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Quality of raw milk available at different markets of Mymensingh region of Bangladesh

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ABSTRACT

The experiment was performed to evaluate the quality of raw milk available at different markets of Mymensingh region of Bangladesh. For this purpose the raw milk samples were collected from different markets of Mymensingh (T_1), Jamalpur (T_2), Netrokona (T_3) and Serpur (T_4) districts and immediately transferred to the Dairy Technology and Microbiology Laboratory, Bangladesh Agricultural University, Mymensingh for analysis. Parameters studied to monitor the quality of milk samples were physical (colour, flavour, taste, texture and specific gravity), chemical (acidity, fat, ash, protein, lactose, TS and SNF) and microbiological (total viable count and coliform count). Organoleptic test revealed that the raw milk samples of Mymensingh (T_1) district were yellowish white 66.66%, Whitish 33.33%; Jamalpur (T_2) were yellowish white 66.66%, light yellowish white 33.33%; Netrokona (T_3) were yellowish white 100% and Serpur (T_4) were yellowish white 33.33%, light yellowish white 33.33% and Whitish 33.33%. Samples of T_1, T_2 and T_3 had normal flavor (pleasant aromatic flavour) but only T_4 had 33.33% abnormal flavour. All the raw milk samples were slightly sweet in taste. Milk samples collected from Netrokona (T_3) showed normal texture (free flowing liquid) but Mymensingh (T_1), Jamalpur (T_2) and Serpur (T_4) had free flowing liquid 66.66% and thin texture 33.33%.The specific gravity of all raw milk samples were more or less same (1.026±0.00). There were significant ($P< 0.01$) differences in chemical parameters (fat and protein) between the raw milk samples.Highest fat (34.30 ±1.00 g/kg) was found in Mymensingh (T_1) and highest protein (31.90±0.20 g/kg) was found in Serpur (T_4). The overall percentage of acidity was 0.16 ±0.01. The average total viable count (cfu/ml) and coliform count (cfu/ml) were $19.26x10^3$ and 559.164, respectively and it was observed that total viable count (cfu/ml) and coliform count (cfu/ml) of milk samples were high.Itis concluded thatthe raw milk quality of different markets of Mymensingh region of Bangladesh was more or less similar butdid not fulfill the legal standard of milk composition. Poor hygienic milking, improper cleaning of dairy utensils, unhygienic handling during marketing of raw milk and use of adulterated with addition of water mayresponsible for unhealthy and inferiority of the milk.

Introduction

Milk is hereby legally defined to be the lacteal secretion, practically free from colostrum, obtained by the complete milking of one or more healthy cows, five days after and fifteen days before parturition, which contains not less than 8.5 percent milk solids-not-fat and not less than 3.5 percent milk fat (U.S. Public Health Service, 1965; Itzerott *et al.*, 1960). Milk is a compulsory part of daily diet for the expectant mothers as well as growing children (Javaid *et al.*, 2009). The composition of normal cow's milk varies to a great extent. The chemical composition of milk varies greatly as a consequence of numerous factors such as species, breed of animal, climate, lactation etc. The main constituents of milk are water, fat, proteins (casein andalbumin), lactose, and Mineral. According to Eckles *et al.* (1951) cow milk contains 87.25% Water and 12.75% Dry Matter and the dry matter contains 3.8% Fat, 3.5% Protein, 4.5% Lactose and 0.65% Mineral. Besides these constituents milk also contains considerable amount of fat soluble (vitamin A, D, E and K) and water soluble (vitamin B complex and C) vitamins. However, the term "quality milk" implies that, it is free from pathogenic bacteria and harmful or toxin substances, free from sediment and other extraneous matter, having good flavor, having normal composition, adequate in keeping quality and low in bacterial count (Foster *et al.* 1958). A dairyman must not only have relatively high production per cow, he must also produce -quality milk' for public health to ensure an immediate market for his milk and long term demand for milk by the consumers. In Bangladesh, milk is produced mostly in non-organized way and usually it being supplied to the consumers from the urban and rural areas by *goalas* (Milk Traders). Although there is little milk pockets specially “Milk Vita”and some established dairy farm where surplus milk is readily available but this perishable product has never received particular attention for by hygienic distribution to the consumers. Milk being nutritious food for human

