CHAPTER I

INTRODUCTION

Milk is very valuable food, readily digested and absorbed. It consists of nutrients, which are needed for proper growth and maintenance of body. Milk and milk products form a significant part of the diet and a substantial amount of our food expenditures goes on milk and other dairy products. Human population of Chittagong metropolitan is over 3.5 million (www.ccc) and total estimated demand (250 ml/day/person) of fluid milk is 875000 litre/day. The amount of produced milk in this city area is very negligible against the demand. To meet the demand of fluid milk of such a huge human population different sources of fluid milk is available here namely as commercial farm milk, different distribution point and market milk of different brands though the quality of milk is beyond question. As a developing country Bangladesh is a low quantity milk producing nation having production of 2.11 million tons of fluid milk annually as per FAO statistics with per capita production of 13 kg/ capita/year. (http://www.fao.org). According to the most recent data of DLS milk production of Bangladesh is 2.27 million tons **(DLS, 2004-2005).** The total number of cattle population is 22.87 million and the total numbers of the registered dairy farms are 5364 in all over Bangladesh. (http://www.dls.gov.bd/about_us.htm).According to **FAO** statistics in 2002 Bangladesh produced 0.35 percent of total world milk production. This represents around 6.7 and 2.5 percent of the milk production of Pakistan and India respectively or less than 2 percent of the milk production of South Asia. According to Bangladesh burrow of statistics the in 1996 the total milk production was 1.57 million metric tons and demand 240 gm/person/day, where as availability is only 37 gm per capita per day (BBS, 1997). So, Most of the people of our country have been suffering from malnutrition, especially protein, calcium and vitamin deficiency. Bangladesh has to import around 250,000 tons of milk equivalents annually to satisfy national milk demand. But adding of adulterate and preservative is a great problem in Bangladesh.

Adulteration means mixing something impure with something genuine, or an inferior article with a superior one of the same kind. It usually refers to mixing other matter of an inferior and sometimes harmful quality with food or drink intended to be sold. The supplied milk is generally found adulterated **(Islam *et al.* 1984).** This adulterated milk may cause various diseases to the consumers. For this reason it is important to examine adulteration of milk in details.

The most common adulteration is to addition of water in milk but more sophisticated adulteration are practiced as e.g. adding starch or flour, cane sugar, low priced powder milk, vegetable oil etc. to increase total solids **(FAO, 1984).**The detection of the adulterants in milk has been approached by the scientists in number of ways. Firstly by knowing the physical and chemical properties (Specific gravity, water, Fat, SNF and TS) and their percentage in milk and then detect the abnormalities in proportion. In this way market milk can be examined for adulteration of water or skimming of milk (removal of fat). The variation in the standard physical property of milk helps to suspect the adulterants present in the milk. On the other hand, presence of flour, sugar, milk powder and starch can be tested chemically. Thus, the known adulterants of the milk can be detected physically and chemically.

There is a wide range of gap between production and requirement of milk. Dishonest producers, middlemen and vendors increase the volume of milk by various ways like by adding water with other solid materials. Dry milk powder and flour are usually added in milk after adulteration with water.

The natural preservatives of milk are lactoperoxidase, thiocynate and hydrogen peroxide **(FAO, 1999).** As we know the commercial life of milk ranges from 4.5 to 6 hours in our country depending upon hygienic quality of milk and environmental temperature. In order to prevent the loss of commercial life sometimes preservatives are being used in raw milk in different areas of Bangladesh. Generally hydrogen peroxide, banana leaves, water hyacinth, formalin, L.P-system, carbonates and bicarbonates, boric acid and borax etc are used. Among these some are very harmful for human health.

Objectives of the Study:

1. Detection of the physical and chemical quality of farm produced milk (FPM), different distributing point milk (DPFM) and brand milk (BM) of different areas of Chittagong Metropolitan.

2. Detection of type of adulteration in milk.

3. Detection of type of preservatives added in milk.

CHAPTER II

Materials and Methods

3.1 Collection of Sample:

Two types of sample namely farm produced milk (FPM), different distributing point milk (DDPM) and brand milk (BM) of different brands were collected from dairy farms, vendors, and retail shops, respectively from different areas of Chittagong Metropolitan.

