Advances in Animal and Veterinary Sciences 1 (1S): 20 – 22
Special issue-1 (Veterinarians approaches for safeguarding animal health and production)
http://www.nexusacademicpublishers.com/journal/4

Short Communication

Microbiological Quality of Raw Milk Samples in Bareilly City, India

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ARTICLE HISTORY

Received: 2013-07-30
Revised: 2013-08-07
Accepted: 2013-08-07

Key Words: Bovine raw milk; total aerobic plate count; total aerobic plate count; *L. monocytogenes* count

ABSTRACT

India is highest producer of raw milk and dairy products in all over the world. It is also one of the largest exporter of dairy products. The quality of these dairy products including raw milk should be examined regularly for maintaining the good hygienic qualities of these products. However, In India, the limited study is available on microbiological quality of raw milk. Therefore the microbiological quality and safety of raw milk from different dairy farms and dairy shops in Bareilly city (Northern India) was examined. Bovine raw milk samples (n = 150) were aseptically collected and analyzed for several microbial quality attributes including total aerobic plate count (TAPC), total coliform count (TCC), and *L. monocytogenes* count (LC). The mean log counts for TAPC, TCC were observed in between 3.3–5.9 cfu/mL and 1.6–3.8 cfu/mL respectively. The LC of two samples, found positive for the presence of *L. monocytogenes*, was 3.8 cfu/mL and log 4.0 cfu/mL. Results indicated that the security of raw milk is hampered due to high microbial counts and, under the present conditions; the population is on potential health risk while consuming raw milk sold in Bareilly. Therefore, food regulatory agencies should take serious considerations to reduce the microbial contamination in raw milk at dairy farms and shops.

ARTICLE CITATION: Khan JA, Rathore RS, Khan S and Ahmad I. (2013). Prevalence, characterization and detection of *salmonella spp.* from various meat sources. Prevalence of *salmonella spp.* from various meat sources. *Adv. Anim. Vet. Sci.* 1 (1S): 20 – 22.

Food safety has been recognized as major issue with international trade and public health implications globally. Countries from all over the world have increased their efforts to improve food safety in response to increasing number of food borne illnesses. Numerous epidemiological reports have marked non–heat treated milk and raw–milk products as the major factors responsible for illnesses caused by food–borne pathogens (De Buyser et al. 2001; Vemula et al. 2012). A variety of bacteria including *Escherichia coli*, *S. aureus* and *Salmonella spp.* have been recovered from raw milk and some of these have been determined to be pathogenic and toxigenic, and implicated in milk borne gastroenteritis. *L. monocytogenes* has been frequently reported in milk and milk products and associated with many outbreaks from all over the world. The importance of various etiological agents in milk borne disease has changed dramatically over time. However, more than 90% of all reported cases of dairy related illness linked to be of bacterial origin (Adzitey and Huda, 2010; Lingathurai and Vellathurai, 2010).

In most of the region in India, milk is produced in traditional way by hand milking, handled and transported under low hygienic measures. Keeping fresh milk at an elevated temperature together with unhygienic practices during the milking process may also result in poorer microbiologically quality of raw milk. These are common practices in small–scale dairy farm producers in Asia and they are selling it to the consumers. Cross–contamination with pathogenic micro–organisms of raw milk may be either by faecal contamination or by direct excretion from the udder into milk (Roopnarine et al. 2007). Furthermore, India is the largest producer of dairy products by volume in all over the world. It also has the world's largest dairy herd. Since from 2001, under the implementation of Operation Flood Programme, India has become a net exporter of dairy products and export has increased at a fast rate (Singh, 2011). However, there is a limited data on the microbial assessment of raw milk. Therefore, in these situations, it is of utmost importance to determine the present hygienic status of the raw milk.

The aim of the present study was to assess the microbial quality of raw milk in Bareilly city, India using some microbiological quality attributes including total aerobic plate count (TAPC), total coliform count (TCC) and *L. monocytogenes* count (LC).

A total of 150 bovine raw milk samples (100 ml each) were collected from local dairy farm and dairy shops in Bareilly city as per method of Bacteriological Analytical Manual Online, USFDA described by Andrews and Hammack (1998). Enumeration of aerobic bacteria, coliforms and *L. monocytogenes* was performed by using the standard procedures of International Organisation of Standardization (ISO) described in BioRad (2011).

The raw milk samples were prepared by serial dilution as per method of NF–EN/ISO 6887–1:1999 (http:// www. biorad. com/ webroot/web/pdf/lsr/literature/ 17933_Food_ safety_v3.pdf). Briefly, raw milk sample (10 mL) was mixed with 90 mL of sterile 0.1% buffered peptone water. The resulting homogenate was serially diluted from 10^{-1} to 10^{-6} dilution in 0.1 % buffered peptone water. The aerobic count was performed as per NF–EN/ISO 4833:2003 method (http:// www.

ISSN: 2307–8316 (Online), ISSN: 2309-3331 (Print)

biorad. com/ webroot/web/pdf/lsr/literature/ 17933_Food_ safety_v3.pdf). Aliquot of 0.1 mL from each dilution was plated in triplicates onto plate count agar (PCA) (Hi Media, India). Plates were incubated at 30°C for 72 h.

