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Article

Evaluation of morning and evening milk of Holstein Friesian crossbred cows collected from Bangladesh Agricultural University Dairy Farm

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Abstract: The present study was undertaken to evaluate the organoleptic, specific gravity, chemical and microbiological qualities of morning and evening milk which collected from Bangladesh Agricultural University Dairy Farm, Mymensingh. In this purposes, six Holstein Friesian crossbred cows were selected for this study. Milk samples were collected every morning and evening immediately after milking and then subjected to test all mentioning parameters. Morning milk showed less yellowish than evening milk whereas flavor, body and texture were found normal in both intervals of milk. Specific gravity was found higher (1.030 ±0.000) in morning milk than evening and significantly ($p<0.01$) higher fat content observed in evening milk sample due to the more exercise the whole day. Again, total solids, solids-not-fat, protein and lactose content of milk showed significant difference at $p<0.05$. Other parameters like acidity percent and ash did not show any significant difference. Significantly ($p<0.05$) higher coliform count was noticed in morning milk than evening milk and non-significant ($p>0.05$) difference found in total viable count of both intervals milk. Considering the research findings, it might be said that evening milk was better than morning milk.

Keywords: morning milk; evening milk; evaluation

1. Introduction

Milk is considered as the nature's single most complete food which is definitely one of the most valuable and regularly consumed foods but at the same time it is highly vulnerable to bacterial contamination (OECD, 2005). The knowledge of different levels of microorganism in milk is very essential to determine its quality for successful dairy operation. A dairyman must not only have relatively high production per cow but also he must produce quality milk to ensure an immediate marketing by holding long term demand for milk to the consumers as well as for public health. Quality milk means the milk which is free from pathogenic bacteria, harmful toxic substances, sediment, extraneous substances and presence of good flavor with normal composition and low in bacterial counts. Through good management practices of the dairy farm, in that situation good quality milk can be expected from both farm and village condition (Islam *et al*., 2013). Milk is hereby legally defined to be the lacteal secretion obtained by the complete milking of one or more healthy cows which is particularly free from colostrums containing not less than 3.5 percent milk fat and 8.5 percent solids-not-fat (US Public Health Service, 1965). The composition of milk varies greatly as a consequence of numerous factors such as species, breed of animal, climate and lactation stage and condition etc. The quality of raw milk and the ability for the breed to produce milk to their potential are vaguely known at the farm and cows are provided with concentrates irrespective of their potentiality. At times milk quality deteriorates before it is consumed due to lack of quick cooling facility like surface cooler. Since milk is liquid which come in contact with some equipments or surface from it is removed from the cow until it is consumed. Milk freshly drawn from a disease free udder contains

small number of bacteria (500 to 1000 bacteria per ml) which derive from organisms colonizing the teat canal (Bocsa-oarga *et al.*, 2010).

Milk starts to deteriorate immediately after milking due to bacteria entering the milk from a wide variety of sources. The quality of raw milk is a term with a very broad meaning and it encompasses such milk characteristics as chemical composition, physical properties, microbiological and cytological quality, sensory properties, technological suitability and nutritive value. A number of authors have demonstrated that differences in the chemical composition and physicochemical properties of milk from cows of various breeds are determined genetically (Boland, 2003). In Bangladesh, milk adulteration is pretty common but recently there are no any information the quality evaluation of morning and evening daily milk collected from dairy farm. Considering the above reasons present research work was undertaken to evaluate the daily morning and evening milk quality as well as to know the physical, chemical and microbiological quality of raw milk collected from Holstein Friesian crossbred cows of Bangladesh Agricultural University Dairy Farm.

2. Materials and Methods

2.1. Place and period of the experiment

Milk samples were collected from the Bangladesh Agricultural University Dairy Farm (BAUDF) and the experiment was conducted at Dairy Technology and Microbiology Laboratory under the Department of Dairy Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh during the period from September to October, 2015.

2.2. Selection of cows and milk sample collection

For this study, total six no. of Holstein Frisian crossbred cows were selected from BAU Dairy Farm. All the cows were in nearly similar age (48±5 month) and in first lactation. Just after complete milking of the cows, total twelve milk samples (6 samples morning and 6 samples evening) were collected per day. Then Morning and evening daily milk samples were subjected to analysis over the period of experiment.

