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Microbiological Quality Assessment of Raw Milk Samples Collected from Different Locations of Bangladesh

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Abstract*: *The aim of this study was conducted to evaluate an assessment of microbiological quality of milk samples collected from different locations of Bangladesh. In this study, a total of 60 milk samples were collected from Pabna, Bogra, Narsingdi and Shirajganj from June 2018 to September 2018. Four bacterial test were performed of these samples including the TVBC (Total Viable Bacterial Count), TCC (Total Coliforms Count), TFCC (Total Fecal Coliform Count) and TSC (Total Staphylococcal Count). The range of TVBC, TCC, TFCC, TSC in raw milk samples were from 2.41x10^6 to 4.58x 10^7cfu/ml,1.52 ×10^4 to 5.52×10^5cfu/ml, 1.28×$10^4$to 9.55×10^3cfu/ml, 4.09×10^3 to 9.15×10^4cfu/ml, respectively.

Keywords: Milk, Viable count, Coliform, Bangladesh.

I. INTRODUCTION

In rural and urban communities around the world, milk and milk products are suitable foods for all ages (1).Milk is a white, nutrient-rich liquid food provided by mammalian mammal glands (2).Milk components include water (87.20 percent), protein (3.50 percent), fat (3.70 percent), sugar or lactose milk (4.90 percent), ash (0.70 percent) and dry matter (12.80 percent)(3). Quality milk means milk free of pathogenic bacteria and harmful toxic substances, free of sediments and foreign substances, good taste, natural composition, sufficient to maintain quality and low in bacterial counts.Milk is mainly processed in non-organized manner in Bangladesh and is typically supplied by Goalas to consumers from urban and rural areas(4). Milk is a highly valued commodity, but raw milk contains and favors the growth of many microorganisms (5).The flavor, taste and texture of the finished types of food can be influenced by microorganisms found in milk and milk products (6). Pathogenic microorganisms are a global health issue for the contamination of milk and milk products; however, its fatal effect on human and animal health in developing countries, including Bangladesh, has not yet been thoroughly resolved except for a few studies works (7, 8). In the dairy industry, microbiological methods play an important role. They are used to protect public health and can minimize economic losses through the early identification of insufficient production, packaging or refrigeration. This can be accomplished by tracking, the microbiological consistency of raw milk supplies, bulk milk and finished milk products immediately after processing and during storage (9). As milk and milk products are very essential nutrients that benefit our health, this study was conducted with an aim of investigating the microbiological quality of raw milk samples from different areas in Bangladesh.

II. MATERIALS ANDMETHODS

1) Research lab and research period: This study was carry out in the Milk, Dairy and Fermented Food Products Research Section of Institute of Food Science and Technology of Bangladesh Council of Scientific and Industrial Research, Bangladesh from June 2018 to September 2018.
2) Collection of samples: Milk samples were procured from different districts of Bangladesh. This process included the weighing of milk and hand quality checking as per laboratory manual. 60 milk samples designated as A-01 to A-15 samples for Pabna, B-01 to B-15 samples for Bogra,C-01 to C-15 samples for Narsingdi, D-01 to D-15 samples for Shirajganj. In this study, ICMSF rules were maintained for sampling milk and yogurt (10).
3) Serial dilutions and estimation of microorganisms: Materials used in this reserach were- reagent, sample, Petri dish, distilled water, glassware, burner, spreader, conical flask etc (11). We were made up serial dilutions of samples to 10-7 in Rangers Solutions. Finally, the bacterial counts were performed by using standard method (APHA, 2001) (12).