3.1.1 Duration of Study: 3rd march to 31th March' 2020

3.1.2 Number of Samples:

A total of 65 samples were collected for this study from 6 farm milk, 4 brand milk and 5 different distributing point milk.

3.1.3 Procedure of sampling:

The samples were collected from bulk sources of milk through proper mixing. Soon after collection samples were kept in cool box for ceasing the activity of acid forming microorganism.

The farm produced fluid milk samples were collected directly from selected farms after completing milking from Khulshi area, Chittagong. The volume of each sample was 500ml.

In case of samples of different distributing point milk (DDPM) were collected from different selective point and from selective person. The volume of each sample was 500ml.

In case of the brand milk (BM) the samples were collected from retail shops, cooling corners and departmental shops of the selected area. The half litter (500ml) packets were procured in this case.

3.2 Methods followed for milk testing:

Due to the collection and sampling procedure the collected milk samples were kept in the refrezarator at 4^0 C until test were conducted. The cooled milk samples were pre warmed for few minutes to regain room temperature.

(i) Chemical composition (specific gravity, fat percentage, protein percentage, lactose percentage) was determined by Lactoster machine (Germany).

(ii) Preservative detection tests were done by Milk testing-rapid examination (ISI, 1960)

(iii) Adulteration detection tests were done by the procedure given Milk testing rapid examination (ISI, 1960)

3.3. Statistical analysis

The obtained information was imported, stored and coded according to record keeping sheet using Microsoft Excel-2013 and then exported to STATA/IC-13 (Stata Corporation College Station). The results were expressed in frequencies with percentages.

CHAPTER III

RESULTS & DISCUSSION

4.1 Physical and Chemical Quality

4.1.1.Chemical quality

4.1.1.1. Farm milk:

Table: 1 shows that the average specific gravity of farm milk is (1.030± 0.017) which ranges from 1.028 to 1.035.Highest specific gravity found in Bhuyan dairy farm (1.035±0.009) and lowest in Munna dairy farm (1.025±0.002). **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±0.33)% which ranges from 2.17% to 4.44%. Highest BF found in Liza dairy farm (4.07±0.14)% and lowest in Bondhan dairy farm (3.16±0.35)%. This results agrees with **Debnath *et al.* (2009).**

The average SNF content of farm milk is (8.34±0.57)% which ranges from 7.63% to 9.20%. Highest SNF found in Liza dairy farm (8.62±0.33)% and lowest in Bondhan dairy farm (7.95±1.010). This results agrees with **Debnath *et al.* (2009).**

The average protein content of farm milk is (3.36±0.22.)% which ranges from 2.98 % to 3.44%. Highest protein found in Liza dairy farm (3.51±0.11)% and lowest in Bondhan dairy farm (3.19±0.39). **Eckles *et al.* (1951)** stated that milk should contain 3.80% protein which agrees with our result.

The average lactose content of farm milk is (4.48±0.46)% which ranges from 4.13% to 5.09%. Highest lactose found in Bondhan dairy farm (3.51±0.11)% and lowest in Azizia dairy farm (4.38±0.095)%. **Eckles *et al.* (1951)** stated that milk should contain 4.80% lactose. Our result is little lower may be due to breed variation.

Table 1: Nutritional and chemical composition of different farm milk (mean±standard error).

Name of the farm	Specific gravity	BF%	SNF%	Protein%	Lactose%
Liza dairy farm	1.021±0.001	4.07±0.14	8.62±0.33	3.51±0.11	4.675±0.45
Bhuyan dairy farm	1.035±0.009	3.62±0.55	8.22±0.33	3.34±0.20	4.59±0.49
Munna dairy farm	1.025±0.002	4.33±0.85	8.43±0.72	3.27±0.09	4.49±0.26
Azizia dairy farm	1.027±0.002	3.69±0.41	8.50±0.48	3.47±0.30	4.38±0.09
Bondhan dairy farm	1.034±0.002	3.16±0.35	7.95±1.010	3.19±0.39	4.68±0.52
AVERAGE	1.030±0.017	3.78±0.33	8.34±0.57	3.36±0.22	4.48±0.46
Level of significance	NS	NS	NS	NS	NS

NS=Non significant

4.1.1.2. Brand milk:

Table: 2 shows that the average specific gravity of brand milk is (1.027±0.005) which ranges from 1.024 to 1.029. Highest specific gravity found in Milk vita (1.029±0.009) and lowest in Farm fresh (1.026±0.003). This results agrees with research findings of **Azad *et al.* (2007).**

