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An Assessment of Microbiological Quality of Raw Milk and Yogurt Samples from Five Selected Districts of Bangladesh

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ABSTRACT: This study was conveyed with an aim to assess the microbiological quality of raw milk and yogurt samples collected from five selected district of Bangladesh. The milk and yogurt samples were collected from different areas of Kishoreganj, Naranganj, Shariatpur, Faridpur and Tangail districts during the period from August 2018 to September 2018. The samples were tested for the Total Viable Bacterial Count (TVBC) and Total Coliform Count (TCC) for the determination of microbiological quality. The range of TVBC and TCC in raw milk samples were 1.63×10^6 to 6.34×10^6 cfu/ml and 2.12×10^4 to 9.72×10^4 cfu/ml respectively. The range of TVBC and TCC in yogurt samples were 2.10×10^6 to 6.58×10^6 cfu/ml and 1.38×10^2 to 6.84×10^3 cfu/ml respectively.

KEYWORDS: Milk, Yogurt, Total bacterial count, Coliform, Microbiological quality, Bangladesh

I. INTRODUCTION

Milk is an important source of all basic nutrients required for mammals including human beings [1]. Milk essentially is 88% water and 12% solids. Of these solids, 4% are fat, 3.5% are protein, 4% are lactose (milk sugar) and 0.5% are minerals [2]. As an essential part of our daily diet, liquid milk plays a crucial role to meet up the increasing nutritional demand as well as ensures food safety in developing countries like Bangladesh [3]. Milk is one of the highly consumed food products around the world. Because of the consumption rate around the world it is called the "Liquid Diamond" [4]. The substances in milk provide both energy and the building materials necessary for growth [5]. Milk from various mammals are used for producing different dairy products including milk cream, butter, yogurt, ghee, sour milk, etc. Consumers always demands nutritionally enriched milk and dairy products [6]. Microbiological methods can reduce economic losses by the early detection of inadequate processing, packaging or refrigeration. This can achieve by monitoring the microbiological quality of raw milk supplies, bulk milk and finish milk products immediately after production and during storage [7]. Consumers prefer wholesome and nutritious food produced and processed in a sound and sanitary manner such that it is free from pathogens and chemical contaminants. For fulfilling consumer's demand, production of quality milk is essential [8]. Milk and Yogurt are highly perishable because it acts as an enrichment medium for growing and multiplication of the microbial community [9]. Fresh milk considered as a complete diet because it contains the essential nutrients as lactose, fat, protein, mineral and vitamins in balanced ratio rather than the other foods [10].

The purposes of this study were to investigate microbiological quality of raw milk and yogurt samples collected from five selected district of Bangladesh. Another objective of this present study was to make people aware of the milk quality they consumed every day.

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II. LITERATURE SURVEY

Various related works were available in several journals. We found that there was another publication on Microbiological Quality Analysis of Raw Milk and Yogurt Available in Some Selected Areas of Bangladesh by Hossain et al. in International Journal of Innovative Research in Science, Engineering and Technology. Besides, Evaluation of Physico-chemical Properties and Microbiological Quality of Milk Collected from Different Dairy Farms in Sylhet, Bangladesh by Abdul Kader et al. was also found. From several journals we found that precaution is necessary during production, handling, transportation and preservation of raw milk and milk products. As these districts such as Kishoreganj, Narayanganj, Shariatpur, Faridpur and Tangail are very much rich in milk production and there was no publication on Microbiological Quality Analysis of Raw Milk and Yogurt in these district, we investigate the microbiological quality of raw milk and yogurt collected from these five districts of Bangladesh.

III. MATERIALS AND METHODS

Working place and study period: In these experiments, all of the tests were done 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 August 2018 to September 2018.

Collection of milk and yogurt samples and Sampling: Twenty five raw milk samples were collected from local daily markets and twenty five yogurt samples were purchased from different yogurt shops from different areas of the Kishoreganj, Naranganj, Shariatpur, Faridpur and Tangail by using a sterile aseptic container together with ice. They were carried to laboratory with isolated iceboxes. For microbial assessment, these 25 raw milk and 25 yogurt samples designated as K-01 to K-05, N-01 to N-05, S-01 to S-05, F-01 to F-05 and T-01 to T-05 respectively from Kishoreganj, Naranganj, Shariatpur, Faridpur and Tangail. We maintain ICMSF [11] rules for sampling milk and yogurt.