2.3. Analysis of the milk samples

Organoleptic tests were performed by a panel of expert judges, Department of Dairy Science through visually, nasally and lingually to evaluate the color, flavor, texture and appearance of collected raw milk samples. Specific gravity was determined using Quevenne's lactometer, cylinder and floating Dairy thermometer according to the procedure described by Aggarwala and Sharma (1961). Acidity test (%) was performed by titrating milk samples with 0.1N NaOH solutions according to the method described by Aggarwala and Sharma (1961). Fat test (%) was done according to Gerber Fat Test method and protein test (%) was performed by formal titration method according to Horwitz (1975). Total solids (TS) and solids-not-fat (SNF) (%) were calculated by mathematical formula of Eckles *et al*. (1951). Ash content (%) was determined by evaporation method and lactose content (%) was determined by calculation method. Total viable count (cfu/ml) and coliform count (cfu/ml) were determined as per recommended by the American Public Health Association, 1960.

2.4. Statistical analysis

Completely Randomized Design (CRD) was performed to investigate the effect of morning and evening milk samples on the parameters. Statistical analysis was done using Statistical package software (SPSS). Also, means were compared by using Duncan's Multiple Range Test (DMRT) in Web Agri. Stat Package (WASP) as described by Gomez and Gomez (1984).

3. Results and Discussion

3.1. Effect of morning and evening milk on organoleptic parameters and specific gravity

3.1.1. Color and appearance

The average color and appearance score of morning and evening milk samples were 14.05±0.61 and 14.66±0.29 (Table 1). Statistical analysis showed that there was non-significant ($p>0.05$) difference existed among the morning and evening milk. Morning milk was light yellowish white whereas evening milk was more yellowish in color. The differences in color may be due to the difference in nature of feed consumed especially green high yielding fodder feeding, the fat content and solids-not-fat in milk. Lampert (1970) also stated that color variation depends upon fat, solids-not-fat and the size of the fat globule. Variation in color may be due to carotene content results in milk impart a yellowish in color. This color result agreed with Eckles *et al*. (1951) who reported that milk color depends on the breed of animal, kinds of feed consumed, the amount of fat and solids present in milk.

3.1.2. Flavor

Flavour score was showed higher in evening milk (37.55±0.77) than morning milk (35.77±0.65). Statistical analysis showed that there was significant ($p<0.05$) difference existed among the two milk samples (Table 1). It was also found that both milk samples had pleasant aromatic flavor. This result agreed with the finding of Bari (2001) who reported that the milk flavor of Bangladesh Agricultural University Dairy Farm was pleasant aromatic and similar results also found by Monem (2012) and Islam *et al.* (2013).

3.1.3. Body and texture

The average value of body and texture of morning and evening daily milk were 31.33±0.91 and 31.88±0.90 (Table 1). Obtained result from this study revealed that there was non-significant ($p>0.05$) difference among the morning and evening milk samples. All the milk samples collected from morning and evening from BAUDF showed normal texture that means free flowing liquid. This result agreed with the findings of Datta (2013) who reported that the morning milk of BAUDF was normal body and texture.

3.1.4. Specific gravity

There was non-significant ($p>0.05$) difference existed within the specific gravity of milk collected from morning and evening milk of BAUDF. It was observed that the highest specific gravity of milk was obtained from morning milk and which was 1.030±0.000 (Table 1). Islam *et al.* (1984) observed that the mean specific gravity of milk from Bangladesh Agricultural University Dairy Farm was 1.031 and specific gravity of cow's milk ranges from 1.027-1.035 (Eckles *et al*., 1951).

3.2. Chemical parameters

3.2.1. Acidity (%)

Result revealed that average acidity percentages of milk samples from morning and evening milk were same that was 0.14±0.001. Statistical analysis showed that there was non-significant ($p>0.05$) difference existed between the two milk samples (Table 2). Alam (1998) found 0.15% acidity of milk from AFTAB fresh raw milk. The normal range of acidity of cow milk is 0.13-0.14% lactic acids but when acidity level goes above 0.15% then it was considered to be as developed acidity (Lampert, 1970).

3.2.2. Total solids content (g /Kg)

Statistical analysis showed that total solids content of milk samples collected from morning and evening milk differed significantly ($p<0.05$). Result indicates that higher total solids present in evening milk which was 128.11±2.87 g/kg (Table 2). Ali (1999) found that the mean total solids content of milk from BAUDF were 122.5 g/kg. The results are in contradicted with Islam *et al.* (2008) studied the milk quality of local cows in BAUDF and found that the total-solids content of cow's milk was 142.50 g/kg which is higher than present study.