The average BF content of brand milk is (3.52±0.11)% which ranges from 3.36% to 3.77%. Highest BF found in Pran (3.65±0.04)% and lowest in Arong (3.43±0.07)%. This results agrees with standards of **BSTI.**

The average SNF content of brand milk is (8.23±0.38)% which ranges from 7.63% to 8.87%. Highest SNF found in Milk vita (8.62±0.33)% and lowest in Farm fresh (7.92±0.49). This results agrees with research findings of **Debnath *et al.* (2009).**

The average protein content of brand milk is (3.22±0.12) % which ranges from 3.00 % to 3.47%. Highest protein found in Milk vita (3.42±0.09) % and lowest in Farm fresh (3.15±0.17).

The average lactose content of brand milk is (4.39±0.13) % which ranges from 4.19% to 4.83%. Highest lactose found in Milk vita (4.452±0.21) % and lowest in Farm fresh (4.25±0.13) %. **Eckles *et al.* (1951)** stated that milk should contain 4.80% lactose. Our result is little lower may be due to breed variation.

Considering above data it can easily be said that milk of Milk vita is superior and milk of Farm fresh is inferior in quality among brand milk.

Table 2: Nutritional and chemical composition of brand milk (mean±standard error).

Name of the brand milk	Specific gravity	BF%	SNF%	Protein%	Lactose%
Arong	1.026±0.001	3.43±0.07	8.13±0.25	3.15±0.164	4.41±0.13
Milk vita	1.029±0.009	3.48±0.11	8.76±0.50	3.42±0.095	4.45±0.21
Pran	1.027±0.006	3.65±0.04	8.11±0.12	3.17±0.034	4.44±0.19
Farm fesh	1.026±0.003	3.55±0.21	7.92±0.49	3.15±0.167	4.25±0.15
AVERAGE	1.027±0.005	3.52±0.11	8.23±0.38	3.22±0.124	4.39±0.17
Level of significance	NS	NS	NS	NS	NS

NS=Non significant

4.1.1.3.Different distributing point milk:

Table: 3 shows that the average specific gravity of point milk is (1.024±0.0043) which ranges from 1.012 to 1.027. Highest specific gravity found in Baddar hat (1.027±0.002) and lowest in Citygate (1.021±0.0013). This results agrees with research findings of **Debnath *et al.* (2009).**

The average BF content of point milk is (3.32±0.34)% which ranges from 2.25% to 4.5%. Highest BF found in Baddarhat (3.60±0.67)% and lowest in City gate (2.98±0.212)%. **USPHS (1965)** stated milk should not contain less than 3.25% fat which agrees with our result. Some sample showed lower value that was due to water adulteration.

The average SNF content of point milk is (6.89±0.32)% which ranges from 3.39% to 8.46%. Highest SNF found in Karnafuli bridge (7.5±0.23)% and lowest in Citygate (6.08±0.47). **Debnath *et. al.* (2009)** reported that 7.85% butterfat presents in distributing point milk. Our result showed lower value that was due to more water adulteration or breed variation.

The average protein content of point milk is (2.73±0.29)% which ranges from 1.52 % to 3.33%. Highest protein found in Karnafuli bridge (2.83±0.17)% and lowest in Citygate (2.51±0.33). **Eckles *et al.* (1951)** stated that milk should contain 3.80% protein which agrees with our result. Our result shows lower value due to water adulteration.

The average lactose content of point milk is (3.67±0.02)% which ranges from 2.11% to 4.53%. Highest lactose found in Karnafuli bridge (3.99±0.39)% and lowest in baddar hat (3.64±0.19)%. **Eckles *et al.* (1951)** stated that milk should contain 4.80% lactose. Our result showed lower value , that is due to water adulteration.

Considering above data it can easily be said that milk of Karnafuli bridge is superior and milk of Citygate is inferior in quality among distribution point milk.

Table 3: Nutritional and chemical composition of different distributing point milk (mean±standard error).