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A. Microbiological Analysis

1) *Total Viable Bacterial Count (TVBC):* These plate count method depends on bacteria growing a colony on a nutrient medium. Sterile petridish and poured plate count agar medium are used for each dilution. After the solidification of the agar, the plate were incubated at 37°C for 24-48 hours. CFU known as colony forming units measures only viable cells.
2) *Total Coliforms Count (TCC):* Total coliform counts obtained by means of standard membrane filtration techniques, using Mac Conkey agar. After incubation of plates at 37◦C for 24 hours, typical pink colonies were counted to determine the Total Coliform.
3) *Total Fecal Coliform Count (TFCC):* Total fecal coliform count is the membrane filter method using a fine porosity filter which can retain bacteria. The filter was placed in a petri (culture) dish on a pad with growth enrichment media (mEndo).After incubation for 24 hours at 35◦C,dome-shaped colonies were counted for estimation of total fecal coliform in colony forming unit per ml (cfu/ml).
4) *Total Staphylococcal Count (TSC):* By using MacConkey agar medium and Mannitol Salt Agar medium, total staphylococcal count (TSC) were done in the same way.

III. RESULTS ANDDISCUSSIONS

A. Milk Samples

Total Viable Bacterial Count (TVBC): We know the presence of microorganisms such as bacteria in a sample by performing the test Total viable bacterial count(13). The number of colony forming units (cfu) per g (or ml) was known by counting. The number of colony represents microbial contamination during production, collection and handling. The range of TVBC of the milk samples from different district are presented in Table 1.

Table1: Microbial assessment of Milk samples collect from different locations of Bangladesh:

Sample No	Collection Point	Location	TVBC (cfu/ml)	TCC (cfu/ml)	TFCC (cfu/ml)	TSC(cfu/ml)
A-01	Banwarinagar	Pabna	4.25×10^{6}	4.42×10^{4}	5.60×10^{3}	4.55×10^{4}
A-02	Bera		3.85×10^{6}	4.89×10^{4}	6.41×10^{3}	1.29×10^{4}
A-03	Kashinathpur		5.12×10^{6}	1.42×10^{5}	7.20×10^{3}	2.10×10^{4}
A-04	Nakalia		1.15×10^{7}	8.89×10^{4}	5.60×10^{3}	3.79×10^{4}
A-05	PuranBharenga		4.15×10^{6}	6.22×10^{4}	2.83×10^{3}	4.85×10^{4}
A-06	Bhangura		6.31×10^{6}	1.89×10^{5}	8.72×10^{3}	6.73×10^{4}
A-07	Chatmohar		4.75×10^{6}	3.42×10^{4}	7.28×10^{3}	8.23×10^{4}
A-08	Debottar		1.31×10^{7}	2.19×10^{4}	3.82×10^{3}	7.80×10^{4}
A-09	Dhapari		4.15×10^{6}	3.52×10^{4}	7.98×10^{3}	4.44×10^{4}
A-10	Ishwardi		3.82×10^{6}	2.82×10^{4}	1.31×10^{3}	5.28×10^{4}
A-11	Pakshi		4.12×10^{6}	3.32×10^{4}	8.30×10^{3}	9.15×10^{4}
A-12	Rajapur		4.14×10^{6}	6.89×10^{4}	7.98×10^{3}	2.73×10^{4}
A-13	Hamayetpur		6.18×10^{6}	7.42×10^{4}	1.31×10^{3}	4.69×10^{4}
A-14	Kaliko Cotton Mills Area		4.12×106	5.79×10^{4}	8.30×10^{3}	3.23×10^{4}
A-15	PabnaSadar		4.67×10^{6}	4.61×10^{4}	7.98×10^{3}	8.23×10^{4}
B-01	Adamdighi	Bogra	3.65×10^{6}	5.12×10^{4}	8.85×10^{3}	3.74×10^{4}
B-02	Nasharatpur		4.21×10^{6}	3.82×10^{4}	3.81×10^{3}	4.24×10^{4}
B-03	Santahar		7.12×10^{6}	2.12×10^{4}	4.70×10^{3}	2.36×10^{4}
B-04	BograCanttonment		1.35×10^{7}	5.69×10^{4}	7.98×10^{3}	2.82×10^{4}
B-05	BograSadar		8.25×10^{6}	2.32×10^{4}	9.55×10^{3}	2.31×10^{4}
B-06	Dhunat		7.31×10^{6}	1.11×10^{5}	3.82×10^{3}	1.54×10^{4}
B-07	Gosaibari		5.19×10^{6}	2.32×10^{4}	6.75×10^{3}	4.72×10^{4}
B-08	Dupchachia		7.61×10^{6}	5.79×10^{4}	7.29×10^{3}	7.21×10^{4}