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beings, also serves as a good medium for the growth of many microorganisms, especially Lactobacillus, Streptococcus, *Staphylococcus* and *Micrococcus* sp. Bacterial contamination of raw milk can originate from different sources such as, air, milking equipment, feed, soil, facces and grass (Torkar & Teger, 2008). The number and types of microorganisms in milk immediately after milking are affected by factors such as animal and equipment cleanliness, season, feed and animal health. It is hypothesized that differences in feeding and housing strategies of cows may influence the microbial quality of milk (Torkar &Teger, 2008). Rinsing of milking machine and milking equipment with unclear water may also be one of the reasons for the presence of a higher number of microorganisms including pathogens in raw milk (Bramley & McKinnon, 1990). The presence of these pathogenic bacteria in milk often emerge as a major public health concern, especially for those individuals who still drink raw milk. Keeping fresh milk at an elevated temperature together with unhygienic practices in the milking process may also result in microbiologically inferior quality. Oliver *et al*. (2005) reported that milk and milk products derived from milk of dairy cows can harbor a variety of microorganisms and can be important sources of food borne pathogens. The examination of market milk in different parts of our country would be valuable addition to our knowledge of dairy technology. As for the reason the present study was undertaken with the aim of investigating the hygienic quality (physical, chemical and microbiological) of raw milk from different markets of Mymensingh region in Bangladesh.

Materials and Methods

Collection of samples

Mymensingh (T_1), Jamalpur (T_2), Netrokona (T_3), and Serpur (T_4) are the four districts of the Mymensingh region from which raw milk samples were collected from different market vendors. Immediately after collection the raw milk samples transported in sterile bottles to the Dairy Technology and Microbiology Laboratory, Bangladesh Agricultural University, Mymensingh.

Samples were investigated according to the standard methods.

Analytical methods

Physical tests

The physical parameters like organoleptic test was performed visually and nasally to observed the colour, flavour and textures according to Nelson and Traught (1964) by a panel of judges who evaluated the samples. The specific gravity test was performed using Quevenne lactometer, Lactometer cylinder and floating dairy Thermometer according to the method described by Aggarwala and Sharma (1961).

Chemical tests

The chemical tests included Fat content (g/kg), Solids-not-fat (SNF) content(g/kg), Total Solids (TS) content(g/kg), Ash content(g/kg), Protein content(g/kg), Lactose content (g/kg) and Acidity content (percentage).

Fat test was performed by Babcock fat test methods as described by Aggarwala and Sharma (1961). Acidity test was done by titrating milk with N/10 NaOH solution as per method described by AOAC (2000). SNF and TS were calculated by the mathematical formula of Eckles *et al*. (1951). Protein test was done by formal titration method and Lactose was determined by calculation method: SNF-(Protein+ Ash) = Lactose Details experimental procedures of above tests are given in appendix section.

Microbiological examination

Total Viable Count (cfu/ml) and Coliforms Count (cfu/ml) were performed. The experimental procedures followed for the determination of the number of total viable bacteria in a sample and the detection and enumeration of coliform bacteria were as per recommendation of American Public Health Association (APHA) (1958, 1960).

Statistical analysis

Analysis of variance (ANOVA) was performed by the Completely Randomized Design (CRD) with four treatments Mymensingh (T_1), Jamalpur (T_2), Netrokona (T_3), and Serpur (T_4) are the four districts of the Mymensingh region. The data was statistically analysed with the help of SPSS statistical program to find out the differences among the different parameters of raw milk studied from four different district of Bangladesh. Least Significance Difference (LSD) was determined for ranking the treatments.

