

Predicting dyscalcemia at 4 days in milk using activity and rumination data in multiparous Holstein cows

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Introduction

Dyscalcemia, reduced blood calcium at 4 DIM, is associated with reduced milk production and reproduction and increased risk for negative health events. Cowside testing of blood calcium to diagnose dyscalcemia is difficult and alternative methods to identify dyscalcemia are needed. Our objectives were to use activity and rumination data to predict dyscalcemia.

Materials and methods

A retrospective cohort analysis was performed on data collected from multiparous Holstein cows ($n = 182$) from 2 herds in N.Y. Cows were affixed with ear or neck loggers to record daily activity (arbitrary units (AU)/d, defined by manufacturer) and rumination (min/d) times. Daily activity and rumination times were collected from 14 d prior to calving until 14 DIM. No cows received supplemental Ca or experienced clinical hypocalcemia during the study period. A blood sample was collected at 4 DIM and analyzed for total calcium and cows were subsequently classified as dyscalcemic if total calcium ≤ 2.2 mmol/L ($n = 57$), or eucalcemic if total calcium > 2.2 mmol/L ($n = 125$). We used linear mixed models to analyze differences in pre- and postpartum activity and rumination times between calcemic groups. Logistic models were used to predict the probability of dyscalcemia from activity and rumination time variables.

Results

Prepartum activity time was similar between eucalcemic and dyscalcemic cows (402.0 ± 10.4 AU/d and 395.1 ± 14.5 AU/d, respectively; $P = 0.5$). Postpartum, eucalcemic cows had greater activity time than dyscalcemic cows (436.1 ± 10.7 vs. 407.8 ± 14.7 AU/d, respectively; $P = 0.004$). Prepartum rumination time was similar between eucalcemic and dyscalcemic cows (512.6 ± 9.8 min/d and 504.2 ± 14 min/d, respectively; $P = 0.3$). Postpartum, eucalcemic cows had greater rumination time than dyscalcemic cows (512.3 ± 10.5 min/d vs. 480.5 ± 15 min/d, respectively; $P < 0.001$). The prediction model including daily changes in rumination time between 0 and 4 DIM and raw activity time for 1 to 4 DIM yielded the greatest predictive capacity (AUC = 80%, sensitivity = 45%, specificity = 94%, negative predictive value = 79%, positive predictive value = 76%, accuracy = 78%).

Significance

Our findings suggest that differences exist in postpartum activity and rumination times between cows that experience dyscalcemia and those that remain eucalcemic. Utilizing activity and rumination time data in the immediate postpartum period shows utility in identifying cows with dyscalcemia at 4 DIM which could be beneficial to aid in management decisions that may ameliorate the associated negative outcomes.