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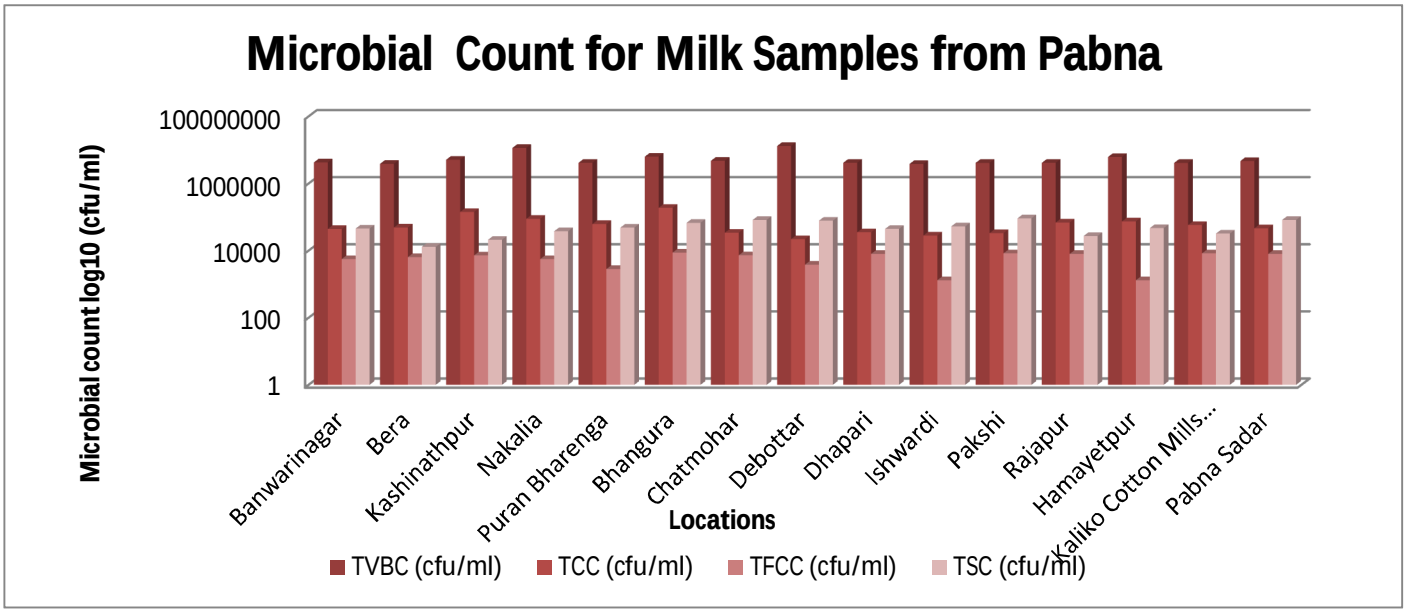
B-09	Talora		3.21×10^{6}	1.52×10^{4}	2.63×10^{3}	8.54×10^{4}
B-10	Gabtoli		4.61×10^{6}	4.22×10^{4}	8.23×10^{3}	2.19×10^{4}
B-11	Sukhanpukur		5.39×10^{6}	3.12×10^{4}	3.74×10^{3}	3.82×10^{4}
B-12	Kahalu		2.69×10^{6}	2.39×10^{4}	1.54×10^{3}	4.43×10^{4}
B-13	Nandigram		3.21×10^{6}	6.12×10^{4}	7.35×10^{3}	7.27×10^{4}
B-14	ChandanBaisha		$2..69\times10^{6}$	3.99×10^{4}	2.30×10^{3}	3.89×10^{4}
B-15	Sariakandi		3.87×10^{6}	2.81×10^{4}	9.51×10^{3}	2.44×10^{4}
C-01	Hatirdia	Narsingdi	2.51×10^{7}	4.31×10^{5}	5.60×10^{3}	4.55×10^{4}
C-02	NarsingdiSadar		3.09×10^{7}	3.02×10^{5}	2.83×10^{3}	6.73×10^{4}
C-03	Narsingdi College Area		4.15×10^{6}	2.34×10^{5}	3.82×10^{3}	8.23×10^{4}
C-04	Madhabdi		2.37×10^{7}	1.81×10^{5}	7.98×10^{3}	4.40×10^{4}
C-05	Monohordi		4.51×10^{6}	4.42×10^{4}	4.74×10^{3}	5.32×10^{4}
C-06	Karimpur		3.09×10^{7}	2.41×10^{5}	5.85×10^{3}	8.69×10^{4}
C-07	Katabaria		2.09×10^{7}	5.52×10^{5}	7.41×10^{3}	6.09×10^{4}
C-08	UMC Jute Mills Area		3.51×10^{6}	3.24×10^{5}	2.50×10^{3}	7.89×10^{4}
C-09	Raypura		4.58×10^{7}	4.01×10^{5}	3.58×10^{3}	6.49×10^{4}
C-10	Radhaganj bazar		2.41×10^{6}	2.62×10^{4}	4.81×10^{3}	7.84×10^{4}
