

# **Evaluation of Nutritional and chemical quality of raw milk from household dairy farms in Hathazari upazilla, Chattogram, Bangladesh**



**A production report submitted in partial satisfaction of the requirement for the Degree of Doctor of Veterinary Medicine (DVM)**

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# **Evaluation of Nutritional and chemical quality of raw milk from household dairy farms in Hathazari upazilla, Chattogram, Bangladesh**



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### List of abbreviations

Abbreviation	Elaboration
Sp gravity	Specific gravity
SNF	Solid Not Fat
BF	Butter Fat
TS	Total solid

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## Abstract

Milk is considered to be a nearly complete food since milk contains nutrients like high-quality proteins, lipids, carbohydrate, vitamins and minerals far more than any other single food. (Neumann et al.,2002). In chattogram district, the upazilla of Hathazari is home to more than thousand people. Four sources of fluid milk are available in the Hathazari to suit the needs of such a huge human population: farm produced milk, vendor-supplied farm milk, vendor supplied rural milk, and market milk of various brands. But maximum farmers have their own dairy farm to produce milk for their need. Thus, to assess the nutritional value of raw milk from dairy farms in Hathazari, the current study was conducted from February 22 to march 16, 2023. Some areas like Fatika road,11 mile, foteyabad, kachari road, sarkarhat were selected to collect milk samples.

In order to evaluate the physical (specific gravity) and chemical (% of butter fat, solids-not fat, total solids, protein, and water) properties of milk samples and analyse them using the I.S.I. (1984) method for identifying the nutritional and chemical parameters, a total of 15 samples, 3 from each entry point were collected. The results of the study show that practically some of the samples had very poor nutritional quality. 50% of the samples had adulteration in the water. More water adulteration is done both to improve milk volume and to generate more money. Raw cow milk means milk from dairy cow not less than 3 days after parturition and shall not contain colostrum. Milk shall not be either addition to it or extraction from it, or subject to any process except cooling.

**Keywords:** Complete food, adulteration, colostrum, parturition

## **Chapter-I**

### **Introduction**

In contrast to other foods, fresh milk contains the key elements lactose, fat, protein, minerals, and vitamins in a balanced ratio, making it considered to be a complete diet (Khalid, 2006). It is described as the entire, clean, lacteal secretion obtained by complete milking of one or more healthy animals, excluding that obtained within fifteen days prior to or five days following calving or such periods as may be necessary to render milk virtually colostrum free, and containing the minimum prescribed percentage of milk fat (3.5%) and solids not fat (8.5) (Goff and Hill, 1993). Liquid milk, a critical component of our daily diet, is essential for meeting the world's growing nutritional needs as well as for ensuring food safety in developing nations like Bangladesh. However, it is also quickly perishable due to its great susceptibility to bacterial contamination (Kim et al., 1983; OECD 2005). In Bangladesh, milk adulteration is also a very prevalent occurrence. Thus, it is crucial to assess the quality of milk.

Additionally, milk has significant amounts of both water (A, D, E & K) and fat-soluble vitamins (B complex & C). The constituent can differ across members of the same breed depending on factors including breed, kind of feed, lactation stage, season, cow age etc. Objectives of my study is to compare the chemical and nutritional quality of raw milk with the BSTI standard, to detect the quality of nutritional components like Protein, Casein, Butter fat, SNF, to detect the adulteration of water in Raw milk.



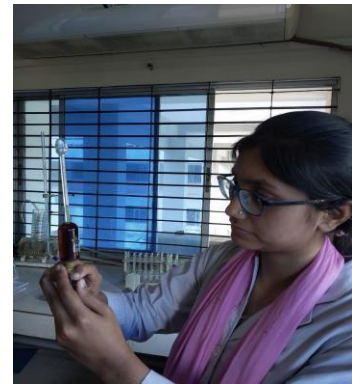
## Chapter-II

### Materials & Methods

**2.1 Duration:** The Farm milk quality tests were done in the dairy science laboratory of CVASU during the period from February 22 to March 16, 2023.



