

Research Article

Microbiological Quality Analysis of Buffalo Raw Milk in Northern India

Javed Ahamad Khan^{1,2*}, Ram Swaroop Rathore², Hussein Hasan Abulreesh³, Iqbal Ahmad¹

¹Department of Agricultural Microbiology, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, India

²Division of Veterinary Public Health, Indian Veterinary Research Institute (IVRI), Izatnagar, Bareilly, India

³Department of Biology, Faculty of Applied Science, Umm Al-Qura University, Makkah, Saudi Arabia

ABSTRACT

Raw milk is known excellent medium for the microbial growth. India is the world largest producer of milk. It is a highly perishable commodity and poor handling can exert both a public health and economic loss. Therefore it is requiring hygienic attention throughout the production from milking to consumer. Although freshly drawn milk from buffalo may possess temporary 'germicidal' or 'bacteriostatic' properties. At farm the microorganism in raw milk can originate from different sources such as air, milking equipment, feed, soil, faeces and contaminated water source. In the present study the microbiological quality and safety of 50 raw milk samples collected from local dairy farms in Bareilly city, India were determined. Milk samples were analyzed for Total Aerobic Plate Count (TAPC), and Total Coliform Count (TCC). The mean counts per ml for TAPC and TCC were ranged from log 4.0 to log 4.9 cfu ml⁻¹ and log 2.0 to log 2.9 cfu ml⁻¹ respectively. The coliform bacteria contaminated approximately all (n=100%) of raw milk samples and TCC were found more than the acceptable limit as standard established by the FSSAI. In developing countries including India milk processing performed under poor sanitary conditions and are not adequately monitored or regulated. Under such conditions the risk of foodborne zoonotic disease posed by milk and milk products is more and of great public concern. Therefore the good hygienic practices must be adopted strictly at farm level to consumer.

Key words: Milk; bacteriostatic; coliform bacteria; microbiological quality

Introduction

Raw milk is a major constituent of human diet and also considered as excellent medium for the growth of several microbes with resultant spoilage of the product or infections or intoxications in consumers. A number of many milk-borne epidemics and outbreaks such as tuberculosis, typhoid, diphtheria, dysentery, etc., have been occurred through consumption of milk and their product in human (Edward and Inya, 2013). These microbes may gain entry into raw milk in numerous way such as directly from dairy buffaloes

experiencing sub clinical or clinical mastitis, contaminated water source used for washing and utensils used for the storage of milk on farm or during transportation. However animal affected with mastitis might shed large numbers of micro organisms into the milk. A number of pathogenic bacteria including *S. aureus*, *Escherichia coli* and *Salmonella* spp. have been recovered from raw milk (Mistry et al., 2015).

The raw milk from healthy buffalo starts to contaminate when actually it leaves the udder. Generally, at this time it contains very low numbers of micro-organisms. Therefore bacterial contamination of raw milk is due to sanitary practices adopted at farm and indicates its sanitary quality. Various methods are available for

Received: 01.05.2018, Revised: 13.06.2018,
Accepted: 18.06.2018

*Correspondence E-mail: jakfor,ra@gmail.com

determining the bacterial contamination in milk such as Standard Plate Count (SPC) and Total Coliform Count (TCC). SPC determines total number of bacteria in a milk sample that can grow in countable colonies. The presence of coliforms in milk indicates poor hygienic condition followed during milk processing and indicates unsuitability of milk for consumption (Banik et al., 2014).

India is a pioneer in producing and exporting milk. The output of milk and milk products from India is increasing regularly in international market also. Considering its economic potential, extensive and intensive exploitation of buffalo milk can contribute to the nutrient requirements of the Indian public as well as increase in the income of farmers also. Moreover the growing public awareness about food safety and quality, knowledge of the microbial and chemical composition of milk is of great significance for further development of its hygienic processing into high quality consumer products (Singh and Shankar 2017).