C-11	Bazar Hasnabad		2.51×10^{7}	2.41×10^{5}	3.40×10^{3}	1.43×10^{4}
C-12	Sarkarkhana		3.09×10^{7}	5.52×10^{5}	5.31×10^{3}	2.52×10^{4}
C-13	Char Sindhur		4.15×10^{6}	3.24×10^{5}	2.80×10^{3}	4.29×10^{4}
C-14	Ghorashal		2.37×10^{7}	4.01×10^{5}	3.57×10^{3}	5.35×10^{4}
C-15	Palash		4.51×10^{6}	2.62×10^{4}	2.51×10^{3}	8.31×10^{4}
D-01	Baiddya Jam Toil	Shirajganj	8.31×10^{6}	4.35×10^{4}	2.30×10^{3}	4.24×10^{4}
D-02	Belkuchi		3.54×10^{6}	5.48×10^{4}	3.34×10^{3}	3.74×10^{4}
D-03	Enayetpur		4.12×10^{6}	8.63×10^{4}	1.85×10^{3}	4.24×10^{4}
D-04	Rajapur		5.38×10^{6}	6.78×10^{4}	2.30×10^{3}	2.36×10^{4}
D-05	Sohagpur		3.69×10^{6}	2.32×10^{4}	4.35×10^{3}	2.82×10^{4}
D-06	Sthal		7.21×10^{6}	7.77×10^{4}	6.51×10^{3}	2.31×10^{4}
D-07	Dhangora		5.65×10^{6}	5.24×10^{4}	2.50×10^{3}	1.54×10^{4}
D-08	Malonga		3.82×10^{6}	1.12×10^{5}	7.98×10^{3}	4.72×10^{4}
D-09	Gandail		2.57×10^{6}	5.38×10^{4}	1.28×10^{3}	7.21×10^{4}
D-10	Kazipur		3.82×10^{6}	6.72×10^{4}	8.55×10^{3}	8.54×10^{4}
D-11	Shuvgachha		7.82×10^{6}	6.36×10^{4}	3.82×10^{3}	2.19×10^{4}
D-12	Jamirta		4.54×10^{6}	5.13×10^{4}	5.55×10^{3}	3.82×10^{4}
D-13	Kaijuri		6.38×10^{6}	2.65×10^{4}	3.75×10^{3}	7.21×10^{4}
D-14	Porjana		4.74×10^{6}	6.78×10^{4}	5.55×10^{3}	8.54×10^{4}
D-15	Shahjadpur		6.68×10^{6}	3.55×10^{4}	5.45×10^{3}	4.09×10^{3}

