

PHYSICAL AND MICROBIAL QUALITIES OF RAW MILK COLLECTED FROM BANGLADESH AGRICULTURAL UNIVERSITY DAIRY FARM AND THE SURROUNDING VILLAGES

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ABSTRACT

The present study was undertaken with the aim of investigating the physical parameters (e.g. organoleptic and specific gravity of raw milk) and also to study the microbiological quality of raw milk (total viable count, Coliform count and Staphylococcal count) from different villages and Bangladesh Agricultural University (BAU) Dairy Farm of Mymensingh District of Bangladesh, during the period from July to November 2007. A total number of 100 raw milk samples were collected at morning and evening from BAU dairy farm and surrounding four villages of BAU campus. The organoleptic and bacteriological qualities of each sample were analyzed. The organoleptic examination included taste panel score to assess consumer's acceptance and the bacteriological analysis comprised enumeration of total viable count (TVC), total coliform count (TCC) and total staphylococcal count (TSC) for the determination of sanitary quality. The organoleptic quality of the milk samples is more or less same except the Churkhali milk samples which had flat taste (in 16% milk sample). The average values of TVC/ml were log 5.920, 5.934, 6.007, 6.075 and 6.127 for BAU Dairy Farm, Boira, Shutiakhali, Churkahi and Paglabazar respectively; coliform count were log 2.501, 2.522, 2.550, 2.620 and 2.619 respectively; staphylococcal count were log 2.832, 2.812, 2.866, 2.931 and 2.988 respectively. So, it may be concluded that the raw milk samples of BAU Dairy Farm were superior to others collected from the selected villages which may be due to maintaining better hygienic condition.

Key words: Raw milk, physical and microbial quality

INTRODUCTION

Milk is defined to be the lacteal secretion, practically free from colostrums, obtained by the complete milking of one or more healthy cows, five days after and 15 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, 1960). According to Byron *et al.* (1974), the average composition of milk are (i) Water (87.20%), (ii) Protein (3.50%), (iii) Fat (3.70%), (iv) Milk sugar or lactose (4.90%), (v) ash (0.70%) and (vi) Dry matter (12.80%). The constituents may vary with breed, type of feed, stage of lactation, season and age of the cow etc. and also between individuals of the same breed.

It is well established that consumers want clean, wholesome and nutritious food that is produced and processed in a sound, sanitary manner and is free from pathogens. For fulfilling consumer's demand, quality milk production is necessary. Quality milk means, the milk which is free from pathogenic bacteria and harmful toxic substances, free from sediment and extraneous substances, of good flavor, with normal composition, adequate in keeping quality and low in bacterial counts. 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. Although there are 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. On the other hand, it is also an excellent media for growth of large variety of bacteria. Cousin (1982) reported that there are so many sources viz. udder, body of the cows, litter, floor, flies, insects and rodents, water supply, milker, milk utensils and atmosphere etc. for bacterial contamination of milk. 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. So, the present study was undertaken with the aim of investigating the physical parameters (e.g. organoleptic and specific gravity of raw milk) and also to study the microbiological quality of raw milk (total viable count, Coliform count and Staphylococcal count) from different villages and Bangladesh Agricultural University (BAU) Dairy Farm of Mymensingh District of Bangladesh.

MATERIALS AND METHODS

Experimental design

The whole study was conducted at Bacteriology Laboratory under the Department of Microbiology and Hygiene, Faculty of Veterinary Science, BAU, Mymensingh, during the period from July to November 2007. A total number of 100 raw milk samples were collected at morning and evening from BAU dairy farm and surrounding four villages of BAU campus. The organoleptic and bacteriological qualities of each sample were analyzed. The organoleptic examination included taste panel score to assess consumer's acceptance and the bacteriological analysis comprised enumeration of total viable count (TVC), total coliform count (TCC) and total staphylococcal count (TSC) for the determination of sanitary quality.

Sources, collection and transportation of samples

Bangladesh Agricultural University Dairy Farm and other four different villages (Boira, Shutiakhali, Churkhali, Paglabazar) surrounding the BAU campus, were selected for collection of milk sample. About 250 ml of individual raw milk samples were collected at morning and evening from each cow. After collection, the samples were transported to the laboratory using ice containing box maintaining sterile condition. Twenty individual samples of raw milk (10 of morning and 10 of evening) were randomly collected from milking cow of each village and dairy farm.

