
				Lower bound	Upper bound		
Fat (%)	25	3.70	1.058	3.263	4.137	1.35	5.88
Protein (%)	25	3.15	0.265	3.048	3.267	2.08	3.75
Lactose (%)	25	4.61	0.418	4.44	4.78	3.18	5.07
SNF (%)	25	7.76	0.642	7.50	8.03	5.20	8.63
TS (%)	25	11.47	1.388	10.89	12.04	8.35	14.06
Acidity (%)	25	0.189	0.02	0.180	0.198	0.154	0.231

SD= Standard deviation, SNF= Solid not fat, TS= Total solid

Table 4. Comparisons of chemical composition of different farms of raw milk

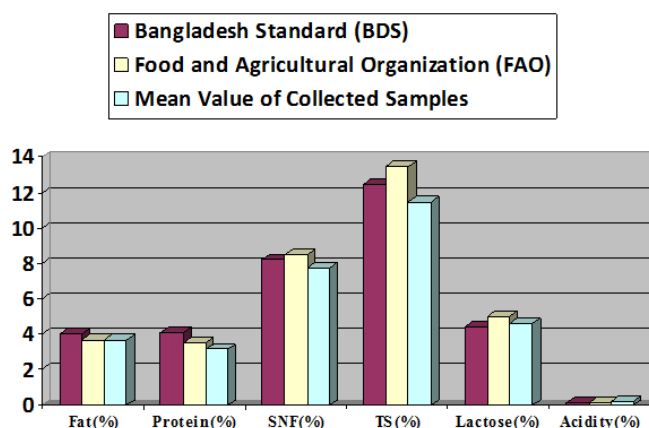| Farm	Fat (%)	Protein (%)	Lactose (%)	SNF (%)	TS (%)	Acidity (%)
A (n=5)	3.82	3.17	4.69	7.86	11.69	0.187
B (n=5)	2.04	3.16	4.61	7.77	9.81	0.156
C (n=5)	4.50	3.32	4.93	8.26	12.77	0.192
D (n=5)	4.49	3.21	4.76	7.98	12.48	0.209
E (n=5)	3.63	2.90	4.04	6.95	10.59	0.200
Significance level	0.000001	0.141	0.002	0.007	0.0001	0.00001

Fig. 1. Comparison of mean value of milk composition with FAO and BDS ideals
SNF= Solid Non Fat, TS=Total Solid

4. CONCLUSION

The quality of raw milk largely depends on the physical and chemical properties of milk that vary from breed to breed, animal to animal and farm to farm. Some other factors include the type of feed, ration formulation, use of concentrate feed and milking time. Physical parameters of all samples were almost correlated with the BDS and FAO standards. This study has shown that there is a correlation between the physical and chemical properties of milk samples with BDS and FAO standards.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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