Microbiological quality of milk plays an important role in ensuring both safety to the consumer as well as profit to producers also. Microbiological quality of milk is of public health concern due to milkborne zoonotic diseases such as tuberculosis, brucellosis, shigellosis and salmonellosis. There are also important pathogens of public health importance such as *E. coli* O157: H7, *Campylobacter jejuni*, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Salmonella* spp (John 2016). Due to this fact that milkborne diseases are of public health importance, there is a always need of screening the milk in informal market for the sake of consumer health protection. Till date, the information on these aspects are available but screening of food products including milk is a regular process for maintaining the quality of the products. Therefore this study was carried out to investigate the microbiological quality and safety of raw milk from buffalo locally in Bareilly city, India.

Materials and Methods

Sample collection & transportation

A total 50 raw milk samples were collected from local dairy farms and shops in Bareilly city. Milk

sample (100 ml) was collected in centrifuge tube directly from milk container and transferred to the laboratory within two hours.

Preparation of Raw meat/milk samples

The raw milk samples for microbiological analysis were prepared by serial dilution method of NF-EN/ISO 68871:1999. Briefly, milk sample (10 ml) was homogenized in sterile 0.1 % buffered peptone water (90 ml). The resulting homogenate was serially diluted using 0.1 % buffered peptone water from 10⁻¹ to 10⁻⁶ dilution.

Enumeration of micro-organisms in food samples

Enumeration of micro-organism was performed by using the standard procedures of International Organisation of Standardization (ISO) as described by BioRad (2011).

Total aerobic plate count (TAPC): The aerobic count was performed as per NF-EN/ISO 4833:2003 method. Aliquots of 0.1 ml from dilutions were plated in triplicates onto Plate Count Agar (PCA). Plates were incubated at 30°C for 72 h.

Total coliform count (TCC): Enumeration of the coliform bacteria was performed as per EN/ISO 4832:2006 method. The Violet Red Bile (VRB) agar was used for the total coliform counts. The 0.1 ml from 10⁻¹ to 10⁻⁶ serially diluted samples were plated in triplicates onto VRB agar and incubated at 37 °C for 24 h.

Results and Discussion

Enumeration of bacteria in food samples

This study reveals the microbiological standards of raw and processed milk samples from different areas in Bareilly city, India. The findings of the study are an indication about the initial bacterial loads in raw milk samples as well as how much it is safe for consumptions. Besides, different regulatory bodies may also realize the importance of frequent inspection of the market milks to ensure whether they meet the minimum microbiological standards for the consumers. According to Food Safety Standards Authority of India (FSSAI) Act 2006, Rule 2011, Standard plate count and Coliform count for raw milk should be less than log 6.3 cfu ml⁻¹ and log 1.0 cfu ml⁻¹ respectively. The total aerobic plate count for raw

milk samples (n=50) under this study were ranged from log 4.0 to log 4.9 cfu ml⁻¹. On the otherside Total coliform count were observed from various in various raw milk samples varied between log 2.0 to log 2.9 cfu ml⁻¹. The total aerobic counts from various raw milk samples are depicted in

table 1 & figure 1. Therefore, it was observed that the TAPC for all (100%) raw milk samples were found according to the standard of FSSAI. However, TCC was observed more (>log 1.0 cfu ml⁻¹) than the acceptable limit in all (100%) raw milk samples.