Physical examination of the samples

Organoleptic test of raw milk was performed visually, nasally and lingually with the help of a panel of expert to determine colour, flavour and texture. Specific gravity was also determined using lactometer.

Taste panel scores

The organoleptic quality of each raw milk was evaluated by a panel of experts with the help of appearance, texture, smell and taste characteristics as per standard score card (ISO, 1995).

Microbiological examination of samples

Enumeration of TVC, TCC and TSC: Ten fold dilution of each raw milk sample was prepared using peptone water. For the determination of TVC, 0.1 ml of each dilution was transferred using sterile pipette and spreaded on PC agar using a sterile glass spreader for each sample. The plates were then kept in an incubator at 37°C for 24-48 hours. Following incubation, plates exhibiting 30-300 colonies were counted. The average number of colonies in a particular dilution was multiplied by the dilution factor to obtain the TVC. The TVC was expressed as the number of organism of colony forming units per ml (CFU/ml) of samples according to ISO (1995). TCC and TSC were also determined by following the similar method of TVC count except the agar. In case of TCC, MacConey agar and in case of TSC, manitol salt agar was used.

Gram's staining

Gram's Method of staining was performed as per the procedures recommendation of Cowan (1985) to study the morphology and staining character of each isolated bacteria.

Statistical Analysis

All the data obtained during the study were analyzed statistically to find out the level of significance. The analysis of variance was determined by F-test. The mean differences were evaluated at 1% level of significance by Duncan's New Multiple Range Test.

RESULTS AND DISCUSSION

Physical parameters

The physical parameters were studied after collection and sampling of milk from different villages surrounding the BAU campus and BAU Dairy Farm, Mymensingh. Out of 100 samples, 60 samples were found yellowish white, 20 samples were white, 10 samples were light yellowish white and remaining 10 samples were deep yellowish white in colour (Table 1). These findings agreed with the reports of Judkins and Mack (1955) who reported that normal milk has a yellowish white color due to the presence of fat, casein and the presence of small amount of colouring matter. These differences in colour may be due to the differences in nature of feed consumption or the breed of cow or the fat and solid contents of the milk (Eckles *et al.*, 1951).

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Among 100 milk samples 86 had normal flavour, 10 had sweet aroma and 4 had flat flavour (Table 1), similar to the findings of Islam *et al.* (1984) who reported that the samples those were collected from BAU dairy farm were yellowish white in colour, slightly sweet in taste and normal in flavour and present investigation also recorded flat flavour taste in four milk samples. In this respect Foley *et al.* (1972) reported that a covey flavour was found in milk from cows with Ketosis. The texture of raw milk sample was examined before starting the experiment. All the milk samples (100%) collected from BAU Dairy Farm and from different villages had normal texture (free flowing liquid) except Paglabazar (Table 1). Sixteen milk samples of Paglabazar had thin texture. Thin texture in milk sample of Paglabazar might be due to breed quality of the milking cows or percentage of water in milk.

Table 1. Physical parameters of raw milk samples collected from different sources

Physical Parameters	BAUDF	Boira	Shutiakhali	Churkhali	Paglabazar
Color	YW 100%	YW 50% DYW 50%	YW 84% White 16%	YW 34% White 66%	YW 84% LYW 16%
Flavor	Normal 50% Sweet aroma 50%	Normal 100%	Normal 100%	Normal 84% Flat 16%	Normal 100%
Texture	Normal* 100%	Normal 100%	Normal 100%	Normal 100%	Normal 84% Thin 16%
Specific gravity**	1.0295	1.0279	1.0242	1.0237	1.0296

BAUDF = Bangladesh Agricultural University Dairy Farm; % = percent; YW = Yellowish white; DYW = Deep yellowish white; LYW = Light yellowish white; *= free flowing liquid; **= Mean±SD (Standard deviation).

The mean and standard deviation of the specific gravity of raw milk samples collected from BAU Dairy Farm, Boira, Shutiakhali, Churkhali and Paglabazar were 1.0295±0.0015, 1.0279±0.0007, 1.0242±0.0019, 1.0237±0.003 and 1.0296 ± 0.0009 respectively (Table 1). The specific gravity of milk of BAU dairy farm and Paglabazar were found relatively higher than the milks of other three villages. This might be due to the breed of milking cow and feed consumption. The findings of this study are in agreement with the findings of Ekles *et al.* (1951) and Islam *et al.*, (1984). The standard specific gravity of normal whole milk varies from 1.0229 to 1.035 with an average of 1.032 (Ekles *et al.*, 1951).