**Figure 1:** Measurement of Moisture



**Figure 2:** Measurement of Butter Fat by Gerber method



**Figure 3:** Protein & Casein percentage by titration of milk sample

**2.2 Collection of samples:** Raw milk of five different areas were collected from different farms of Hathazari. To collect milk samples, milk was collected from the nearest teat and taken in the tube or vial without contamination.

**2.3 Number of samples:** 15 samples of each farm of different stages of production (Lactation /pregnancy period) were collected for this study.

**2.4 Quality Tests:** The following tests are done of evaluate the quality.

Tests	Methods followed
Butter fat%	Gerber method (Volumetrics 1984)
Solids-not fat%	ISI 1984
Specific Gravity	FAO,1984
Protein%	Pyne,1932
Lactometer Reading	Milk Lactometer
Adulteration detection	ISI,1960
Temperature	Thermometer

## 2.6 Physical Analysis:

1. Organoleptic test
2. Specific gravity test

## 2.7 Chemical Analysis:

1. Alcohol test
2. Fat content Gerber method
3. SNF test
4. TS test

## 2.8 Statistical Analysis:

The collected information was entered into a work sheet created in Microsoft Excel 2016. The statistical programme SPSS (SPSS Inc., Chicago, IL, USA) was used to analyse descriptive statistical parameters.

## Chapter-III

### Results and Discussion

#### Results

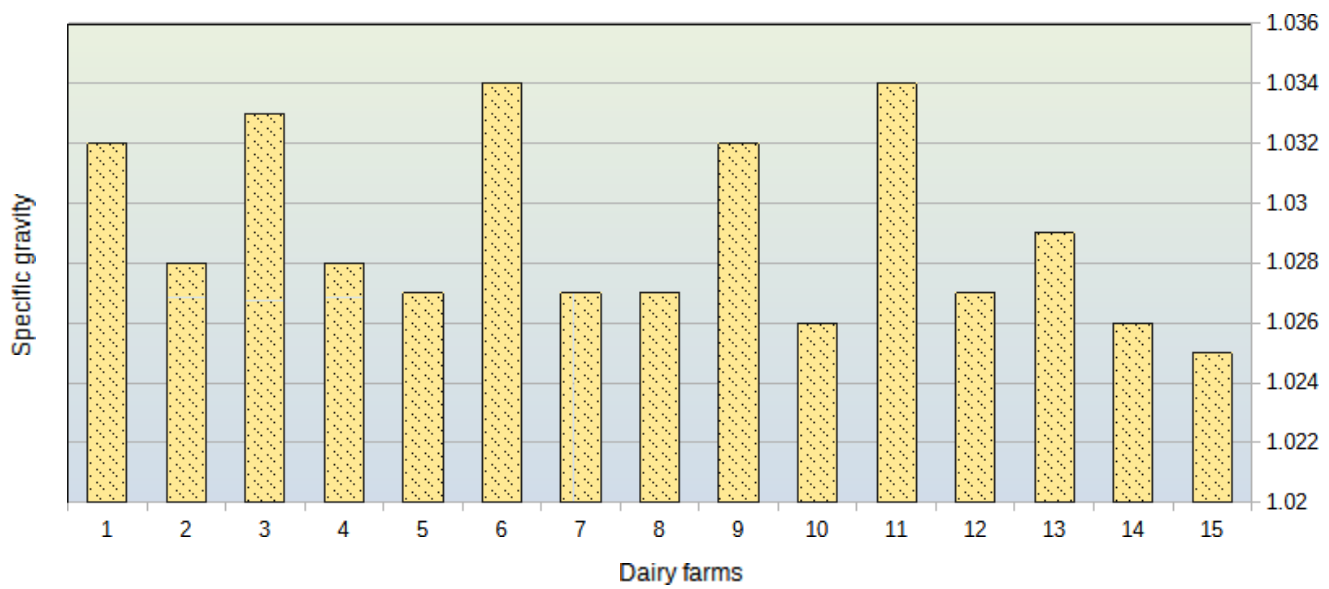
**Table-1: Composition of different components in Milk.**