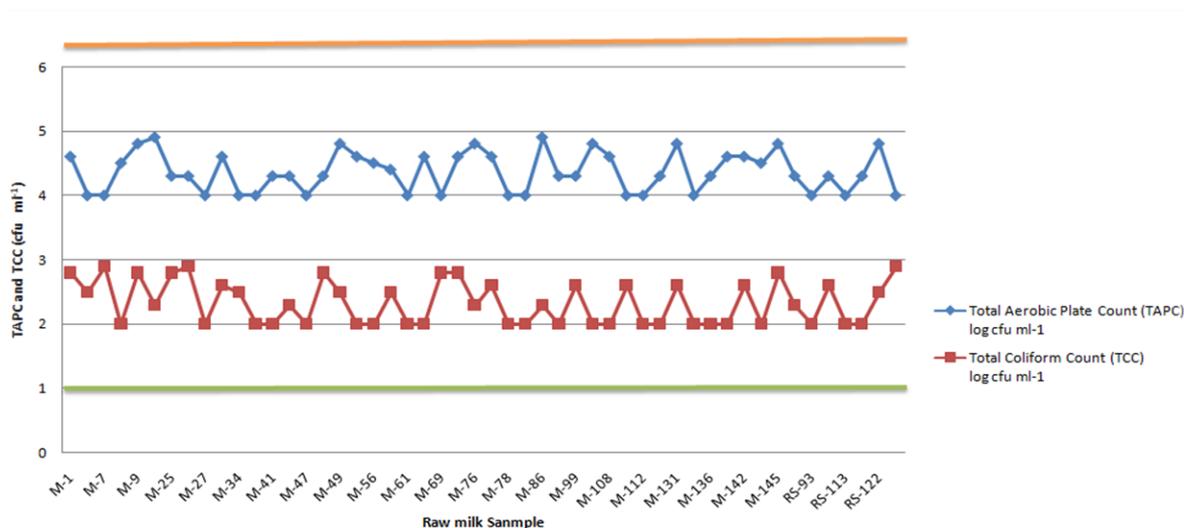


Figure 1: Total Aerobic Plate Count and Coliform Count from raw milk samples
line (-) represents TAPC (orange) and TCC (green) standards as per FSSAI

Table 1 Microbiological Count of raw milk samples screened in this study

Sample Number	Total Aerobic Plate Count (TAPC) log cfu ml ⁻¹ (Mean±SD)*	Total Coliform Count (TCC) log cfu ml ⁻¹ (Mean±SD)	Sample Number	Total Aerobic Plate Count (TAPC) log cfu ml ⁻¹ (Mean±SD)*	Total Coliform Count (TCC) log cfu ml ⁻¹ (Mean±SD)
M-1	4.6±0.2	2.8±0.1	M-77	4.6±0.1	2.6±0.1
M-4	4.0±0.1	2.5±0.2	M-78	4.0±0.2	2.0±0.2
M-7	4.0±0.1	2.9±0.2	M-83	4.0±0.2	2.0±0.2
M-8	4.5±0.2	2.0±0.2	M-86	4.9±0.2	2.3±0.2
M-9	4.8±0.2	2.8±0.3	M-88	4.3±0.1	2.0±0.1
M-23	4.9±0.2	2.3±0.2	M-99	4.3±0.1	2.6±0.1
M-25	4.3±0.3	2.8±0.2	M-103	4.8±0.2	2.0±0.2
M-26	4.3±0.3	2.9±0.2	M-108	4.6±0.2	2.0±0.2
M-27	4.0±0.2	2.0±0.1	M-111	4.0±0.1	2.6±0.2
M-31	4.6±0.2	2.6±0.2	M-112	4.0±0.2	2.0±0.2
M-34	4.0±0.2	2.5±0.2	M-126	4.3±0.1	2.0±0.1
M-38	4.0±0.1	2.0±0.2	M-131	4.8±0.2	2.6±0.2
M-41	4.3±0.2	2.0±0.3	M-132	4.0±0.2	2.0±0.1
M-46	4.3±0.2	2.3±0.2	M-136	4.3±0.2	2.0±0.1
M-47	4.0±0.3	2.0±0.2	M-139	4.6±0.3	2.0±0.1
M-48	4.3±0.2	2.8±0.1	M-142	4.6±0.1	2.6±0.2
M-49	4.8±0.2	2.5±0.1	M-144	4.5±0.2	2.0±0.2
M-53	4.6±0.1	2.0±0.1	M-145	4.8±0.1	2.8±0.2
M-56	4.5±0.2	2.0±0.1	RS-84	4.3±0.2	2.3±0.2
M-58	4.4±0.2	2.5±0.2	RS-93	4.0±0.3	2.0±0.1
M-61	4.0±0.1	2.0±0.2	RS-102	4.3±0.3	2.6±0.1
M-63	4.6±0.2	2.0±0.2	RS-113	4.0±0.2	2.0±0.1
M-69	4.0±0.2	2.8±0.2	RS-116	4.3±0.1	2.0±0.1
M-74	4.6±0.1	2.8±0.2	RS-122	4.8±0.2	2.5±0.2
M-76	4.8±0.1	2.3±0.1	RS-127	4.0±0.2	2.9±0.2

