Bulk Tank Raw Milk Quality: On-farm Assessment of Risk Factors

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Introduction

Raw bulk tank milk (BTM) quality (SCC and bacteria burden) is used to quantify the health and safety of milk and is associated with consumer acceptance of milk products. No case–control study examining specific on-farm risks for decreased milk quality (increased bacteria burden) has been conducted. The objective of this study was to determine on-farm risk factors for overall and class specific bacteriological quality of bulk tank milk.

Materials and Methods

Bulk tank raw milk quality was evaluated on all Prince Edward Island dairy herds (n = 235) over a two year period. Biweekly total bacterial (TBC), preliminary incubation (PIC), laboratory pasteurization (LPC) and coliform (CC) counts, were conducted using Petrifilm®. Case and control herds were defined based on the last 6 results (approximately 3 months). The following bacteria count cutoffs were used: TAC < 20,000, PIC < 50,000 LPC < 200 and CC < 50 cfu/ml. Data were examined in two ways. For overall determination of case versus control, herds were defined as a case if at least four out of six tests for TBC or PIC or CC or three out of six tests for LPC were above the threshold. For this comparison, control herds were herds with no tests in any bacteria class above the threshold over the same period. For examination of individual bacterial class (TBC, PIC, LPC and CC) cases versus control, herds were defined as a specific bacterial class case as described for overall cases, whereas, controls were herds that had 0/6 high counts for the specific bacterial class of interest. On-farm data collection included a survey of management practices, cow, environment and equipment hygiene scoring, milking procedures and mastitis control, and complete wash analysis of the milking equipment. Data were analyzed using univariable and multivariable logistic regression. For individual bacteria class variable cluster analysis was also conducted.

Results

A total of 69 herds (39 cases and 30 controls) were evaluated. For the analysis of overall case versus control, 16 variables were associated with bulk tank milk bacterial quality at $P < 0.10$. Five variables ($P < 0.05$) remained in the final model, including udder clipping (OR = 0.14), water hardness score > 6 (OR = 4.08), pipeline alkaline wash start temperature (OR = 0.93), pipeline alkaline wash alkalinity (OR = 1.005) and teat end cleanliness score (OR = 4.39). For the TBC case-control group, a total of 10 variables were associated with high TBC in bulk tank milk ($P < 0.05$). These ten variables include five related to cow and stall hygiene scores (risk) and five others including teat end cleanliness score (post-prep), udder hair clipping and use of predip (protective), teat wash and pipeline wash alkalinity (detrimental). For the PIC case-control group, 10 variables showed association with high PIC ($P < 0.05$). Six of these 10 were also associated with TBC, in addition to these factors bulk tank alkaline wash fill temperature and alkaline wash chlorine, bypass and trap out scores were protective. For the CC case-control group, 13 variables were associated with high CC count ($P < 0.05$). These 13 variables included three related to cow hygiene score (risk), five to system wash temperature (higher is protective) in addition to alkaline wash chlorine, bypass, trap out, automatic cleaning of bulk tank (protective) and water hardness score (risk). Finally, 10 variables were associated with high LPC count ($P < 0.05$). These factors were mainly related to milking system wash solution temperature and chemistry. Because of predictor colinearity and relative small sample size multivariable logistic models for individual bacteria class were unstable. Graphical cluster analysis of predictor variable will be presented.

Significance

From this study, it can be concluded that equipment hygiene, milking system washing solution temperature and chemistry, udder hygiene and pre-milking udder preparation are associated with bulk tank bacteriological quality.