

8. Summary

The microbiological quality of raw and sour milk from local markets and smallholder dairy farms and associated potential risk for public health in The Gambia

Milk is considered as being an attractive source of energy, proteins and calcium especially for children in developing countries, who have only few alternatives for these nutrients. But milk is equally suitable for the growth of spoilage and pathogenic bacteria and can be the vehicle for the transmission of bacterial, viral and parasitic diseases. Pathogens in milk can derive from the cow but also from the milker or the environment. In The Gambia, as in other West-african countries, cows are milked by hand, after the stimulation of milk let-down by a suckling calf. Water is usually not available at the milking place and neither the milker's hands nor the udder is cleaned before milking. Milking equipment and containers are inadequately rinsed with cold water. The lack of cooling facilities and long distances between producers, traders and consumers provide optimal conditions for the growth of bacteria.

The objective of this study was the identification and quantification of bacterial contaminants and pathogenic agents in milk at producer's, trader's and vendor's level and the comparison with hygiene standards of the European Union and Kenya. Results of this investigation were used to evaluate the potential risk for consumers in The Gambia. This is particularly important in countries such as The Gambia, where the public health infrastructure is insufficient and the public awareness for health risks related to food is more or less inexistant.

Four local markets in different Divisions were selected and milk vendors were interviewed using structured questionnaires. With the information acquired through the interviews, existing milk marketing chains were identified, which served as a basis for the sampling of milk along the marketing ways.

Raw and fermented milk samples were tested for total bacterial count, coliform bacteria, *E.coli*, coagulase-positive *Staphylococci*, *Salmonella* spp., *Bacillus cereus*, *Listeria* spp. and H₂S- reducing *Clostridia*. The results were compared with European and Kenyan hygiene standards to estimate the potential risk for consumers of milk in The Gambia. 236 raw and 142 fermented milk samples were investigated. The total bacteria count of 90.9% of raw milk samples was above Kenyan standard with a highest acceptable count of 2×10^6

cfu/ml. 64% of raw milk and 55% of fermented milk samples contained more than 5×10^4 cfu/ml, which is the acceptance limit in Kenya. *E.coli* counts above 1×10^4 cfu/ml were found in 22.6% of raw milk and 23.7% of fermented milk. 25% of raw milk samples exceeded the European acceptance limit of 2×10^3 cfu/ml coagulase-positive *Staphylococci*. *Listeria* spp. and *Salmonella* spp. were only isolated in a few samples. Sporeforming bacteria such as *Bacillus cereus* and H_2S - reducing *Clostridia* were more frequently isolated. 22.3% of raw milk and 14.4% of fermented milk contained H_2S - reducing *Clostridia*. *Bacillus cereus* could be found in 17% of raw milk and in 12.7% of fermented milk.

The poor hygienic quality of milk is mainly caused by the poor hygienic conditions around milking and to the inadequate cleaning of milking equipment and containers. Bacterial contaminants in milk find good conditions for growth as milk is not cooled and usually transported over long distances to traders and consumers.

Results of this study lead to the assumption that the consumption of both raw and fermented milk in The Gambia poses a public health hazard. However, poor public health infrastructure, lack of laboratory confirmed cases and the low public awareness for food-borne diseases in general make it difficult to establish a direct relationship between the high contamination of milk and the health risk for consumers.