3.2.3. Fat content (g/kg)

There was significant difference ($p<0.01$) exists among the fat content of milk followed by morning and evening (Table 2). Higher (52.55±2.75 g/kg) fat content was found in evening milk than morning milk (38.57±4.23 g/kg) and this finding was supported by Akter *et al.* (2015) who found higher fat % in evening milk. Generally, fat content of cow's milk varies from 2.5 to 8 % (Judkins and Keenar, 1960). Fat content of this experimental result was agreed with Rashid and Manshuri (1996) who reported that milk fat percentages of BAUDF was 3.72±0.59. This result also supported by Datta (2013) who reported that fat percentage of milk collected from Holstein Frisian cross and Sahiwal cross in morning milk was 37.00±1.00 and 40.33±0.58 g/kg, respectively. There are various reasons for the variation of fat content in milk and the lower fat content of milk may be due the adulteration of milk by water or partly skimming the milk. Research showed that the highest percentage of fat was obtained from evening milk compared to morning milk which may be due to low milk production in evening and completeness of milking. Also, changes of temperatures especially hot in summer may affect fluctuation of fat content in milk (Abd El-Ghani, 1993). The fat content of milk decreases as the weather becomes warmer and increases again with the approach of winter (+15 to -5^{o}C).

3.2.4. Solids-not-fat content (g/kg)

The average value of solids-not-fat **(**SNF) of morning and evening milk samples were 86.08±1.96 and 82.28±3.77 g/kg, respectively. Statistical analysis showed that there was significant ($p<0.05$) difference present between morning and evening milk (Table 2). The SNF content of the milk generally follow the variation of the

fat content in milk. When the milk content higher the fat, in this case the SNF are higher (Abd El-Ghani, 1993). Yadav and Saraswat (1982) in an experiment imply that SNF content varies from 63.9 to 88.6 g/kg and present result fall this range. According to the US Public Health Services (1965) and Itzerott (1960) milk contains minimum 8.5% SNF. In these findings of this experiment, it was observed that evening and morning milk contains 8.2 and 8.6% SNF, respectively. So, the SNF content of the present study was little lower in evening milk than standard. When cow suffer from malnutrition then the SNF content decreases without hampering the fat content.

3.2.5. Protein content (g/kg)

Obtained result from this research revealed that average protein contents of milk was 32.93±0.78 and 31.98±1.26 g/kg followed by morning and evening, respectively. Statistical analysis showed that there was a significant ($p<0.05$) difference among the morning and evening milk (Table 2). Islam *et al*. (1984) found 35.00 g/kg protein in milk from Bangladesh Agricultural University Dairy Farm and 23.4 g/kg from Mymensingh town. Ali (1999) also found average protein content of milk samples from BAU Dairy Farm, different hall supplies and vendors were 3.32, 3.35 and 3.31%, respectively. From this experimental result, it may be concluded that the protein content of milk samples collected from morning was higher than evening milk. Result indicated that protein fraction of milk is falls within the normal range and supported with the findings of above mentioned authors.

3.2.6. Lactose content (g/kg)

The mean lactose content was significantly ($p<0.05$) different among the morning and evening milk and the highest lactose was found in morning milk (46.33±1.54 g/kg) (Table 2). This finding was supported by Jenness and Patton **(**1959) who reported that milk contains 4.7-4.9% lactose.

3.2.7. Ash content (g/kg)

There was non-significant difference ($p>0.05$) present among the ash content of milk followed by morning and evening which was similar (6.4±0.15 g/kg) in both type of milk (Table 2). This result also quite similar with Islam *et al*. (1984) who found the ash content of milk in the Bangladesh Agricultural University Dairy Farm was 7.1 g/kg and Mymensingh town was 6.0 g/kg.

3.2.8. pH value

Statistical analysis showed that there was non-significant ($p>0.05$) difference among the morning and evening milk. Result indicates that similar pH value (6.67±0.05) was found in two types milk (Table 2). Generally, p^H of normal milk falls within 6.5-6.7 (Jenness and Patton**,** 1959) and this research p^H value of milk samples collected from two times were within the normal range.