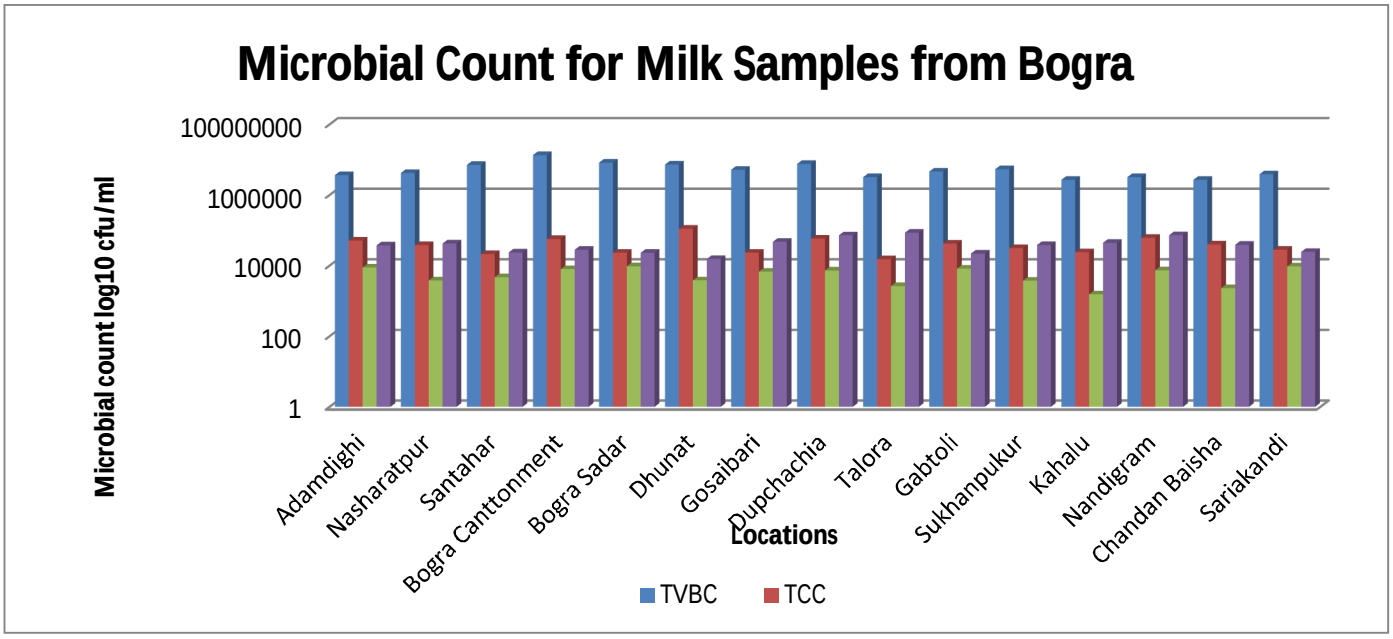
Total Viable Bacterial counts (TVBC), Total Coliform Counts (TCC), Total Fecal Coliform Count (TFCC), Total Staphylococcal Count(TSC)