Enumeration of the coliform bacteria was performed as per EN/ISO 4832:2006 method (http:// www. biorad. com/ webroot/web/pdf/lsr/literature/ 17933_Food_ safety_v3.pdf). The 0.1 mL from 10^{-1} to 10^{-6} serially diluted samples were plated in triplicates onto Violet Red Bile (VRB) agar and incubated at 37 °C for 24 h.

L. monocytogenes count among various milk samples was enumerated as per ISO 11290–2A1:2005 method (http:// www. biorad. com/ webroot/web/pdf/lsr/literature/ 17933_Food_ safety_v3.pdf). The 0.1 mL from 10^{-1} to 10^{-6} serially diluted sample was plated in triplicates onto ALOA agar (Biolife, Italiana, Italy). The agar plates were incubated at 37°C for 24 h. The TAPC for various milk samples varied from log 3.3 to log 5.9 cfu/mL. Out of 150 raw milk samples analyzed, 134 (89.3%) samples showed count between log 4.0 to log 4.9 cfu/mL, whereas, 13 (8.6%) showed the count between log 5.0 to log 5.9 cfu/mL. Only 3 (2.0%) samples showed the count between log 3.0 to log 3.9 cfu/mL (Figure 1). As per FAO WHO (2000) guideline, the permissible limit for total viable count in raw milk is log 5.0 (10^5 cfu/mL). Therefore, in considerable percentage of samples, the TAPC counts were found beyond the permissible limits with the maximum value of log 5.9.

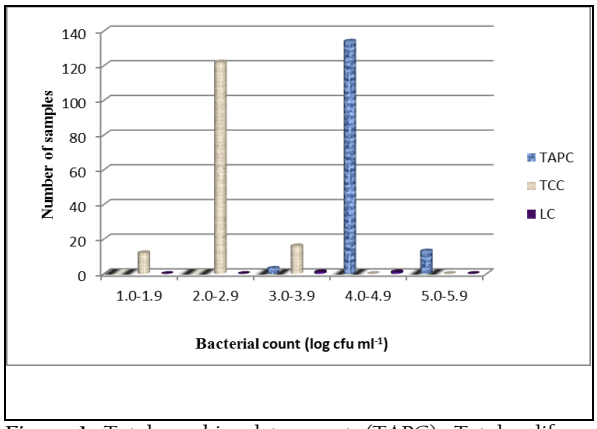

Figure 1. Total aerobic plate count (TAPC), Total coliform count (TCC) and *L. monocytogenes* count (LC) in raw milk samples.

The TCC observed from various raw milk samples varied between log 1.6 to log 3.8 cfu/mL. Majority of raw milk samples (n = 122, 81.3%) showed count between log 2.0 to log 2.9 cfu/mL. The count between log 3.0 to log 3.9 cfu/mL was exhibited by 16 samples (10.6%), whereas, few samples (n =12, 8.0%) showed the count between log 1.0 to log 1.9 cfu/mL (Figure 1). The acceptable limit for coliform is log 1.0 (10 cfu/mL) from raw milk (FAO WHO, 2000). Therefore, in the present study, all milk samples were showing the presence of coliforms more than log 1.0 which is unacceptable.

The findings of our study were in close concord with the some other earlier related studies conducted in India and other parts of world. Nanu et al. (2007) revealed the total viable count and coliform count between log 6.1 – 6.5 log cfu/mL and log 2.97 – 3.20 cfu/mL respectively in raw milk from three farmer societies in Kerala whereas Lingathurai and Vellathurai (2010) reported total viable count and coliform count between log 7.0 to 8.0 cfu/mL and log 3.0 to log 4.0 cfu/mL respectively from raw milk samples in Madurai. However, El–Diasty and El–Kaseh (2008) has reported a higher mean value of total plate count and coliform count of log 5.0 to 6.0 cfu/mL and log 6.8 MPN/mL in raw milk from Libya. This higher contamination of coliform may be attributed to differences in environmental conditions.

Among all the raw milk samples screened, only 2 (1.3%) samples found positive for the *L. monocytogenes* and showed the count of log 3.8 cfu/mL and log 4.0 cfu/mL. In India, the low incidence of *L. monocytogenes* in milk as obtained in this study has also been reported by Bhilegaonkar et al. (1997) and Barbuddhe et al. (1997).

The presence of coliforms immediately after production is an indication of presence of faecal contamination which is from the water used for the washing of the utensils and human contamination by handlers. On the other hand *Listeria* contamination in milk may due to direct contact with contaminated sources in the dairy farm environment and excretion from the udder of an infected animal, (El Zubeir and Ahmed, 2007). Water and the environment may have played major role in contamination of the raw milk, especially during washing of the udder and milk collecting containers (Batool et al. 2012).

Therefore, the results obtained in this study indicate that a significant amount of unsafe raw milk is regularly being consumed by the population. Therefore, it is suggested that implementation of Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) should be ensured and periodical inspection must be done by food quality specialists on the dairy farms and shops to minimize the milk contamination and, to maintain the good quality of raw milk for consumption of human being.

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ISSN: 2307–8316 (Online), ISSN: 2309-3331 (Print)