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Hyperketolactia occurring before or after artificial insemination and monitored in milk samples is associated with a decrease in conception in lactating dairy cows

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The reproductive performance of dairy cows is a key parameter of profitability and sustainability, affected by many factors, such as a Negative Energy Balance (NEB). NEB leads to ketosis, characterized by an excessive production of circulating ketone bodies, like acetone and beta-hydroxybutyrate (BHBA) after calving. Estimation of milk Acetone and BHBA concentrations are now routinely available through the mid infrared spectroscopy profiles (MIR spectrum), providing large datasets. This offers new opportunities to study the changes in conception rates, in relation to hyperketolactia (HKL) around artificial insemination (AI). In this study, data were collected from a Milk Recording Program in West part of France during years 2013 to 2016. Lactation characteristics and test-day milk results for all lactations has been included, as well as milk concentrations of acetone and BHBA, and data on insemination (AI). For each AI, conception was considered as a binary trait and defined as successful if it was followed by a calving after a referent pregnancy period. Many thresholds were considered and tested as positive test to define cows with HKL, which were then categorized into four classes according to the HKL dynamics before and after AI. A two-step statistical analysis was performed, using R software. First, the best thresholds to define the categorical variables SCC, DIM (Day In Milk) and 305d MY (Milking Year) to be included in the final logistic regression (second step) were obtained through generalized additive models. Then, a logistic regression with a Poisson correction was performed, using a step-by-step procedure to include explanatory variables. The final model included the HKL categorical variables defined by the different Acetone and BHBA thresholds and was adjusted by the variables DIM, parity, and 305d MY, and herd as a random variable. SSC dynamics, DIM, 305d MY and parity were significantly associated with conception success in all models. No interaction between the above mentioned variables or with HKL was detected. HKL defined by Acetone or BHBA concentrations before or after AI was significantly associated with a decrease in conception, depending on the threshold, the milk component and the class (HL, HH, LH). High milk BHBA values were associated with a 4 to 14% less likely conception compared to low ones, whatever the BHBA increase is seen before AI, after AI or both. High Acetone after AI was associated with a more than 10% less likely conception for all thresholds > 0.10 mM, but not before AI. The significant association between HKL after AI and conception has never been reported before. The negative association between HKL and reproductive performance is consensual and based on pathophysiological and epidemiological evidence. However, the potential physiological mechanisms to explain such association remain not completely defined. The present results suggest that ketosis should be considered as a risk factor for deteriorated reproduction performances and consequently should be of interest for farm advisors.

Keywords: dairy cows, ketosis, MIR, reproduction