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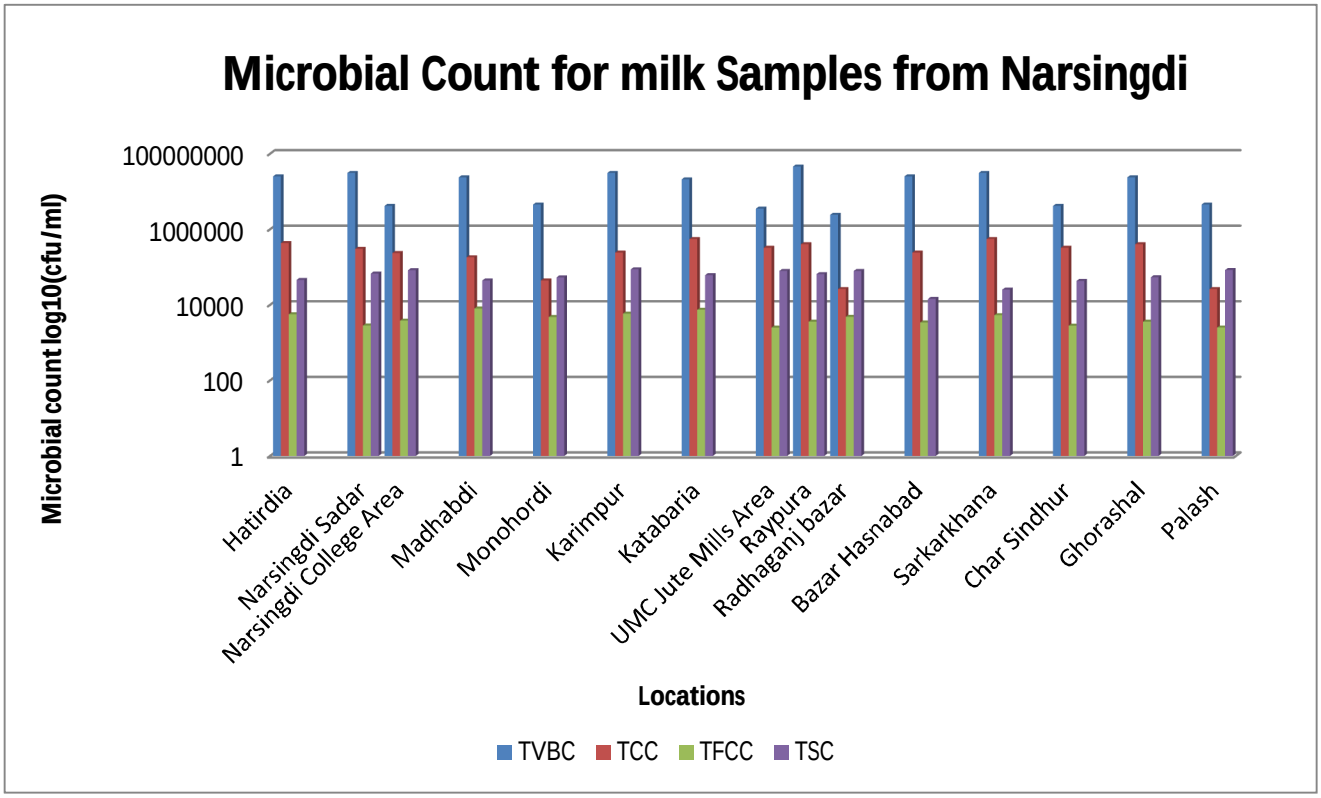
All the milk samples had high bacterial counts ranged from $2.41x10^6$ to $4.81x10^7$cfu/ml. These average values of TVBC were similar to standardrange. Lee et al. (1983) conducted an experimentin Seoul of Korea and found that the bacterial count in raw milk ranged from 4 × 106 to 2.7 × 107 per ml which were very similar as the TVBC values of this experiment(14).

