Effects of postpartum health on expression of estrus detected by activity monitors in dairy cows

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Introduction

Nearly half of dairy cows develop at least 1 health problem in the early postpartum period, which is associated with impaired reproductive performance. The mechanisms by which health status impairs fertility are not fully understood, particularly regarding expression of estrus, which is relevant for herds that use estrus detection in reproductive management. Our objective was to identify postpartum health variables associated with reduced detection of spontaneous estrus using activity monitors in dairy cows.

Materials and methods

Holstein cows (1,084) from 2 commercial dairy herds in Ontario were enrolled 3 weeks before parturition. Body condition score (BCS) and lameness were assessed until week 9 postpartum. Serum total calcium (Ca), haptoglobin (Hp), and non-esterified fatty acids (NEFA) were measured at 2 and 6 (±1) d in milk. Blood β-hydroxybutyrate (BHB) and metritis (fetid, watery, red or brown vaginal discharge evaluated by a Metricheck device) were assessed at 4, 8, 11, and 15 (±1) d in milk. Purulent vaginal discharge (PVD) and endometritis (defined as ≥ 6% polymorphonuclear cells in endometrial cytology) were assessed at 35 ± 3 d, and additional disease data were obtained from farm records. Reproductive management for first AI was based on estrus detection by activity monitors [AfiAct (Afimilk) or Heatime (SCR Engineers Ltd.), Israel] with no hormonal intervention until ~75 d in milk. Metabolites were categorized as high or low concentration based on ROC curve cutpoints associated with endometritis and PVD combined. Probability of detection of estrus between 50 and 75 d was analyzed in multivariable logistic regression models including parity, BCS, metabolites, disease variables and interactions. A second model included the same variables but combined diseases and categorized as uterine (UTD) or nonuterine clinical disease (NUTD). Herd was considered a random effect in all models. Estrus intensity (defined as % increase over baseline activity on the day of estrus) of cows detected in estrus in one of the herds was analyzed by linear regression using similar models.

Results

Estrus was detected in 75% of primiparous and 63% of multiparous cows between 50 and 75 d. Prevalence of hypocalcaemia (Ca ≤ 2.1 mmol/L), high Hp (≥ 1.1 g/L) and high NEFA (≥ 0.8 mmol/L) were 53, 42, and 30%. Metritis, endometritis, and PVD were diagnosed in 15, 31 and 20% of cows. Variables associated with reduced probability of estrus detection (LSM ±SE; %) were endometritis (55 ± 1% vs. 65 ± 6%; $P = 0.01$), PVD in multiparous cows (52±5% vs. 65±4%; $P = 0.04$), displaced abomasum (38 ± 11% vs. 61 ± 6%; $P = 0.04$), and ≥ 0.5-point BCS loss (in a 1-5 scale) from week -3 to 9 (56 ± 6% vs. 64 ± 6%; $P = 0.02$). Category of disease was a risk factor only in cows with high Hp at d 6: those with both UTD and NUTD had lower estrus detection (45 ± 7%) compared to cows with only NUTD (76 ± 8%; $P = 0.05$) or without disease (79 ± 6%; $P < 0.01$), but similar to cows with only UTD (58 ± 6%). Cows with BCS 3.00-3.25 at week 9 had lower estrus detection if they had a ≥0.5-point loss from wk -3 compared to <0.5-point loss (62 ± 5 vs. 77 ± 4%; $P = 0.02$). Estrus intensity was lower in cows with hypocalcaemia at d 2 (340 ± 16% vs. 379 ± 14% increase over baseline activity; $P = 0.04$) and in cows with BCS ≤ 2.75 at week 9 compared to ≥ 3.00 (283 ± 26% vs. 398 ± 16%; $P < 0.01$).

Significance

Uterine inflammation, particularly in combination with systemic inflammation, and body condition loss, were risk factors for lower detection of estrus. Cows with hypocalcaemia showed estrus with lower intensity, which could be linked to reduced fertility. The identification of risk factors for reduced estrus expression will allow refinement of reproductive management that are based on detection of estrus by activity monitors. Farmers might be able to apply health monitoring strategies to select cows for targeted interventions, optimizing reproductive performance with minimized interventions.