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MICROBIOLOGICAL QUALITY ASSESSMENT OF RAW MILK

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Abstract
Milk is product with great nutritional value. It is white liquid produced by the mammary glands of mammals. It is the primary source of nutrition for infant mammals. Because of its chemical composition and nutritional value, milk is an excellent medium for microbial growth.
The aim of this study was to evaluate microbial quality of raw milk. In the study were evaluated 30 samples of raw milk collected from local individual farms and were transported at +6°C to the laboratory for assessment of microbiological quality through determination of total bacterial count. The obtained results of this study showed that microbiological quality of raw milk depends on the implementation of good hygienic practice. For dairy industry products, high quality of raw materials is essential. Milk testing and quality control is an essential component of any milk processing industry.

Keywords: raw *milk, microbiological quality, total bacterial count*

Intoduction

All foods have the potential to cause food borne illness, and milk is no exception. Milk is a rich and convenient source of nutrients. It is a highly perishable commodity, vulnerable to spoilage and consequently health risk to consumers if is not properly handled from production to the consumer in the value chain (Schooman and Swai, 2011). Milk is an important source of Ca, P, riboflavin, vitamin B12, and high-quality proteins. The composition of milk makes it good media for the outgrowth of microorganisms. Because of the specific production it is impossible to avoid contamination of milk with microorganisms therefore the microbial content of milk is a major feature in determining its quality (Rogelj, 2003). Bacterial contamination of raw milk can originate from different sources: air, milking equipment, feed, soil, faeces and grass. The number and types of microorganisms in milk immediately after milking are affected by factors such as animal health and equipment cleanliness, season, and feed (Coorevits et al., 2008; Rogelj, 2003; Torkar and Teger, 2009).

Dairy animals may carry pathogenic microorganisms. Pathogens present in milk may increase the risk of causing food borne illness. Moreover, the milking procedure, subsequent pooling and the storage of milk carry the risks of further contamination from man or the environment or growth of inherent pathogens.

Pathogenic microorganisms may enter the milk directly via the udder of a diseased or infected animal or indirectly during the milking process due to contamination from the udder and teat canal, from the environment, from contaminated equipment, or from workers.
The key risk factors that may affect the status of raw milk on farm are summarized in Table 1.

Table 1. Farm risk factors impacting on raw cow milk safety*

Risk factor	Impact on milk safety	Ways of managing the risk
Disease	Diseased milking animals will show increased shedding of pathogens directly into raw milk or faces which may contaminate the production and milking environment. Infected animals with no signs of disease (asymptomatic carriers) may also harbor and shed pathogens, often intermittently, into milk and faces.	Animal health (including mastitis) control program.
Housing and husbandry	Intensive housing practices may increase the risk of contamination of udders due to high stocking density, concentration of waste, stress and soiled bedding.	Animal welfare
Feces	Feces may contaminate the exterior of the udder and introduce pathogens into raw milk	Udder hygiene at milking.
Feed	Poor nutritional practices will affect animal scouring	Control of preparation, storage and distribution of feed.
Water	Contaminated water used for stock drinking	Ensuring water quality
Milking	Poor milking practices, including dirty, chapped or cracked udder, inadequate cleaning and maintenance of milking equipment, and poor personnel hygiene of farm workers can lead to contamination of raw milk.	Pre and post milking treatment of with udder emollients/antiseptic. Effective equipment maintenance, sanitation and cleaning practices.
Storage	Inappropriate temperature control of raw milk after milking can lead to growth of pathogens.	Rapid cooling and holding of milk at adequate temperature.

* According Microbiological risk assessment of raw cow milk (2009); Risk Assessment Microbiology Section *In* Food Standards Australia New Zealand.

A wide range of pathogenic microorganisms have been found in raw milk, and many have been responsible for causing outbreaks of foodborne illness. Milk-borne and milk-product borne outbreaks represent 2–6% of bacterial food-borne outbreaks reported by surveillance systems from several countries (De Buyser et al., 2001).

Microbial quality of milk is defined by a number of bacteria present in milk. The high bacterial count as well as the presence of pathogenic bacteria in milk not only degrades the milk quality and shelf-life of milk or milk related products but also poses a serious health threat to consumers (Yuen *et al*, 2012).

Material and methods

Examination for the presence and number of specific microorganisms is an integral part of any quality control or quality assurance plan. This study was carried out to investigate the quality of raw milk.

The objective of the work was to evaluate the level of microbiological contamination of raw milk samples taken from farm cooling milk tanks. A total of 30 raw milk samples from 30 individual farms were analyzed. Samples were collected in sterile bottles and transported to the laboratory in cold chain under temperature at 6°C and analyzed within 2 hours of sampling. Assessment of microbiological quality of raw milk samples was done through determination of total bacterial count (TBC) using MKC EN ISO 21187:2004 method and by enumeration of somatic cells using method MKC EN ISO 13366/2:2006.

Results and discussion

The main factors determining the quality of raw milk are the total bacterial count and enumerations of somatic cells. The milk obtained from healthy dairy animals contains a small number of bacteria.

Obtained results of this study have shown low microbiological contamination of analyzed samples with mean value of total bacterial count (TBC) of 325.000 CFU/mL and mean value of number of somatic cells 218.000 /mL.

According results and the National Regulative (Official Gazette of R. North Macedonia 151/2011) analyzed samples of milk can be classified as I class milk.

Table 2. Assessment of microbiological quality of raw milk

Total bacterial count	325.000 CFU/mL
Enumeration of somatic cells	218.000 somatic cells/mL

After milking, milk is cooled, which additionally influence the dynamic of microbial process. Organisms unable to grow at refrigeration temperatures remain at low numbers, implying that temperature is an important factor contributing to the prevalence and proliferation of specific organisms in the milk. According literature data the conditions during storage and transport in refrigerated tanks cause the raw milk microbiota to change from predominantly Gram-positive to predominantly Gram-negative microorganisms as they grow. Gram-negative bacteria usually account for more than 90% of the microbial population in cold raw milk that has been stored. The Gram-negative flora is composed mainly of psychrotrophic species of *Pseudomonas, Achromobacter, Aeromonas, Serratia, Alcaligenes, Chromobacterium, Flavobacterium and Enterobacter* (Garcia-Armesto et al., 1997; Martins et al., 2006; Sørhaug et al., 1997; Ryser, 1999; Torkar and Teger, 2009).

To avoid the increase of the number of microorganisms the European Regulative 853 (2004) recommends that immediately after milking, milk must be held in a clean place designed and equipped to avoid contamination. It must be cooled immediately to not more than 8°C in the case of daily collection, or not more than 6°C if collection is not daily. During transport the cold chain must be maintained and on arrival at the establishment of destination, the temperature of the milk must not be more that 10°C (Regulation EC 853, 2004).

The microbiological quality of milk is affected by storage temperatures and time taken in milk transporting. The longer the time taken to transport the milk, the more likely the milk is going to spoil. The rate of cooling and milk handling procedures during and after milking are also important in determining the quality of milk (John, 2016).

Conclusions

The safety of raw cow milk is influenced by a combination of management and control measures along the entire dairy supply chain. Control of animal health, adherence to good milking practices, and control over milking parlor hygiene are important in reducing the microbial load in raw milk.

Producers should ensure that good agricultural, hygienic and animal husbandry practices are employed at the farm level. Therefore, implementing the proper hygienic control is essential to ensure the safety and suitability of milk for its intended use.

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