The presence of coliform in milk is a common indicator of faecal contamination. The cause for higher coliforms counts in raw milk may be considered as a result of poor hygienic conditions. In developing countries including India raw milk is traditionally produced at the small farms and hygienic conditions and practices are not always followed sufficiently. The unsanitary utensils, flies and polluted water supplies and hygienic conditions of hands of dairy workers may participate in contamination of milk at farm. The delayed in milking process lead also to grow the microorganisms and consequently risk of contamination occurs even greater (Sarkar 2016).

Conclusion

Therefore, the results obtained in this study indicate that the microbiological quality of raw milk samples collected from different areas of Bareilly city were not satisfactory as indicated by presence of high coliform bacteria and a significant amount of unsafe raw milk is regularly transferring to the population. The accomplishment of hygienic practices in dairy farm directly influences the economic through production and health safety perspectives in human beings. It is therefore critically important to ensure high quality raw milk production from healthy animals under good hygienic conditions and to apply control measures to protect human health from various milkborne diseases. Therefore, it is recommended that training and guidance should be given to farms workers and owners responsible for milking process. Meanwhile, more information on health hazards associated with contaminated raw milk should be extended actively to the consumers so that consumption of untreated/improperly treated raw milk could be avoided.

Acknowledgement

Authors are grateful to Director, IVRI, India, for providing facilities during this investigation. We are also thankful to Dr. SVS Malik (Former Head of the Veterinary Public Health Division) and Dr. (existing Head, Head of the Veterinary Public

Health Division) for continuous support during the investigation.

References

- Banik KS, Das KK And Uddin MA (2014). Microbiological quality analysis of raw, pasteurized, UHT milk samples collected from different locations in Bangladesh. *Stamford Journal of Microbiology*, 4(1):5-8.
- BioRad (2011). Biosafety. Guide for bio-Rad products in food testing. http://www.biorad.com/webroot/web/pdf/lsr/literature/17933_Food_safety_v3.pdf.
- Edward, KC and Inya IM (2013). The Microbial Quality of Raw Milk from four locations in Abia State, Nigeria. *Journal of Pharmacy and Biological Sciences*, 5(3):30-33
- FSSAI (2011). Food Standard Authority of India. Notification. Chapter 1. PartIII, Volume 4.
- John MN (2016). Microbiological and compositional quality of raw milk delivered by small scale dairy farmers to the milk collection centres in Hai district, Tanzania. Master's dissertation submitted at Department of Animal Science, Faculty of Agriculture, University of Zimbabwe.
- Mistry TB, Patel ND and Shaikh NM (2015). Bacteriological Quality of Raw Buffalo milk from different villages in Bardoli, Gujarat, India . *International Journal of Current Microbiological and Applied Sciences*, 4(4): 874-884
- Sarkar S (2016). Microbiological Safety Concerns of Raw Milk. *Journal of Food Nutrition and Dietetics* 1(2):1-7.
- Singh KS and Shankar U (2017). Microbiological Study of Raw Milk Collected from Local Milk Vendors of Lucknow District, UP, India. *International Journal of Current Microbiological and Applied Sciences*, 6(5): 2866-2873.

How to Cite This Article:

Javed Ahamad Khan, Ram Swaroop Rathore, Hussein Hasan Abulreesh, Iqbal Ahmad. 2018. Microbiological quality analysis of buffalo raw milk in northern India. *Ind. J. Biotechnol. Pharma. Res.* 6(2): 1-4.