Composition	percentage
water	87
Dry matter	12.8
Fat	3.7
protein	3.5
Lactose	4.9

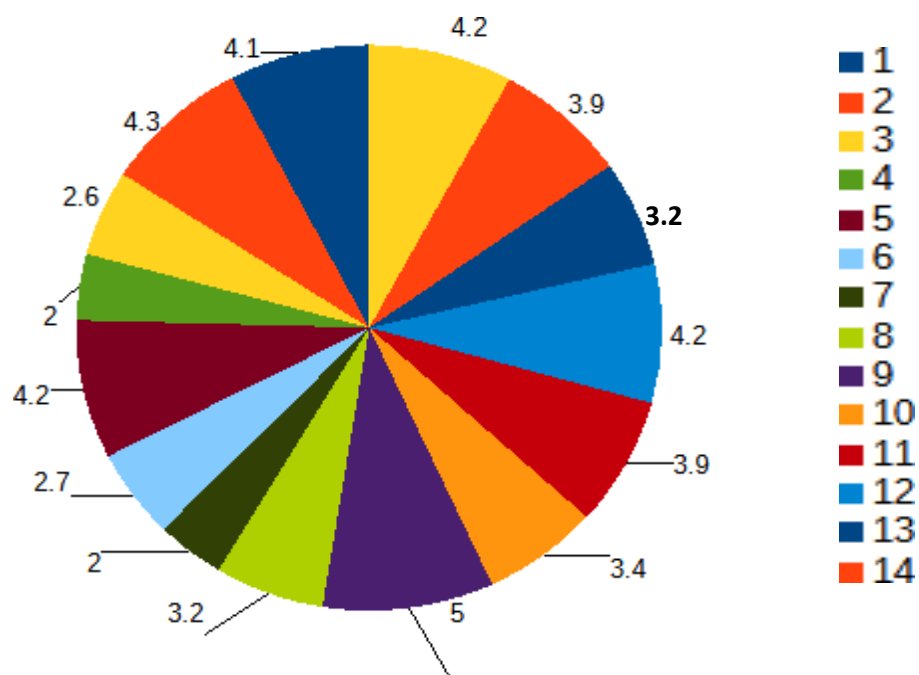
**Table-2: Comparison of Raw milk of different farms of Hathazari with BSTI standard.**

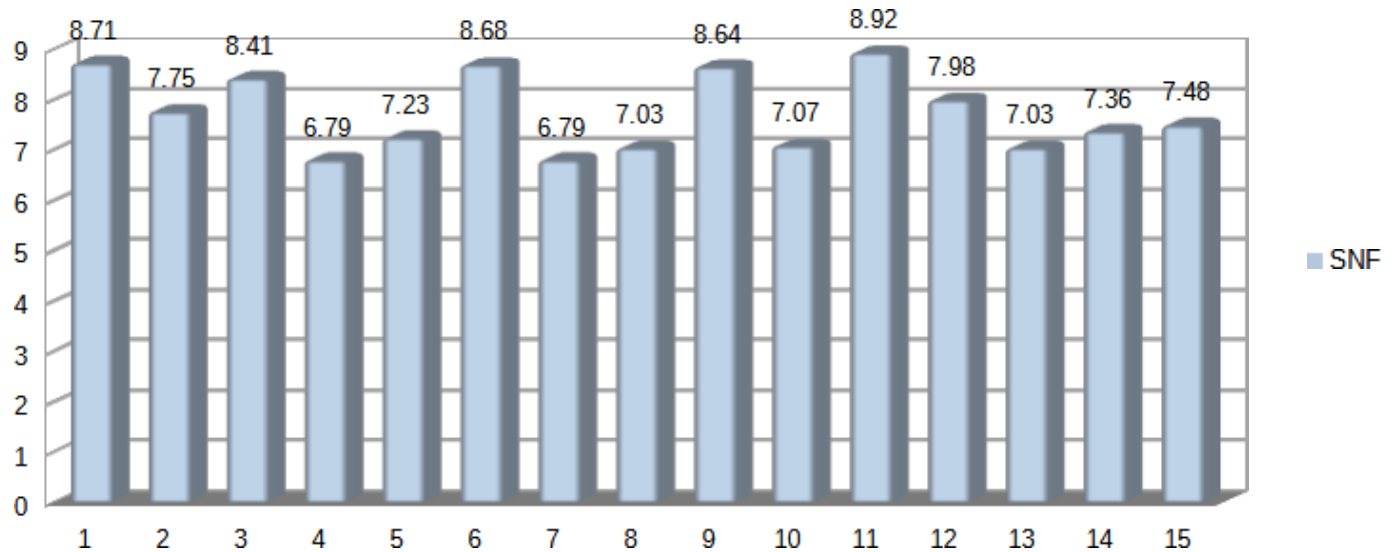
Name of quality test	Standard of Raw milk	Fatika road	11 mile	Foteyabad	Kachari road	Sarkarhat
Specific gravity	1.026-1.034	1.031	1.029	1.028	1.029	1.026
Protein (%)	3.3	3.8	2.6	2.9	2.7	3.7
Fat (%)	3.5	3.6	2.9	3.4	3.8	3.7
SNF (%)	8.5	8.29	7.56	7.48	7.99	7.29
TS (%)	12	11.95	10.53	10.88	11.82	11.12