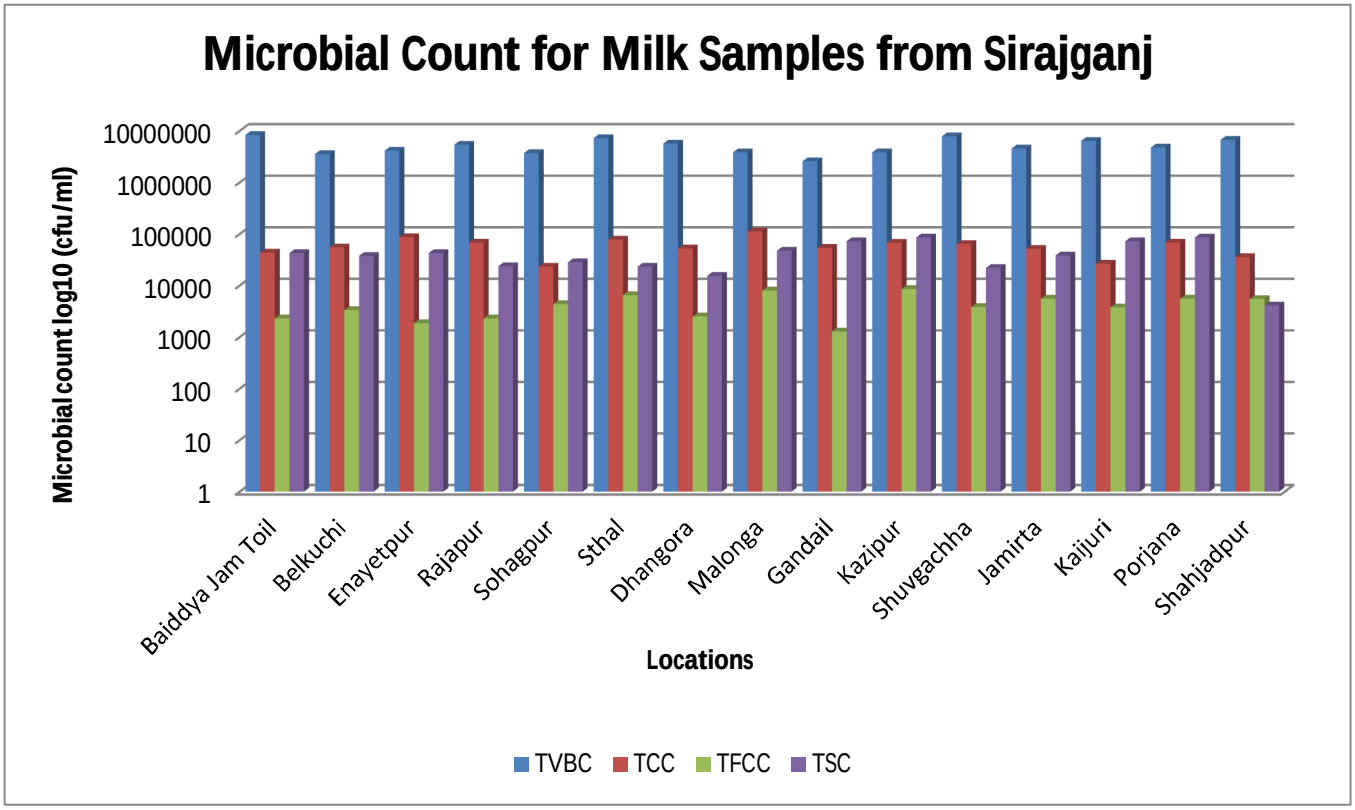
1) *Total Coliform Count (TCC):* The coliform counts of all the samples found in high range which were from 1.51×10^4 to 5.52×10^5cfu/ml (Table1). The raw milk and products were heavily contaminated by E. coli in India (15). Reasons for higher coliforms counts in raw milk may be as a result of poor hygiene, contaminated water, unsanitary milking practices and improperly washed and maintained equipment (16,17).
2) *Total Fecal Coliform Count (TFCC):* The milk samples had high fecal coliform count which were ranged from 1.28×10^3 to 9.55×10^3cfu/ml. These average values of TFCC were similar to standard range. Milk from emerging economies has been reported to contain very high coliform counts due to public health concern.
3) *Total Staphylococcal Count (TSC):* In this study, the highest value of staphylococcal count is 9.15×10^4cfu/ml and the lowest value of staphylococcal count is 4.09×10^3cfu/ml. In Italy, the raw milk and products were heavily contaminated by Staphylococcus aureus (18).This microorganism can cause food poisoning through the production of enterotoxins (19).