Name of the farm	Specific gravity	BF%	SNF%	Protein%	Lactose%
Citygate	1.021±0.0013	2.98±0.21	6.08±0.47	2.51±0.33	3.49±0.16
Solasahar	1.023±0.009	3.23±0.13	7.06±0.34	2.82±0.43	3.57±0.21
Baddar hat	1.027±0.002	3.52±0.67	6.90±0.24	2.76±0.22	3.64±0.19
Karnafuli bridge	1.025±0.001	3.40±0.66	7.50±0.24	2.83±0.17	3.99±0.34
AVERAGE	1.024±0.004	3.32±0.34	6.89±0.32	2.73±0.29	3.67±0.23
Level of significance	NS	NS	NS	NS	NS

NS=Non significant

Figure: 2 shows comparison of nutritional and chemical composition among farm milk, brand milk and different point milk samples from this figure it can be easily understood that farm milk is superior milk among these sample considering all parameters of nutritional and chemical composition. Besides this brand milk showed standard quality of BSTI and distribution milk showed poor quality compared to farm milk and brand milk.

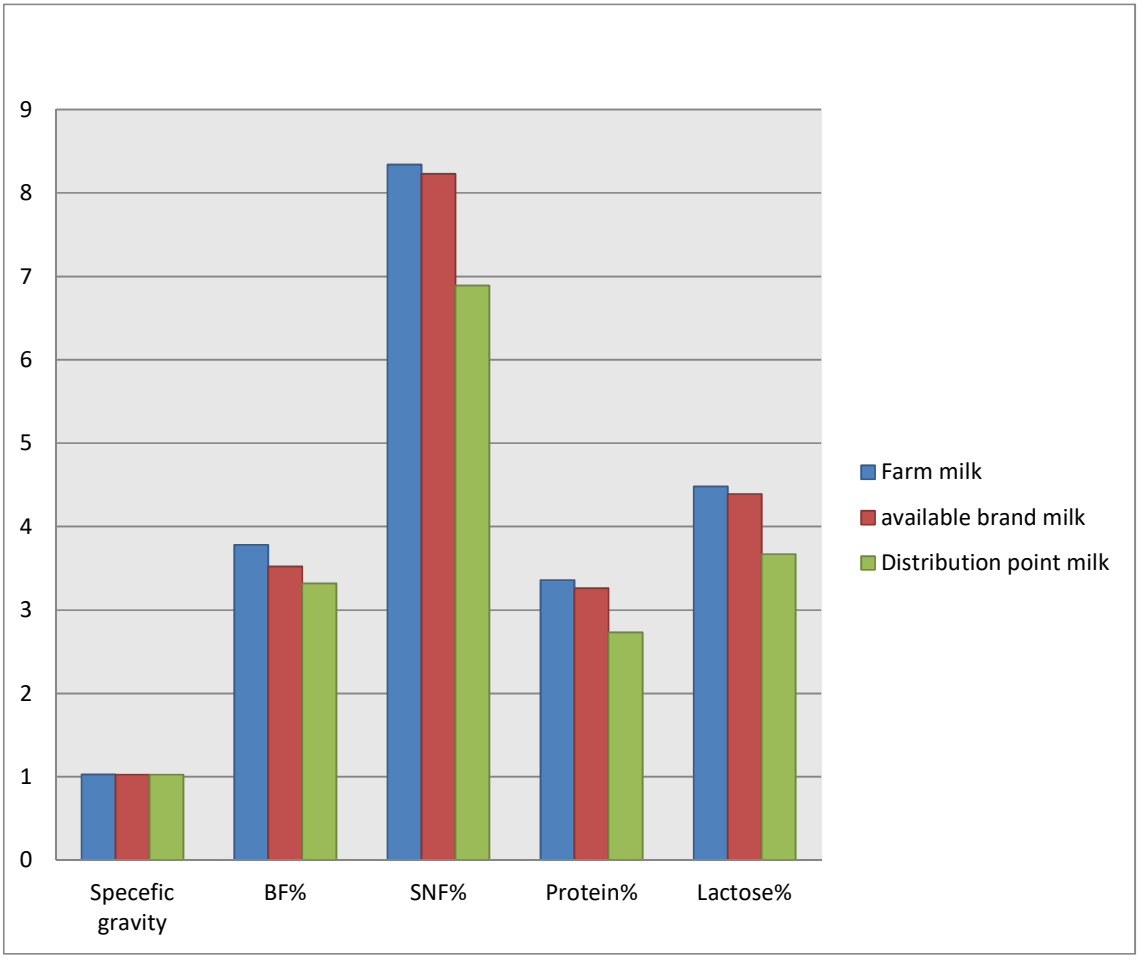

Figure 2: Nutritional and chemical comparison among farm milk, brand milk and distributing point milk

4.1.2. Adulteration

4.1.2.1. Farm milk

Table 4: shows that 40% sample of Bhuyan dairy, 25% sample of Azizia dairy, 20% sample of Bondhan farm adulterated with percentage of water added is 5%, 4%, 4.5%, respectively. Other adulteration like starch, powder milk, cane sugar not detected in farm milk.