**Chart No-1: Comparison of specific gravity of different farms.**



**Chart No-2: component of fat% of different dairy farms of Hathazari**



**Chart No-3: component of SNF% of different dairy farms of Hathazari****Fig: Comparison of Solid not fat percentages in dairy farms of Hathazari upazilla****Table-3: Nutritional and chemical composition of different farm milk (mean±standard error).**

Name of the area of Dairy farm	Sp gravity	BF%	SNF%	Protein%	TS%
Fatika road	1.031±0.016	3.6±0.55	8.2±0.33	3.8±0.42	11.95±0.45
11 mile	1.029±0.002	2.9±0.23	7.5±1.201	2.6±0.32	10.53±1.105
Foteyabad	1.028±0.002	3.4±0.36	7.4±0.72	2.9±0.09	10.88±0.36
Kachari road	1.029±0.001	3.8±0.64	7.9±1.010	2.71±0.47	11.82±1.032
Sarkarhat	1.026±0.009	3.7±0.57	7.95±1.010	3.7±0.22	11.12±0.52
AVERAGE	1.030±0.018	3.78±0.33	7.65±0.93	3.36±0.36	11.26±0.73
Level of significance	NS	NS	NS	NS	NS

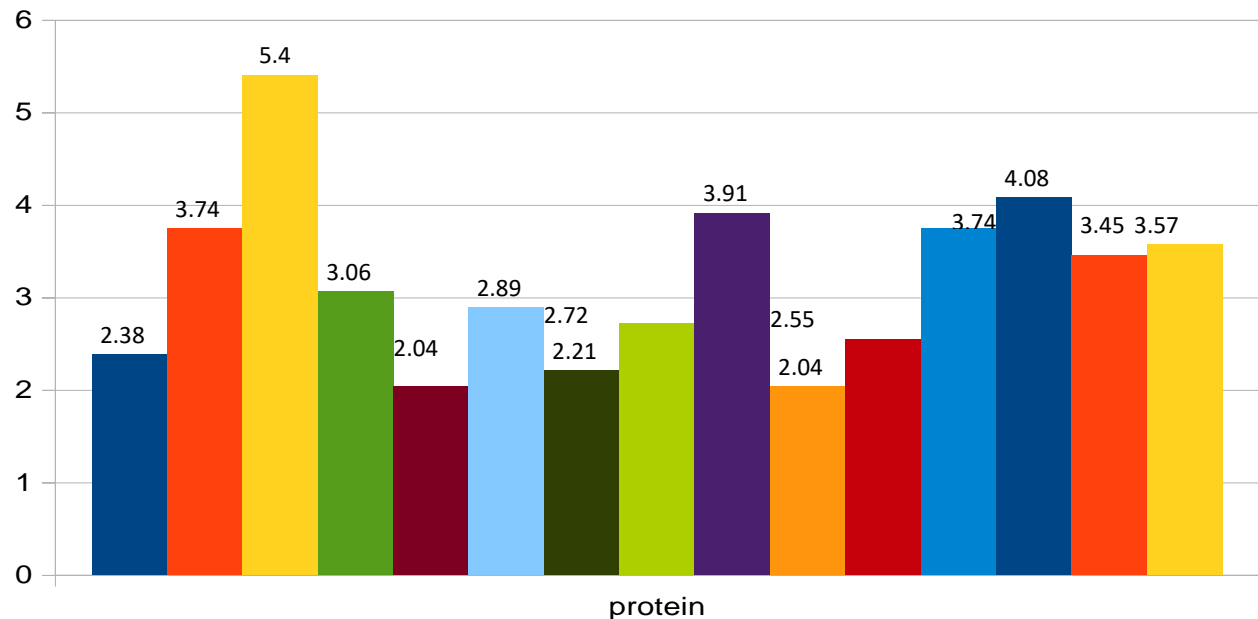
**NS=non-significant**

**Table-4: Nutritional and chemical composition of different farm milk (mean±standard deviation).**

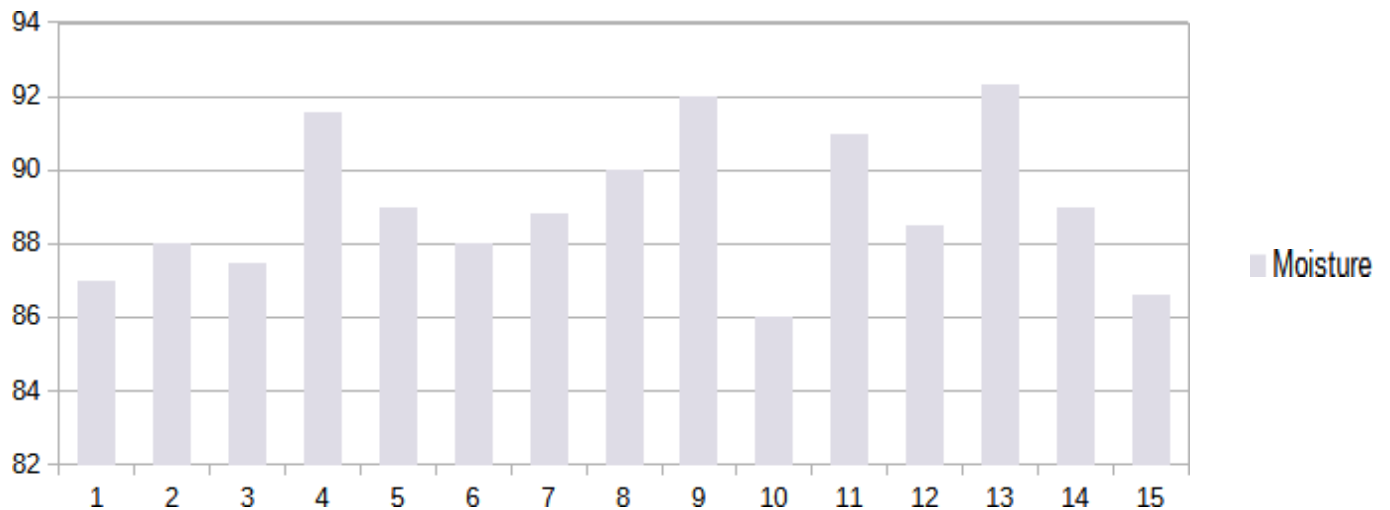
Name of the area of Dairy farm	Sp gravity	BF%	SNF%	Protein%	TS%
Fatika road	1.031±0.002	3.6±0.42	8.2±0.23	3.8±0.42	11.95±0.32
11 mile	1.029±0.0031	2.9±0.56	7.5±0.12	2.6±0.61	10.53±1.62
Foteyabad	1.028±0.003	3.4±0.49	7.4±0.38	2.9±0.056	10.88±0.84
Kachari road	1.029±0.0032	3.8±0.72	7.9±1.015	2.71±0.47	11.82±1.098
Sarkarhat	1.026±0.001	3.7±0.81	7.95±1.043	3.7±0.28	11.12±0.74
AVERAGE	1.030±0.0024	3.78±0.60	7.65±0.55	3.36±0.36	11.26±0.92
Level of Significance	NS	NS	NS	NS	NS