Results and Discussion

Physical parameters

Physical parameters of raw milk samples collected during experimental period are presented in Table 1. The result revealed that the colour of all the raw milk from four different district of Mymensingh region-Mymensingh (T_1), Jamalpur (T_2), Netrokona (T_3), and Serpur (T_4) were yellowish white, light yellowish white and whitish in colour (Table 1). While the rawmilk sample collected from Mymensingh (T_1)district were yellowish white 66.66%, Whitish 33.33%; Jamalpur (T_2) were yellowish white 66.66%, light yellowish white 33.33%; Netrokona (T_3)were yellowish white 100% and Serpur (T_4) were yellowish white 33.33%, light yellowish white 33.33% Whitish 33.33%. The results of this study is in agreement with Judkins and Mack (1955) who reportedthat normal milk has a yellowish white colour due to the presence of fat and casein and tothe presence of small amount of colouring matter. These differences in colour may be due tothe differences in nature of feed the cows consumed, the breed, the fat and solidcontent of the milk. These results agree with Eckles *et al.* (1951) who reported that colour of milk depends upon the breed, the amount of fat and solids present and most of all casesdepend upon the nature of feed the cow consumed. Similar type of results were also reported that due to Carotene (to some extent xanthophylls), milk imparts a yellowish in colour. Again, it was found that 100% of the milk samples collected from Mymensingh (T_1), Jamalpur (T_2), Netrokona (T_3) had normal flavor (pleasant aromatic flavour) and a Serpur (T_4) had 66.66% normal flavor and 33.33% in flat (Table 1). This might be due to the fact that the farmers take hygienic measures during milking and not to allow the cow to seat with some sorts of flavoured feed prior to or during milking their cows (Islam *et al.,* 1984) indicated that flavour of milk produced hygienically was normal. Foley et al. (1972) reported that cow flavour is found in milk from cows suffering ketosis. Olson (1956) stated that feedy and weedy flavours develop in milk if cow consumes onion, french weeds, bitter weeds, green rye, etc. just before milking. Milk samples collected from Netrokona (T_3) showed normal texture (free flowing liquid) but Mymensingh (T_1), Jamalpur (T_2) and Serpur (T_4) had free flowing liquid 66.66% and thin texture 33.33% (Table 1). These results indicated that quality of milk obtained from T_3 were superior to the milk collected from T_1, T_2 and T_3 in respect of texture. However, the taste of all milk samples collected from Mymensingh (T_1), Jamalpur (T_2), Netrokona (T_3) and Serpur (T_1) were slightly sweet intaste in (Table 1). Generally normal taste of milk is slightly sweet (Eckles *et al.* 1951). These results agree with Judkins (1960) who reported that milk produce underproper hygienic condition, had slightly sweet taste. Again, the specific gravity of raw milksamples collected from T_1, T_2, T_3 and T_4 were 1.026±0.00, 1.027±0.00, 1.026±0.00 and1.027±0.00, respectively (Table 1). Statistically it was found that there were no significant differences (P>0.05) within the specific gravity of milk collected from different districts. Generally normal cow's milk may range in specific gravityfrom 1.027 to 1.035 with an average of 1.032 (Eckles *et al.* 1951). Yadav *et al.* (1982) reported lower specific gravity of market milk in Vasranasi town, India. In another experiment, Salam (1993) reported that theaverage specific gravity of milk of Bhaghabarighat Dairy Plant was 1.0275 ± 0.001. Specific gravity mostly depends on the total solid content and increases when the solid content rises. As the higher the fat content of milk, the lower will be the specific gravity.Lower specific gravity of milk collected from vendors due to adulteration with water.

Table 1: Physical parameters of raw milk samples collected during experimental period

Physical Parameter		**T_1**	**T_2**	**T_3**	**T_4**
Colour (%)	Yellowish White	66.66	66.66	100	33.33
	Whitish	33.33	-	-	33.33
	Light Yellowish White	-	33.33	-	33.33
Flavour (%)	Pleasant Aromatic	100	100	100	66.66
	Flat	-	-	-	33.33
Taste (%)	Slightly Sweet	100	100	100	100
Texture (%)	Free Flowing Liquid	66.66	66.66	100	66.66
	Thin	33.33	33.33	-	33.33
Specific Gravity	(Mean±SD)	1.026±0.00	1.027±0.00	1.026±0.00	1.027±0.00

(T_1=Mymensingh, T_2=Jamalpur,T_3=Netrokona,T_4=Serpur)

Chemical Properties

Chemical properties of raw milk samples collected during experimental period are presented in Table 2. The result said that the fatcontent of raw milk collected from T_1, T_2, T_3; and T_4 were 34.30±1.00, 30.30±0.30, 32.30±2.00 and 32.30±1.00 g/kg, respectively. Statistical analysis showed thatthe differences between the fat percentages of milk obtained from the different fourdistricts were significant (P< 0.01). Generally fat content of milk varies from2.5 to 9% (Judkins and Keener, 1960). Fat content of milk collected from all four areas were normal range which agrees with (Judkins and Keener 1960). Islam (1984) also studied the fat content of milkcollected from local market and from co-operative society and reported that the fat content ofthese two sources were 30 g/kg and 35.8 g/kg, respectively.The average SNF and TS content of raw milk collected from T_1, T_2, T_3 and T_4 were no significant differences. The average SNF content of raw milk collected from T_1, T_2, T_3 and T_4 were 74.703.68, 75.73 3.61, 75.90+2.00 and 75.57±2.05 g/kg, respectively and TS content were 107.0+2.00, 106.101.00, 108.20+2.00 and 110.0 2.00 g/kg, respectively (Table 2). The average TS of collected raw milk samples were 10.78%. This was agreed with the result of Islam et al. (1984) who found lower total solid percentage in milk from local markets (8.55-12%) and also Yadav and Saraswat (1982) reported lower total solids content in market milk (9.78-15.06%).The average protein content (g/kg) and lactose (g/kg) of different raw milk samples collected from T_1, T_2, T_3 and T_4 were 30.90±0.30, 30.30 0.90, 31.70±0.30 and 30.90±0.20 respectively and 17.80+0.20, 38.50+0.20, 37.90+0.10 and 38.30+0.30 (g/kg) respectively (Table 2). Statistical analysis showed that there was significant difference (p<0.01) within the protein content of different districts. The acidity percentage in raw milk samples collected during experimental period were 0.16±0.01 for T_1, 0.15±0.00 for T_2,0.16 ±0.01 for T_3 and 0.15±0.01 for T_4 respectively (Table 2). Statistical analysis showed that there was no significant differences (P>0.05) within the acidity percentage of milk collected from different districts of Bangladesh. The normal range of acidity of cow's milk is 0.13 to 0.18% lactic acid (Lampert,1970)and the entire sample within this range. Acidity of milk of the four different markets was found within the normal range. The result of acidity percentage of the milk collected from four districts agrees with Islam *et al.* (1984). They reported that acidity percentage of market milk was 0.14 + 0.010%. Hossain and Dev(2013) reported that average acidity percentage of raw milk was 0.14%±0.004%. From the normal acidity value of milk obtained from different markets of four districts it may be pointed out that all the milk samples were fresh during experiment on laboratory.

