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Assessment of milk quality endowment in the supply chain in bangladesh: implications for developing bio-economic model

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Abstract

The objective of this study was to evaluate milk quality standards along supply chain, comparing formal and informal milk production channels in three agroclimatic and progressive dairy zones of Bangladesh: Mymensingh, Pabna, and Sirajganj. A series of experiments were performed to assess various milk quality parameters, including fat and solids-not-fat (SNF), heavy metal contamination, somatic cell count (SCC), total viable bacterial count (TVC), total coliform count (TCC), and prevalence of antibiotic-resistant bacteria. Milk fat and SNF were measured using an Eco-milk dairy milk analyzer. Lead (Pb) contamination in raw and pasteurised milk from bulk tankers was determined through atomic absorption spectrophotometry (AAS). SCC was analysed using Ekomilk SCAN technique, providing rapid and precise udder health assessments. TVC and TCC were measured using standard plate count techniques. The study found that daily milk yield per cow ranged from 6.3±5.78 L to 7.46±2.6 L, with fat content varying between 4.02 % and 4.13 %, and SNF levels between 7.75 % and 7.94 %. Microbiological analysis revealed that the mean TVC in raw milk at herd level ranged from (1.42±0.186) ×10 cfu/ml to (2.25±1.803) ×10 cfu/ml, while pasteurised milk showed lower counts, ranging from (2.07±0.604) $\times 10^3$ cfu/ml to (2.11±0.512) $\times 10^3$ cfu/ml. TCC varied from (2.143±0.617) ×10 cfu/ml to (2.165±0.617) ×10 cfu/ml. Somatic cell counts were found between (5.55±5.23) ×10 /ml and (5.69±4.44) ×10 /ml. Significant differences in TVC were observed between groups at the herd level ($p < 0.02$) and at milk collection canters ($p < 0.001$). Pb concentrations were minimal, with bulk tanker raw milk containing (0.0006 ±0.00074) mg/L and pasteurised milk containing (.00008 ±0.00027) mg/L, both well below the regulatory limit of 0.02 μg/L. However, Multi Drug Resistance (MDR) was prevalent in 73.13 % of raw milk samples at herd level, 62.22 % of samples at milk collection centers, and 38.88 % at the factory level. Alarmingly, no pasteurised milk from various market brands was completely free of multidrug-resistant bacteria, raising concerns about global harmonisation of milk quality and safety. These results are expected to be used as input for the development of milk price and quality-based bio-economic model for an incentive milk price package for the dairy farmer suppling milk with recommended quality.

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