**NS=non-significant**

**Chart No-4: component of Protein% of different dairy farms of Hathazari**



**Fig:** Comparison of protein percentages in dairy farms of Hathazari upazilla

**Chart No-5: Moisture content in milk sample of Hathazari dairy farm**

## Discussion

### 3.1 Physical Quality:

#### Organoleptic evaluation:

- a) **Colour:** The judging of colour was done by eye for the organoleptic test. The colour of milk is a blend of individual effects produced by Carotene, which imparts a yellowish colour.
- b) **Flavour:** Flavour may be detected by sniffing the products before placing in the mouth and also while in the mouth.
- c) **Taste:** The sample was placed in the mouth, rolled around in the mouth to come in contact with the taste buds located on the various portion of the tongue.
- d) **Texture:** The judging of the texture of milk sample was also done by eye.

### 3.2 Chemical Quality:

#### 3.2.1. Farm milk:

Table: 2 shows that the average specific gravity of farm milk is  $(1.030 \pm 0.018)$  which ranges from 1.026 to 1.029. Highest specific gravity found in Fatika road.  $(1.031 \pm 0.016)$  and lowest in Sarkarhat  $(1.026 \pm 0.009)$ . **De, S. (2000)** reported that specific gravity of farm milk of all area remained within the normal range of specific gravity of milk. This results also agrees with research findings of **Islam et al. (1993)** and **Eckles et al. (1951)**.

The average BF content of farm milk is  $(3.78 \pm 0.33)$  % which ranges from 2.9% to 3.8%. Highest BF found in kachari road  $(3.8 \pm 0.64)$  % and lowest in 11 mile farms  $(2.9 \pm 0.23)$  %. This result agrees with **Debnath *et al.* (2009)**.

The average SNF content of farm milk is  $(7.65 \pm 0.93)$  % which ranges from 7.4% to 8.20%. Highest SNF found in fatika dairy farms  $(8.2 \pm 0.33)$  % and lowest in foteyabad farm  $(7.4 \pm 0.72)$ . This result agrees with **Debnath *et al.* (2009)**.

The average protein content of farm milk is  $(3.36 \pm 0.36)$  % which ranges from 2.6 % to 3.8%. Highest protein found in fatika dairy farms  $(3.8 \pm 0.42)$  % and lowest in 11 mile dairy farm  $(2.6 \pm 0.32)$ . **Eckles *et al.* (1951)** stated that milk should contain 3.80% protein which agrees with our result.

The average TS content of farm milk is  $(11.26 \pm 0.73)$  % which ranges from 10.53% to 11.95%. Highest BF found in fatika road dairy farms  $(11.95 \pm 0.45)$  % and lowest in 11 mile farms  $(10.53 \pm 1.105)$  %. This result agrees with **Debnath *et al.* (2009)**.

Chart No:5 shows that food adulteration, particularly with regard to raw milk, is a pressing concern right now. Normal milk adulterants include water, flour, skim milk powder, sugar, detergent and fat are commonly added to milk to extend its shelf life. So, the results are shown that highest moisture in milk (92.3%) is a prove that the water is added.



## **Chapter-IV**

### **Conclusion**

It is clear from the discussion above that, regardless of the intended application, some milk samples nutritional value fell below the recommended amount. Water adulteration was widespread in entering milk from rural regions. In case, Hathazari is included as one of them. According to the data, the quality of the milk in the five places (Fatika, 11 miles, Kachari road, Sarkarhat, Foteyabad) that were chosen was more or less comparable. Farmers must be educated on the hygienic aspects of milk production in order to produce milk of higher quality. That could aid in lowering the increased incidence of variance in milk components like protein, casein, Butter fat, SNF, TS, moisture, which would improve milk quality overall.