Dilutions and estimation of microorganisms: Serial dilutions of samples were made up to 10^{-7} in Ringers Solutions. The bacterial counts were then performed by standard method recommended by (APHA, 2001) [12].

Microbiological Analysis: Milk and Yogurt are highly vulnerable to bacterial contamination [7]. The assessment of microbial concentration is an important step for assuring quality of milk and yogurt. There are various techniques available for detection of microorganisms. In present study, Total Viable Bacterial counts (TVBC) and Total Coliform Counts (TCC) were performed.

Total Viable Bacterial Count:

The total viable bacterial count is the number of bacteria in a sample that can grow and form countable colonies on Plate count agar after being held at 37 °C for 24 hours. TVBC is achieved by plating serial tenfold dilutions of the sample until between 30 and 300 colonies can be counted on a single plate. In this study, Total Viable Bacterial Count was performed by pour plate method. The sample (0.1ml) of each dilution was taken onto each sterile petri dish and poured plate count agar medium. The plates were then incubated at 37°C for 24 hours. After incubation period, Total viable bacterial count was measured in colony forming unit per ml (cfu/ml).

Total Coliforms Count (TCC):

Coliform count was done using MacConkey agar medium. Typical pink colonies were counted for determination of Total Coliform after incubation of plates at 37°C for 24 hours. After incubation period, Total coliforms count was measured in colony forming unit per ml (cfu/ml).

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IV. RESULTS AND DISCUSSION

Milk samples:

Total Viable Bacterial Count (TVBC): Total Viable Count (TVC) is the most common microbiological test gives a quantitative idea about the presence of microorganisms such as bacteria in a sample [13]. The highest total bacterial count were 4.49×10^6 cfu/ml, 6.21×10^6 cfu/ml, 6.34×10^6 cfu/ml, 3.62×10^6 cfu/ml and 4.35×10^6 cfu/ml which were found in samples K-02, N-02, S-01, F-01 and T-03, collected respectively from Bajitpur, Bandar, Bhedarganj, Alfadanga and Bhuapur. The lowest total bacterial count were 2.09×10^6 cfu/ml, 1.63×10^6 cfu/ml, 2.75×10^6 cfu/ml, 2.33×10^6 cfu/ml and 2.10×10^6 cfu/ml which were found in samples K-03, N-03, S-02, F-05 and T-04, collected respectively from Bhairab, NarayanganjSadar, Damudya, FaridpurSadar and Delduar. The variation in TVBC values may be due to the hygienic maintenance during production, collection, transportation and handling. With the values of TVBC to ensure about microbial contamination. There is no BDS standard for raw milks in Bangladesh. The results of Total Viable Bacterial Count (TVBC) and Total Coliform Count (TCC) of the raw milk samples are presented in Table 1:

Table 1: Microbial assessment of Milk samples collect from five selected districts of Bangladesh.

Sample No	Collection Point	Location	TVBC (cfu/ml)	TCC (cfu/ml)
K-01	Austagram	Kishoreganj	4.25×10^6	4.42×10^4
K-02	Bajitpur		4.49×10^6	3.32×10^4
K-03	Bhairab		2.09×10^6	2.20×10^4
K-04	Hossainpur		3.35×10^6	9.39×10^4
K-05	Austagram		2.45×10^6	2.62×10^4
N-01	Araihazar	Narayanganj	2.20×10^6	2.12×10^4
N-02	Bandar		6.21×10^6	3.80×10^4
N-03	NarayanganjSadar		1.63×10^6	2.26×10^4
N-04	Rupganj		2.52×10^6	5.21×10^4
N-05	Sonargaon		3.24×10^6	3.52×10^4
S-01	Bhedarganj	Shariatpur	6.34×10^6	3.42×10^4
S-02	Damudya		2.75×10^6	5.59×10^4
S-03	Gosairhat		4.22×10^6	2.72×10^4
S-04	Naria		5.17×10^6	8.89×10^4
S-05	ShariatpurSadar		4.43×10^6	2.22×10^4
F-01	Alfadanga	Faridpur	3.62×10^6	2.42×10^4
F-02	Bhanga		3.57×10^6	2.29×10^4
F-03	Boalmari		2.41×10^6	4.32×10^4
F-04	Charbhadrasan		3.17×10^6	7.36×10^4
F-05	FaridpurSadar		2.33×10^6	4.20×10^4
T-01	Gopalpur	Tangail	4.21×10^6	4.31×10^4
T-02	Basail		2.62×10^6	4.57×10^4
T-03	Bhuapur		4.35×10^6	3.24×10^4
T-04	Delduar		2.10×10^6	9.72×10^4
T-05	Ghatail		4.29×10^6	8.28×10^4

