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Early lactation hyperketonemia impairs reproductive performance in dairy cows

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Optimal health and performance is dependent on a successful transition period. Hyperketonemia, characterized by elevated levels of ß-hydroxybutyrate (BHB), has a relatively high prevalence in Canadian herds. Although levels of BHB have been traditionally measured in blood and urine samples of dairy cattle, recent advances have made it possible to reliably measure BHB in milk by Fourier-transform infrared in routine DHI samples. The first objective of this study was to identify the impact of elevated milk BHB on 305-day lactation yields and on reproductive success. Analysis was performed on 505,412 Holstein cow records (159,525 1st lactation, 132,694 2nd lactation and 213,193 3rd + lactation) from 3,551 that were retrieved from Valacta's database between 2011 and 2017. Cows were grouped based on lactation number and according to the milk BHB concentration from first test-day collected between 5 and 35 days in milk (DIM) into negative (NEG; <0.15 mM), suspect (SUS; 0.15–0.19 mM), and positive (POS; ≥ 0.20 mM). Mixed model analyses with PROC MIXED of SAS including herd as a random effect revealed that POS cows produced both greater milk fat (376 vs 361 kg SEM 6.4; P<0.01) and more energy-corrected milk (9,419 vs 9,153 kg; SEM 146; P <0.01) over a 305-day lactation compared to NEG cows. However, analysis of reproductive performance revealed that POS cows experienced more days open (149 vs 126 d; SEM 3.6; P< 0.01), had a greater interval from first service to conception (41 vs 31 d; SEM 1.7; P<0.05) and required more services per conception (2.1 vs 1.8; SEM 0.10; P<0.01) than NEG cows. These changes in reproductive parameters were observed across all lactations. Additionally, a survival analysis with PROC LIFETEST and PROC PHREG of SAS revealed reduced pregnancy rates for POS cows, especially for multiparous cows. Moreover, frequency analysis with PROC GENMOD of SAS was used to assess culling rates, where by 60 DIM, the culling rates were higher for POS cows (3.4 vs 2.6%; ± 0.35; P<0.01) compared to NEG cows. In the second objective, we refined the database and further categorized the cows based on level of milk production over the 305-day lactation into low (LOW; <9,000 kg), medium (MED; 9,000–11,000kg), and high (HGH; >11,000 kg). This analysis included 423,197 observations. Results indicated a greater negative impact on reproductive performance for cows with high milk production (HGH): in the LOW group, POS cows had a 7 day increase in service to conception interval compared to NEG cows, whereas this difference was 13 day for HGH cows. Similar results were obtained for other reproductive performance measures. Overall, high producing cows were more likely to have elevated BHB levels. Elevated BHB levels hindered reproductive performance of high producing cows and increased their risk of being culled. Taken together, monitoring milk BHB levels from individual cows provides producers with a beneficial indicator to improve transition cow management.

Keywords: hyperketonemia, reproduction, betahydroxybutyrate, dairy cows