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Milk fatty acid profiles in early lactation as potential indicators for reproduction success

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ABSTRACT

The reproductive performance of a dairy cow can be influenced by her metabolic status during early lactation. As this period is also characterized by important changes in the milk yield and milk fatty acid (FA) profile, we aimed to assess the potential of first test date milk FA profiles analyzed by Fourier-transform infrared (FTIR) spectroscopy to predict the subsequent reproduction performance. First-test date records (N = 145,993) from 138,632 cows in early lactation (5–35 DIM) across Quebec, Canada, were included in the analysis. Records pertained to 2,863 Holstein herds and spanned over 2 years (February 2020 to January 2022). Cows were grouped in similar cohorts based on their first test date milk composition, FA (expressed as g/100 g of total FA) and yield by clustering on principal components. The principal components were used to de-noise the data and to balance the influence of similar milk components. Clustering was based on the CLARA concept using a k-medoid approach on subsamples. Three clusters were identified after iteration. Reproduction success was assessed based on the interval between first service to conception (FSTC) and culled by 60 DIM (CULL) using a linear regression and binomial logistic regression mixed effect model, respectively. Fixed effects were cluster (n = 3), parity (1, 2, 3+), milking system (parlour, automatic, pipeline), week at test day (week 1-5), and season (n = 4), whereas herd and year were considered random effects. Cluster 3 was composed of cows with high preformed FA (55.5% on total FA basis), 18:1-to-14:0 ratio (4.61), BHB (0.17 mM) and milk yield (36.7 kg/day), but particular low de novo FA (17.6%). In contrast, Cluster 2 was composed of cows with low preformed FA (39.5%), 18:1-to-14:0 ratio (2.12), BHB (0.08 mM) and milk yield (35.6 kg/day), but high de novo FA (25.8% total FA). Cluster 1 was in between Cluster 3 and 2 but had the highest SCC content. The FSTC was greatest (P <0.001) for Cluster 3 (41 days) followed by Clusters 2 and 1 (35 and 37 days, respectively). Likelihood for CULL was greatest (P <0.001) for Cluster 3 (odds ratio of 2.1). These preliminary analysis suggests that FTIR milk FA profiles at first test date could be early indicators for the following reproduction success of dairy cows and help improve the transition management through continuous monitoring. :

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