Technologically difficult, pathogenic and food risky bacterial contamination of raw milk and other materials from dairy cow herds

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Processing of milk for higher value-added products and milk food chain safety require prevention of higher occurrence of microorganisms that can produce spores. It is important to carry out prevention already during raw milk production by farm hygienic measures. The above-mentioned microorganisms can jeopardize the quality and safety of milk foods. This is the reason why the knowledge of factors, interrelationships and possibilities of milk contamination is assumed. The occurrence of hygienically important groups of microorganisms in mixed rough fodder (F) in feeding trough, in excrements (E) and in bulk milk (M) was investigated on seven farms with a good level of milk yield, management and hygienic conditions for three years in summer (S) and winter (W) feeding seasons. The data set was well balanced in terms of other possible farm factors (such as height above sea level, breed of dairy cows and so on). In total 70 samples of each mentioned material were collected. The investigations were focused on counts of thermoresistant bacteria (TRB), total counts of bacilli (TBA), frequency of occurrence of *Bacillus cereus* (BCE) and *Bacillus licheniformis* (BLI), and counts of other bacilli (OBA) in all mentioned materials and on the frequency of occurrence of main mastitis pathogens *Streptococcus agalactiae* (SAG) and *Staphylococcus aureus* (SAU) in milk. The means of parameters did not exceed the defined standard limits, in particular in raw milk that was suitable for direct human consumption in raw state or for processing for milk products without heat treatment according to relevant EU food legislation. The variabilities of hygienic parameters were relatively high: from 179% (TBA) to 315% (TRB) in F; from 178% (BLI) to 350% (TRB) in E; from 117% (TBA) to 459% (SAG) in M. S increased TRB in F ($P > 0.05$). Counts of bacilli were well balanced between S and W. S increased BLI in E ($P < 0.05$), an opposite trend was observed in BCE. The season did not influence SAG and SAU in M. Higher ($P \leq 0.01$) counts of BCE were in S, the trend was opposite for BLI ($P \leq 0.05$). The season effect on the occurrence of technologically and hygienically difficult microorganisms was not confirmed in general for M, F and E of dairy cows. Regression analysis of the investigated parameters was done. There were significant positive correlations between bacilli and TRB in F as well as in E (correlation coefficients from 0.32 to 0.65; $P \leq 0.01$). The relationships between TRB and occurrence of bacilli in M were less close (0.30; $P \leq 0.05$) than in F and E. No significant relationships were found between TRB and occurrence of main mastitis pathogens in milk (SAG $r = -0.14$ and SAU $r = 0.11$; both $P > 0.05$). It confirmed the high pasteurization efficiency at liquidation of mentioned pathogens. The relationship SAU × SAG in M was 0.23 ($P < 0.05$). It suggests a simultaneous effect of dairy cow health state on the occurrence of both pathogens. The majority of significant relationships (from 0.26 to 0.76; from $P \leq 0.05$ to $P \leq 0.001$) was in F × E within TRB, BLI, OBA and TBA. 7% to 58% of the changes in E were dependent on changes in F. The occurrences of TRB and BLI in M were significantly influenced (0.24 and 0.32; $P \leq 0.05$ and $P \leq 0.01$) by their occurrences in E and F. The observed dependences confirm the relationships between materials (F, E and M) and possibilities of penetration of TRB and bacilli through the technological chain along the axis F – E – M. The hygiene of rough fodder harvest and preservation is highly important for prevention of the above-mentioned risks.

Keywords:

dairy cow; hygiene; rough fodder; excrements; milk; thermoresistant bacteria; total bacilli; *Bacillus cereus*; *Bacillus licheniformis*; other bacilli; food pathogens; mastitis pathogens; *Streptococcus agalactiae*; *Staphylococcus aureus*; food chain safety; prevention