3.3. Microbiological parameters

3.3.1. Standard plate count (SPC) or total viable count

The average number of SPC on morning and evening milk samples were 3.06×10^4 and 3.01×10^4 cfu/ml, respectively. Statistical analysis showed that there was non-significant ($p<0.05$) difference existed between the two milk samples (Table 3). Similar result was found Akter *et al*. (2015) who reported that total viable count were higher in morning milk collected from selected dairy farms in Chittagong City of Bangladesh. 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. High microbial counts and the possible rapid multiplication are likely to affect the keeping quality of the raw milk sold directly to consumers without processing and cooling (Marshall, 1982).

3.3.2. Coliform count

The mean coliform content was significantly ($p<0.05$) differed among the morning and evening milk and the highest coliform was found in morning milk (6.67±0.55) (Table 3). The presence of high numbers of coliform in milk provides an index of hygienic standard used in the production of milk, as unclean udder and teats can contribute to the presence of coliforms from various sources such as manure, soil, feed, personnel and water (Thomas *et al*., 1971, Lampert, 1970). Higher number of coliforms is of public concern as may carry serious pathogenic coliforms such as *E. coli, Salmonella, Shigella spp.* etc. One *Salmonella* organism in 100 ml of contaminated milk may result in human infection and diseases (Fountaine *et al*., 1980). These coliforms may have originated from the feeds such as concentrates, hay or dry grass, personnel and water.

Table 1. Effect of morning and evening milk samples of Holstein Friesian crossbred cows on organoleptic parameters and and specific gravity.

Parameters	Morning milk (mean ± SD)	Evening milk (mean ± SD)	Level of significance
Color and appearance (15)	14.05 ± 0.61	14.66 ± 0.29	NS
Flavor (40)	35.77^{b} ± 0.65	37.55^{a} ± 0.77	*
Body and Texture (35)	31.33 ± 0.91	31.88 ± 0.90	NS
Specific gravity	1.030 ± 0.000	1.029 ± 0.001	NS

[a,b] Mean values within a row having different superscripts differ significantly. *Significant at p<0.05 and NS indicates non-significant.

Table 2. Effect of morning and evening milk samples of Holstein Friesian crossbred cows collected from BAUDF on chemical parameters.

Parameters	Morning milk (mean±SD)	Evening milk (mean±SD)	Level of significance
Acidity (%)	0.14 ± 0.000	0.14 ± 0.001	NS
TS (g/kg)	124.63^{b} ± 5.12	128.11^{a} ± 2.87	*
Fat (g/kg)	38.57^{b} ± 4.23	52.55^{a} ± 2.75	**
SNF (g/kg)	86.08^{a} ± 1.96	82.28^{b} ± 3.77	*
Protein (g/kg)	32.93^{a} ± 0.78	31.98^{b} ± 1.26	*
Lactose (g/kg)	46.33^{a} ± 1.54	44.47^{b} ± 2.21	*
Ash (g/kg)	6.4 ± 0.15	6.4 ± 0.15	NS
pH	6.67 ± 0.05	6.67 ± 0.05	NS

[a,b] Mean values within a row having different superscripts differ significantly. **significant at p<0.01, *Significant at p<0.05 and NS indicates non-significant.

Table 3. Effect of morning and evening milk samples of Holstein Friesian crossbred cows collected from BAUDF on microbiological parameters.

Parameters	Morning milk (mean ± SD)	Evening milk (mean ± SD)	Level of significance
SPC	$3.06 \pm 0.14 \times 10^{4}$	$3.01 \pm 0.18 \times 10^{4}$	NS
Coliform	6.67^{a} ± 0.55	5.33^{b} ± 0.51	*

[a,b] Mean values within a row having different superscripts differ significantly. *Significant at p<0.05 and NS indicates non-significant.

4. Conclusions

Analysis from the obtained results in this research work of all physical, chemical and microbiological parameters, it was found that the evening milk was superior than morning milk regarding to the organolaptic tests such as color and appearance, flavor, body and texture score and chemical qualities on the basis of total solids, fat and lactose content. Also, total viable count and coliform bacteria were found lower in evening milk than morning milk.

Conflict of interest

None to declare.

References

Abd El-Ghani S, 1993. On bacterial quality of raw market milk in rural areas of Giza Province. Egyp. J. Food Sci., 21:73-77.

Aggarwala AC and RM Sharma, 1961. A Laboratory Manual of Milk Inspection. 4th edition, Asia Publilishing House, Bombay, India.

Akter S, MAA Galib, H Kabir, SK Nath, K Afrin and MS Sarker, 2015. Chemical and microbial qualities of morning and evening milk collected from selected dairy farms in Chittagong City of Bangladesh. Bang. J. Anim. Sci., 44: 171-175.