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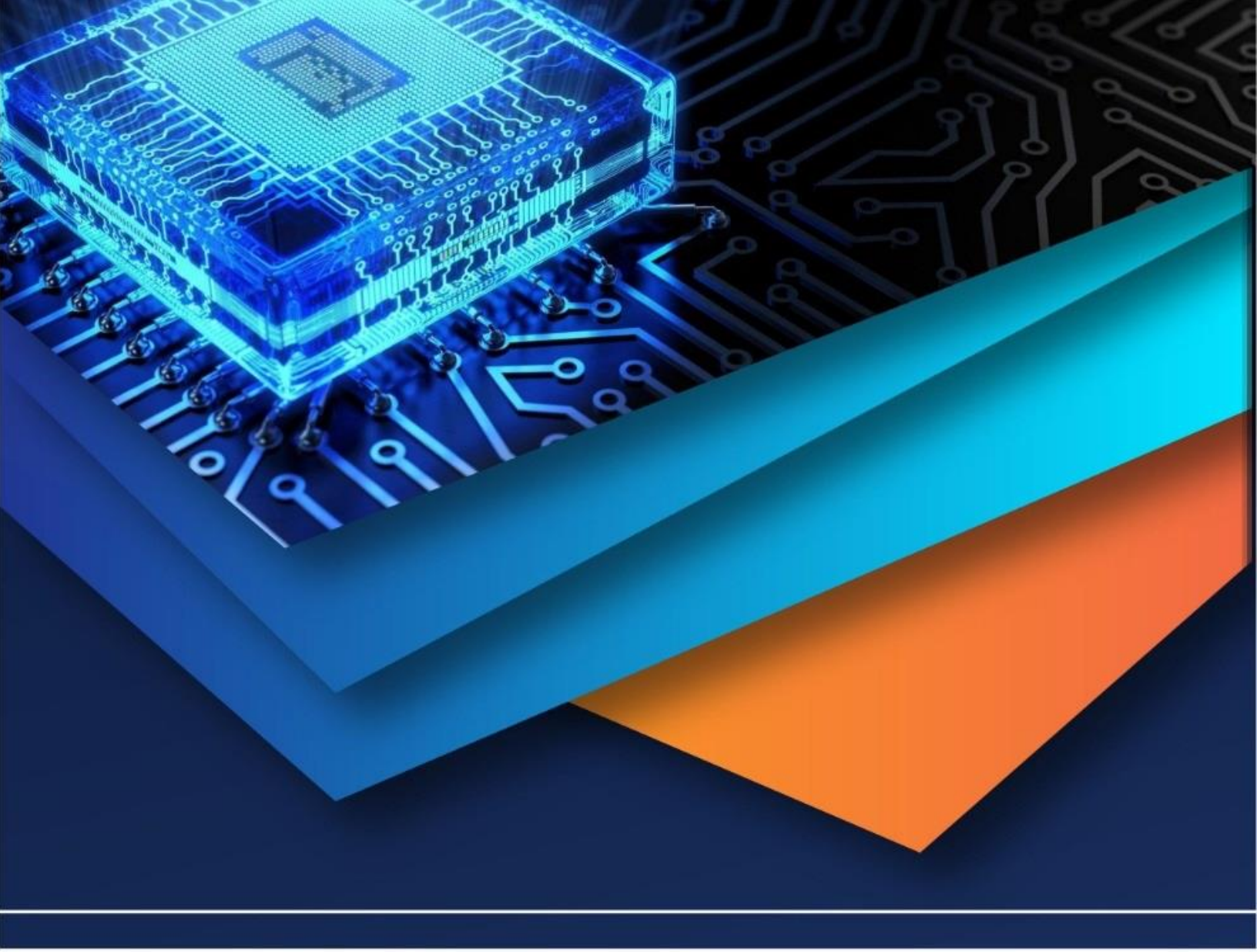
IV. CONCLUSION

Milk is packed with important nutrients& excellent source of protein. It can be concluded from the results of this study that the microbiological quality of raw milk was similar as standard quality milk. Precaution is essential during production, handling, transportation and preservation of raw milk and yogurt. Temperatures and refrigeration should be maintained properly for raw milk and yogurt. BSTI for milk is necessary to control the quality of raw milk. As it is very beneficial to our health, more studies are needed to establish standard for raw milk and milk products in Bangladesh.

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