Total viable count

The average values of TVC/ml were 8,33,333 CFU/ml (log 5.920), 8,60,833 CFU/ml (log 5.934), 10,17,500 CFU/ml (log 6.007), 11,89,083 CFU/ml (log 6.075) and 13,40,50 CFU/ml (log 6.127) for BAU Dairy Farm, Boira, Shutiakhali, Churkhali and Paglabazar respectively (Table 2). It was found that total viable bacterial count per ml of raw milk collected from Paglabazar were significantly higher (P<0.01) than the milk samples of other collected areas. In this study it was found that TVC is comparatively higher in milk sample of Paglabazar and lower in the milk sample of BAU Dairy Farm. The variation in TVC of the milk may be due to the hygienic maintenance during milking. The results of this experiment correlate with findings of Iknomov *et al.* (1956) who reported that the total bacterial counts ranged from 1,70,000 to 9,000,000 per ml of milk depending on milking techniques and cleanliness. The number of bacteria in aseptically drawn milk was 100-92,000 per ml, but infection occurred subsequently from the skin of animals, milkers hands, cow shed and milking utensils. Lee *et al.* (1983) conducted an experiment in Seoul of Korea and found that the bacterial count in raw milk ranged from 4×10^6 to 2.7×10^7 per ml.

Total coliform count

The average values of coliform counts/ml of milk samples collected from BAU Dairy Farm and surrounding four villages (Boira, Shutiakhali, Churkhali, Paglabazar) were 317.375 CFU/ml (log 2.501), 332.75 CFU/ml (log 2.522), 355.50 CFU/ml (log 2.550), 417.25 CFU/ml (log 2.620), 416.25 CFU/ml (log 2.619) respectively (Table 2). Statistically it was found that the count of coliform bacteria per ml of raw milk which was collected from Paglabazar were statistically higher ($P < 0.01$) than other samples. The results of this investigation are in agreement with the finding of Mutukumira *et al.* (1996) who found the coliform bacteria 3.2×10^2 to 2.3×10^5 . Saitanu *et al.* (1996) examined and found that the total coliform count of < 1000 CFU/ml.

Staphylococcal count

The average values of staphylococcal counts/ml of milk samples collected from BAU Dairy Farm, Boira, Shutiakhali, Churkhali and Paglabazar were 680.50 CFU/ml (log 2.832), 662.975 CFU/ml (log 2.812), 735.00 CFU/ml (log 2.866), 855.00 CFU/ml (log 2.931), 973.00 CFU/ml (log 2.988) respectively (Table 2).

Table 2. The average value of TVC, TCC and TSC in raw milk of BAU Dairy farm and surrounding villages of BAU campus

Sources of samples	No. of samples tested	Total viable count/ml		Total coliform count/ml		Staphylococcal count/ml	
		CFU/ml	Log	CFU/ml	Log	CFU/ml	Log
S ₁	20	8,33,333	5.920	317.38	2.501	680.50	2.832
S ₂	20	8,60,833	5.934	332.75	2.522	662.98	2.821
S ₃	20	10,17,500	6.007	355.50	2.550	735.00	2.866
S ₄	20	11,89,083	6.075	417.25	2.620	855.00	2.913
S ₅	20	13,40,500	6.127	416.25	2.619	973.00	2.988
Level of significance		**		**		**	

**means $p < 0.01$; NS means $p > 0.05$; CFU = Colony Forming Unit; S₁ = BAU Dairy Farm; S₂ = Boira; S₃ = Shutiakhali; S₄ = Churkhali; S₅ = Paglabazar; ml = Milliliter.

It was found that the count of staphylococci bacteria per ml of raw milk which was collected from Paglabazar were statistically higher ($p < 0.01$) than other samples. In this respect Bae and Seung (1992) suggested that the quality of farm water and other hygienic conditions might be responsible for microbial quality of raw milk. It was found that among the milk samples of the collection site, the raw milk of Paglabazar contained higher TVC, TCC and TSC compare to other four areas (Table 2). This difference may be due to lack of hygienic and other sanitary condition during milking.

So, it may be concluded that the raw milk samples of BAU Dairy Farm were superior to other raw milk samples collected from the selected villages may be due to maintaining better hygienic condition.

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