Alam MZ, 1998. Study on quality of raw milk produced by individual farmers and mixed milk collected from different centers of our Thana of Kisoregonj district under Aftab Bahumukhi Farm Limited. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

Ali MS, 1999. A Study on the quality of milk consumed by students of different halls and residential people of Bangladesh Agricultural University, Mymensingh. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

American Public Health Association (AOAC), 1960. Standard Methods for Examination of Dairy Product.11th edition, ALPHA Inc., New York. pp. 50-53.

Bari AKM, 2001. Comparative study of platform tests on milk in the local markets and Bangladesh Agricultural University dairy farm. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

Bocşa-Oarga AC, AC Semeniuc, AM Rotar, C Guş, R Suharoschi, C Laslo, 2010. A comparison of selected air quality criteria in raw milk. J. Agroali. Processes and Technol., 16:367-372.

Boland M, 2003. Influences on raw milk quality. In: Dairy Processing, Improving Quality, C.H.I.P.S, Weimar, USA. pp. 42–67.

Datta K, 2013. A comparative study on the quality of morning milk of Holstein Friesian cross and Sahiwal cross at Bangladesh Agricultural University Dairy farm. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

Eckles CH, WB Cobms and H Macy, 1951. Milk and milk products. 4th edition, McGarh-Hill Book Company, New York, USA. pp. 49-57.

Fountaine RE, ML Cohen, WT Martin and TM Vernon, 1980. Epidemic of Salmonellosis from cheddar cheese: surveillance and prevention. Amer. J. Epidemiol., 111: 247-253.

Gomez KA and AK Gomez, 1984. Statistical procedures for Agricultural Research. 2nd 255 edition, John Wiley and Sons, New York, Chickester, Brisbane, Toronto, Singapore. pp. 207-215.

Horwitz W, 1975. Official Methods of Analysis of the Association of Official Analytical Chemists. Association of Official Analytical Chemists, Washington, DC. pp. 256-259.

Islam MA, MH Rashid, MFI Kajal and MS Alam, 2013. Quality of milk available at local markets of Muktagacha upazila in Mymensingh district. J. Bang. Agri. Uni. 11:119–124.

Islam MN, SMI Hussain, AKMA Mannan, 1984. Studies on the physical parameters and chemical qualities on market milk in Mymensingh town (Bangladesh). Bang. J. Anim. Sci. 13:52-55.

Islam MR, MN Hassan, MSR Siddiki, MAS Khan and MA Islam, 2008. Determination of quality of milk from different Genotype of dairy cows. Bang. J. Anim. Sci., 37: 53 – 56.

Itzerott G, 1960. A book about notes on milk and indigenous dairy products of Pakistan.

Jenness R and S Patton, 1959. Principles of Dairy Chemistry. John Wiley & Sons, New York..

Judkins H and A Keener, 1960. Milk production and processing. Jon Wiley & sons, Inc. New York.

Lampert IM, 1970. Modern Dairy Products. 3rd edition, Chemical publishing company. Inc. New York. pp.16 - 17.

Lee JT, SY Park, IK Korea and HU Kin, 1983. Quality of raw milk in Korea. Korean J. Dairy Sci., 5:22-28.

Marshall RT, 1982. Relationship between the bacteriological quality for raw milk and the final products: A review of basic information and practical aspects. K. Mil. Forsc., 34:149-157.

Monem PK, 2012. Quality of raw milk available at different markets of Bogra Town. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.

OECD, 2005. Dairy policy reform and trade liberalization .Organization for economic co-operation and development. p. 98.

Prasad J, 1997. Animal Husbandry and Dairy Science. 2nd revised edition, Kalyani Publishers, New Delhi.

Rashid A and MN Mansuri, 1996. A study on the qualities of milk collected from BAU Dairy Farm, its surroundings villages and mini dairy farm in Kawatkhali. Asian J. Dairy Res., 10:53-56.

Thomas SB, RG Druce and M Jones, 1971. Influence of production conditions on bacteriological quality of refrigerated farm bulk milk-a review. J. App. Bact., 34: 659-677.

US Public Health Services, 1965. Grade-A Pasteurized milk ordinance. US Department of Public Health Education and Welfare Service, PI.

Yadav AN and BL Saraswat, 1982. Note on the physical and chemical qualities of market in Varanasi town, India. Asian J. Res., 1:74-76.