Table 4: Adulteration status of milk collected from different dairy farms.

Name of the farms	Type of adulterants detected in the collected samples								
	Water		% of added water	Starch		Powder milk		Cane sugar	
	+ve %	-ve%		+ve%	-ve%	+ve%	-ve%	+ve%	-ve%
Liza dairy	00	100	Nil	00	100	00	100	00	100
Bhuyan dairy	40	60	05	00	100	00	100	00	100
Munna dairy	00	100	Nil	00	100	00	100	00	100
Azizia dairy	25	75	04	00	100	00	100	00	100
Bondhan dairy	20	80	4.5	00	100	00	100	00	100

4.1.2.2. Brand milk

Table:5 shows that in case of Farm fresh 20% sample adulterated with water and percentage of water added is 4%. Other adulteration not found in case of brand milk. All the brand milk maintain standard of BSTI.

Table 5: Adulteration status of different brand milk collected from market.

Name of the brand milk	Type of adulterants detected in the collected samples								
	Water		% of added water	Starch		Powder milk		Cane sugar	
	+ve%	-ve%		+ve%	-ve%	+ve%	-ve%	+ve%	-ve%
Arong	00	100	Nil	00	100	00	100	00	100
Milk vita	00	100	Nil	00	100	00	100	00	100
Pran	00	100	Nil	00	100	25	75	00	100
Farm fresh	20	80	04	00	100	50	50	00	100

Table-6: shows that all the samples collected from six different entry points were adulterated with water. The added water percentage were 18, 16, 12 and 08 in Citygate, Solasahar, Bahaddar hat, Karnafuli Bridge. The highest added water percentage (18%) was detected in Citygate sample and lowest (8%) in Bahaddar hat sample. More water adulteration in case of milk might be due to neutralize the developed acidity in milk aiming to increase the commercial life of milk as well as increase the volume of milk. This result agrees with the research findings of ***Das et al. (2010).***

Other adulteration like starch, powder milk, cane sugar not detected in farm milk .

Table 6: Adulteration status of milk collected from different collection points.

Sample Collection Points	Type of adulterants detected in the collected samples								
	Water		% of added water	Starch		Powder milk		Cane sugar	
	+ve%	-ve%		+ve %	-ve%	+ve%	-ve%	+ve%	-ve%
Citygate	100	00	18	00	100	00	100	00	100
Solasahar	100	00	16	00	100	00	100	00	100
Bahaddar hat	100	00	08	00	100	00	100	00	100
Karnafuli Bridge	100	00	06	00	100	00	100	00	100

4.1.3. Preservatives

Preservative has not found in any sample during the study. Although ***Debnath et al*** **(2009)** found 10.52% of point milk tainted with formalin in Chittagong area. Our result disagrees due to seasonal variation.

CHAPTER-IV

CONCLUSION

From the above discussion it may be concluded that nutritional quality of farm milk was excellent, most brand milk maintain standards of BSTI and different point milk was below standard quqlity of milk. Water adulteration was very common in CMA specially in different distribution point milk. No preservative found during the study period due to low temperature of the environment (temperature approximately 18_20ºC). Considering the quality, farm milk were superior, brand milk were standard according to BSTI and milk of different distributing points are inferior in quality.

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BIOGRAPHY

I am Tonmoy hridoy. I passed Secondary School Certificate examination in 2011 (G.P.A-5.00) followed by Higher Secondary Certificate examination in 2013 (G.PA-4.9). Now I am an intern veterinarian under the Faculty of Veterinary Medicine in Chittagong Veterinary and Animal Sciences University. In the future I would like to work as a veterinary practitioner and do research on clinical animal diseases in Bangladesh.