### **Limitations**

In modern conditions of milk production in the Hathazari upazilla, the factor affecting its quality is the sanitary conditions of farm and farm equipment's, differences in breed, feeding practices, season, stage of lactation, milking method and adding adulterants in milk.

### **Recommendations**

The recommended advice is the cow should be provided enough energy sources quality feed, hygienic environment, feeding mixed forages, hand milking for collecting milk, improving genetic parameters by breeding and finally educating farmers through training program would be effective to reduce alterations in chemical composition of milk.

## References

2<sup>nd</sup> edition, Fox, P.F. (edition). New York: Chapman & Hall. pp. 469.

**De, S. 2000.** Outlines of Dairy Technology. Oxford University Press, London. pp. 1-2.

**Debnath, G.K., Kober, A.K.M.H. and Chanda, G. C. 2009.** Quality of Fluid Milk Available in Chittagong Metropolitan Area, proceedings of the sixth annual scientific conference of CVASU, Bangladesh.**APHA** (American public Health association).**1984.** Standard Methods for the Examination of Dairy products.

**Aggarwala, A. C. and Sharma, R. M. 1961.** A Laboratory Manual of Milk Inspection. 4<sup>th</sup> edition Asia Publishing House, Madras; pp.206.

**Azad, M. A., Hasanuzzaman, M., Azizunnesa, Shil, G. C. and Barik, M. A. 2007.** Milk Production Trend, Milk Quality and Seasonal Effect on it at Baghabarighat Milk Shed Area, Bangladesh. *Pakistan Journal of Nutrition*, 6: 363-365.

**BBS** (Bangladesh Bureau of Statistics). **1997.** Statistical Year Book of Bangladesh Ministry of Planning.

**BBS** (Bangladesh Bureau of Statistics). **2001.** Human population census, 2001.

**Barnard, S. E. 1978.** Freezing points and milk adulteration. *Dairy Science. Abstract.* 40(7): 414.

**BSTI** (Bangladesh Standards and Testing Institution).

**Campbel, J. R. and Marshall, R. T. 1961.** The Science of providing milk for man. Standard edition, Megraw-Hill Book Company, New Delhi. pp. 487-49.

**Chandan, R. 1997.** Dairy-Based Ingredients. Standard Paul, Minn.: Eagan Press. Singh, H., McCarthy, O. J. and Lucey, J. A. 1997. Physio-chemical properties of milk. In: *Advanced Dairy Chemistry Volume 3. Lactose, Water, Salts and Vitamins.*

- Ding, H. C. and Chang, T. C. 1986.** Detection of reconstituted milk in fresh milk. *Journal of Chinese Agricultural Chemical Society*, 23: 406-411.
- Dionysius, D. A. and Milne, J. M. 1997.** Antibacterial peptides of bovine lactoferrin: purification and characterization. *Journal Dairy Science*, 80: 667.
- EDA (European Dairy Association) 1997.** Nutritional Quality of Proteins. Brussels, Belgium.
- Eckles, C., Combs, C. and Macy, H. 1951.** Milk and milk products 4<sup>th</sup> edition, McGraw-Hill book company, New York, Toronto, London. pp. 22-23.
- FAO 1984.** Milk and milk products testing procedures, co-operative dairy organization and Extension programme (Phase: II) Bangladesh.
- FAO 1999.** Manual on the use of LP-system in milk handling and preservation, Animal Production Service, FAO Animal production and Health Division.
- Fox, P. E. and Grufferty, M. B. 1997.** Effect of added NaCl on some physiochemical properties of milk. *Dairy Science, Abstract*. 48:482.
- Fox, P. F. 1992.** Proteins. *Advanced Dairy Chemistry*, 1:52-63.
- German, J. B. and Dillard, C. J. 1998.** Fractionated milk fat: composition, structure, and functional properties. *Food Technology*, 52: 33.
- ISI (Indian Standard Institution). 1984.** Hand book of Food Analysis part XII-XV, ISI, Delhi.
- ISI (Indian Standard Institute). 1960.** Milk testing-rapid examination, 1479 (part I), ISI, Delhi.
- ISI (Indian Standard). 1958.** Determination of milk fat by Gerber method (part I), ISI, Delhi.
- Islam, M. N., Hussain, S.M.I and Mannan, A.K.M.A. 1993.** Studies on the physical parameters and chemical qualities of market milk in Mymensingh town (Bangladesh). *Bangladesh journal of Animal Science*. 13: 52.
- Islam, M. S., Zaman, M. M., Quadir, M. M., Hasan, M. N. and Hossain, M. I. 2002.** Study on the Assessment of Chemical Qualities of Milk Produced by Primary Cooperative Societies (Milk Vita). *Pakistan Journal of Biological Sciences*. 5:1261-1263.