Table 2: Chemical properties of raw milk samples collected during experimental period

Parameter	Treatments/Groups				Level of significance
	T_1	T_2	T3	T4	
Fat (g/kg)	34.30±1.00	30.30 ±0.30	32.30±2.00	32.30±1.00	*
SNF (g/kg)	74.70±3.68	75.73±3.61	75.90±2.00	75.57±2.05	NS
TS (g/kg)	107.0±2.00	106.10±1.00	110.20±2.00	108.0±2.00	NS
Protein (g/kg)	30.90±0.30	30.30 ±0.90	30.70 ±0.30	31.90±0.20	*
Lactose (g/kg)	37.50±0.20	38.80±0.20	38.90±0.10	37.30±0.30	**
Mineral (g/kg)	6.40±0.12	6.60±0.21	6.60±0.21	6.60±0.18	Ns
Acidity (%)	0.16±0.01	0.15±0.00	0.16±0.01	0.15±0.01	NS

T_1=Mymensingh, T_2=Jamalpur, T_3=Netrokona, T_4=Serpur

* = Significant at 5% level of probability; ** = Significant at 1% level of probability,

NS=Non significant

Microbiological Test

The total viable count (TVC/ml) and coliform counts (cfu/ml) of raw milk samples collected during experimental period are presented in Table 3.The result revealed that values of total viable count (cfu/ml) of raw milk samples collected from T_1, T_2, T_3; and T_4 were 1967000±1.40 (log 6.29), 2067000±1.52 (log 6.32), 1733000+2.11(log 6.24) and 1933000±1.25 (log 6.29), respectively. The average values of coliform counts (cfu/ml) of raw milk samples collected from T_1, T_2, T_3; and T_4 were 533.33±9.77, 606.67±9.77, 533.33±4.57 and 563.33+7.85, respectively. Statistical analysis showed that there was no significant difference within the coliform counts/ml of different milk

samples and it was observed that the coliform counts/ml of milk samples were high. This may be due to poor hygienic milking, improper cleaning of dairy utensils and unhygienic handling during marketing of raw milk. High bacterial density of above mentioned four different districts might be due to unhygienic milking and handling.

Table 3: Total viable count (TVC) and coliform count (CC) of bacteria in per ml of raw milk samples collected during experimental period

Parameter	Treatments/Groups				Level of Sig.
	T_1	T_2	T_3	T_4	
TVC (cfu/ml)	1967000±1.40	2067000±1.52	1733000±2.11	1933000±1.25	NS
Log	6.29	6.32	6.24	6.29	
Coliform count(cfu/ml)	533.33±9.77	606.67±9.77	533.33±4.57	563.33±7.85	NS
Log	2.73	2.78	2.73	2.75	

T_1=Mymensingh, T_2=Jamalpur, T_3=Netrokona, T_4=Serpur
NS=Non significant

Conclusion

From this study, it might be concluded that the quality of raw milk different markets of Mymensingh region of Bangladesh was more or less similar but their quality is poor compare to standard value. For the production of "better quality milk" it is necessary to train farmers about the hygienic aspects of milk production and marketing of milk. Person should be honest and sincere who is involved in milk marketing as well as dairy industry. Monitoring of market milk quality by local authority is imperative.

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