In this study, all the raw milk samples had bacterial counts ranged from 1.63×10^6 to 6.34×10^6 cfu/ml. The most frequent cause of high bacterial load is normally as a result of poor cleaning of the milking system. Aaku et al. [13] and Arenas et al. [14] have found 5.5×10^6 cfu/ml and 10^6 to 10^7 cfu/ml of the total number of microorganisms in pooled raw milk, respectively, which were nearly similar as the TVBC values of this experiment. Hossain et al. [15] conducted an experiment in India and found that the bacterial count in raw milk ranged from 1.75×10^6 to 1.22×10^8 cfu/ml which was

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Vol. 8, Issue 11, November 2019

higher than the TVBC values of this study. In Bangladesh there is no BDS standard for raw milk.

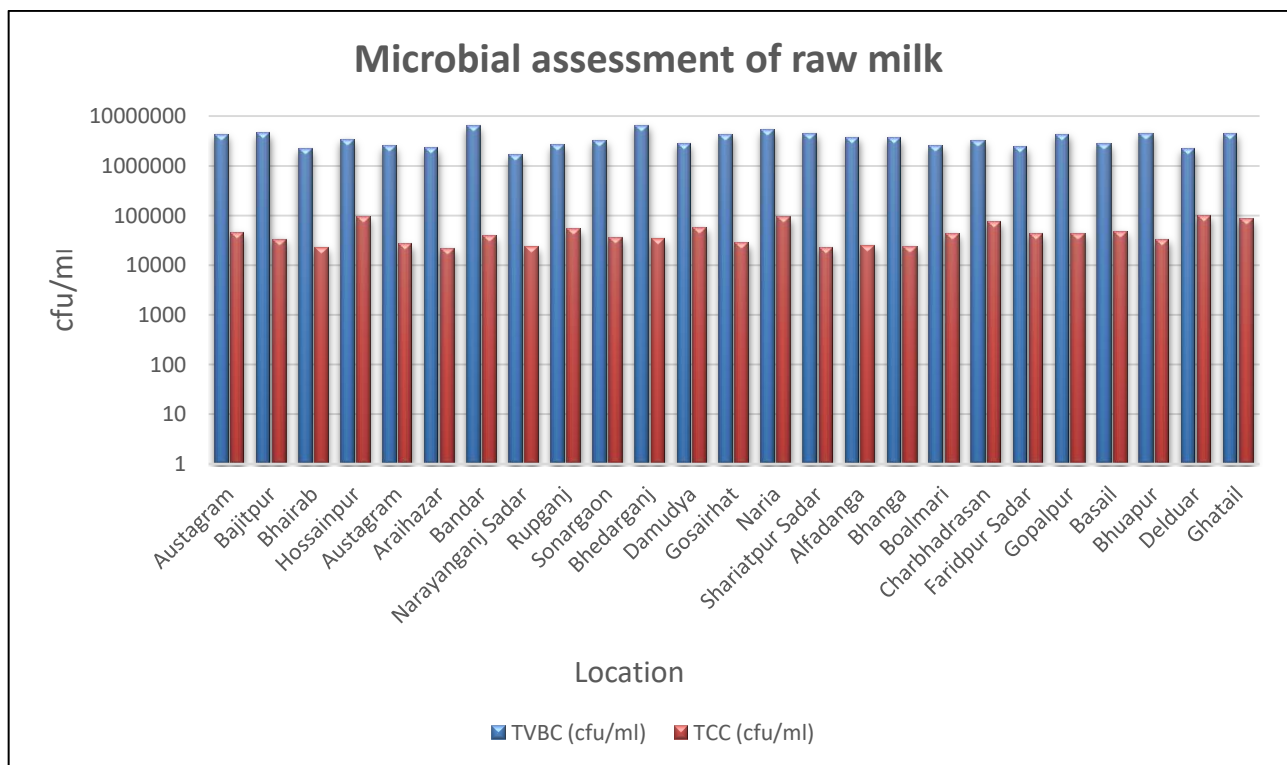


Fig1: Microbial assessment of Milk samples collect from five selected districts of Bangladesh.