- Jensen, R.G. 1995.** *Handbook of Milk Composition*. New York: Academic Press.
- Judking, H. F. and Keener H. A. 1960.** Milk production and processing. 4<sup>th</sup> edition, New York. pp. 227-230.
- Khurody, D. N. 1974.** Dairing in India. 1<sup>st</sup> edition, Asia Publishing House, Bombay. pp. 186-193.
- Miller, G. D., Jarvis, J. K. and McBean, L. D. 1999.** *Handbook of Dairy Foods and Nutrition*. 2<sup>nd</sup> edition, Boca Raton, Fla.: CRC Press.
- Pal, P. K., Battacharya, A. M., Das, M. K. and Bandyopadhyay, T. S. 1989.** Rapid detection of added sugar in milk. *The Indian Journal of Dairy Science* 32: 405.
- Panero, R. 1975.** New method for differentiating watered milk from low quality milk. *Revista Espanola de Lecheria*. 94: 235-238.
- Parodi, P.W. 1976.** Distribution of isomeric octadecenoic fatty acids in milk fat. *Journal of Dairy Science*, 59:98-103.
- PFA 1976.** (The prevention of the Food Adulteration Rules) New Delhi.
- Rangappa, K. S. and Achaya, K. T. 1975.** Indian Dairy Science, 2<sup>nd</sup> edition, Asia Publishing House, Bombay. pp. 30.
- Takada, Y., Matsuyama, H., Kato, K., Kobayashi, N., Yamomura, J. I., Yahiro, M. and Aoe, S. 1997.** Milk whey protein enhances the bone breaking force in ovariectomized rats. *Nutrition Research*, 17: 1709.
- Talukder, O.G. M. 1989.** A study on the physical and chemical quality of milk collected from different markets and villages of trisal Upazilla. M. Sc. Thesis, Department of Dairy Science, BAU, Mymensingh.
- USPHS (United States Department of Public Health Services). 1965.** Grade “A” Pasteurized milk Ordinance.
- Walstra, P. and Jenness, R. 1984.** Dairy Chemistry and Physics. A Wiley Interscience Publication. New York. pp. 107.

**Wong, N. P., Jenness, R., Keeney, M. and. Marth, E. H. 1988.** *Fundamentals of Dairy Chemistry*. 3<sup>rd</sup> edition, New York: Van Nostrand Reinhold Co.

**Yadav, A. N. and Sarawant, B. L. 1982.** Note on the physical and chemical qualities of Markets milk in Varanasi Town, India. *Asia Journal of Dairy Research*. 1: 74-76.

**Ziegler, E. E. and Fomon, S. J. 1983.** Lactose enhances mineral absorption in infancy. *Journal of Pediatr. Gastroenterol. Nutrition*. 2: 288.

### ***Biography***

*My name is Proma Roy. My home town is Chattogram. I graduated from Dr khastogir Govt. Girls' High School in Chattogram with a Secondary School Certificate (SSC) in 2015 and from Chattogram college with a Higher Secondary Certificate (HSC) in 2017. In the 2017-18 academic year, I enrolled at Chattogram Veterinary and Animal Sciences University, Bangladesh to pursue a Doctor of Veterinary Medicine (DVM) Degree.*

*I have a keen interest in gathering knowledge about pet animal medicine and serve the country by becoming a Bangladesh Civil Service Cadre.*