Total Coliform Count (TCC): The existence of coliform bacteria, such as *E. coli*, in milk is a usual indicator of fecal contamination. In this study, the highest coliform bacterial count were 9.39×10^4 cfu/ml, 5.21×10^4 cfu/ml, 8.89×10^4 cfu/ml, 7.36×10^4 cfu/ml and 9.72×10^4 cfu/ml which were found in samples K-04, N-04, S-04, F-04 and T-04, collected respectively from Hossainpur, Rupganj, Naria, Charbhadrasan and Delduar (from table-1). The lowest coliform count were 2.20×10^4 cfu/ml, 2.12×10^4 cfu/ml, 2.22×10^4 cfu/ml, 2.29×10^4 cfu/ml and 3.24×10^4 cfu/ml which were found in samples K-03, N-01, S-05, F-02 and T-03, collected respectively from Bhairab, Araihazar, Shariatpur Sadar, Bhanga and Bhuapur. Coliforms can rapidly grow in moisture, milky residues on milking equipment and then become a major source for contamination for raw milk. All the raw milk samples had coliform counts ranged from 2.12×10^4 to 9.72×10^4 cfu/ml (Table 1) which was lower than that values obtained by Uddin et al. [16]. In the study by Uddin et al. the range of total coliform count was from 8×10^6 cfu/ml to 1.0×10^4 cfu/ml.

Yogurt Samples:

Yogurt is very sensitive to bacterial contamination. There is no specific acceptable limit of bacterial population for yogurt is available in Bangladesh. The results of Total Viable Bacterial Count (TVBC) and Total Coliform Count (TCC) of the yogurt samples are presented in Table 2:

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 8, Issue 11, November 2019

Table 2: Microbial assessment of yogurt samples collected from some selected areas of Bangladesh.

Sample No	Collection Point	Location	TVBC (cfu/ml)	TCC (cfu/ml)
K-01	Austagram	Kishoreganj	2.14×10^6	3.64×10^2
K-02	Bajitpur		3.50×10^6	4.20×10^2
K-03	Bhairab		2.10×10^6	6.84×10^2
K-04	Hossainpur		4.28×10^6	2.22×10^2
K-05	Austagram		3.68×10^6	3.74×10^2
N-01	Araihazar	Narayanganj	3.47×10^6	1.38×10^2
N-02	Bandar		5.74×10^6	4.79×10^2
N-03	NarayanganjSadar		4.27×10^6	3.83×10^2
N-04	Rupganj		3.89×10^6	4.48×10^2
N-05	Sonargaon		5.83×10^6	4.25×10^2
S-01	Bhedarganj	Shariatpur	4.25×10^6	5.63×10^2
S-02	Damudya		3.42×10^6	4.42×10^2
S-03	Gosairhat		3.62×10^6	4.92×10^2
S-04	Naria		6.58×10^6	4.75×10^2
S-05	ShariatpurSadar		2.17×10^6	4.62×10^2
F-01	Alfadanga	Faridpur	4.17×10^6	5.31×10^2
F-02	Bhanga		2.70×10^6	2.32×10^2
F-03	Boalmari		5.38×10^6	2.82×10^2
F-04	Charbhadrasan		2.58×10^6	2.27×10^2
F-05	FaridpurSadar		4.49×10^6	2.73×10^2
T-01	Gopalpur	Tangail	5.82×10^6	2.62×10^2
T-02	Basail		3.21×10^6	6.23×10^2
T-03	Bhuapur		4.81×10^6	4.67×10^2
T-04	Delduar		3.83×10^6	2.73×10^2
T-05	Ghatail		2.72×10^6	4.32×10^2

Total Viable Bacterial Count (TVBC): The yogurt samples collected from different areas of some selected district of Bangladesh showed a variable number of Total viable bacterial counts. Among the 25 yogurt samples from 5 districts, the highest total viable bacterial count was 6.58×10^6 cfu/ml which was found in sample S-04, collected from Naria of the district Shariatpur. The lowest total viable bacterial count was 2.10×10^6 cfu/ml which was found in sample K-03, collected from Bhairab of the district Kishoreganj. In this yogurt samples, TVBC ranged from 2.10×10^6 cfu/ml to 6.58×10^6 cfu/ml (Table 2). These yogurt samples had total viable bacterial counts ranged from 2.10×10^6 cfu/ml to 6.58×10^6 cfu/ml which was lower than that obtained by Abdul Matin et al. [17].

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Vol. 8, Issue 11, November 2019

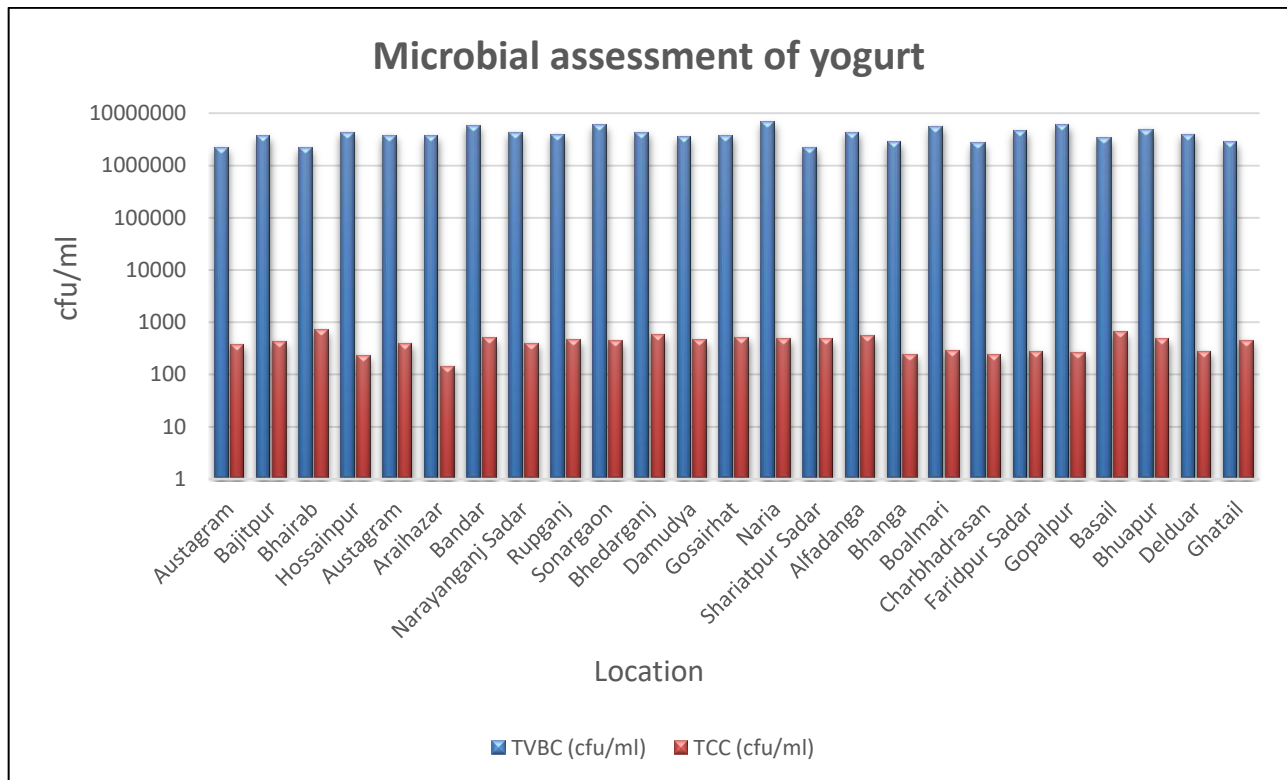


Fig 2: Microbial assessment of Yogurt samples collect from five selected districts of Bangladesh.

Total Coliform Count (TCC): Among the 25 yogurt samples from 5 districts, the highest total coliform count was 6.84×10^2 cfu/ml which was found in sample K-03, collected from Bhairab of the district Kishoreganj. The lowest total coliform count was 1.38×10^2 cfu/ml which was found in sample N-01, collected from Araihazar of the district Narayanganj. In this yogurt samples, TCC ranged from 1.38×10^2 to 6.84×10^2 cfu/ml (Table 2). This result was nearly similar as that values which was obtained by Abdul Matin et al. [18].

V. CONCLUSION

As these districts such as Kishoreganj, Narayanganj, Shariatpur, Faridpur and Tangail are very much rich in milk production so a proper investigation can be done with the raw milk and milk products. Milk and dairy products are very essential for our daily life. For this, it must be necessary to know about the quality of milk. Every shop is suggested to adopt proper healthy condition to preserve the raw milk. Proper refrigeration temperature should be maintained. Besides, BDS standard for raw milks in Bangladesh should be developed.

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Vol. 8, Issue 11, November 2019

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