

Metabolic Predictors of Disease in Transition Dairy Cows

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Introduction

Risk factors for retained placenta (RP) and displaced abomasum (DA) are well described, but significant gaps remain in understanding their pathogenesis. This field study investigated metabolic tests available in clinical practice to identify cows at increased risk of RP and DA.

Materials and Methods

From one week prior to expected calving until one week postpartum, 1076 cows in 19 herds were visited by a technician weekly. Cows were assigned a body condition score (BCS) and samples were collected at each visit for complete blood count and for measurement of serum non-esterified fatty acids (NEFA), cholesterol, beta-hydroxybutyrate (BHB), glucose, urea, calcium and phosphorus. Prepartum, collection of a free-flow urine sample was attempted, and postpartum a milk sample was collected for measurement of ketones with Acetest (Bayer, Etobicoke, Canada) and Ketolac-BHB (Sanwa, Nagoya, Japan) tests, respectively. All disease events before 30 days in milk (DIM) were recorded. Test results were screened for association with disease occurrence using contingency tables. Multivariable logistic regression models were built to account for significant covariates and to control for the correlation of cows within herds.

Results and Conclusions

Overall, incidence rates of RP and DA were 15% and 5%, respectively. While mean NEFA concentrations in cows with DA began to diverge from the mean in cows without DA 14 days before calving, mean serum BHB concentrations did not diverge until the day of calving.

From 0 to 6 days prepartum, cows with NEFA concentration ≥ 0.5 mEq/L were 3.5 times more likely to develop DA ($p < 0.0001$). Sensitivity and specificity were 64% and 66%, respectively. Urine samples were obtained from 46% of cows and among these, cows with a positive urine ketone test were 11.8 times more likely to develop DA ($p < .0001$). However, the sensitivity and specificity of the test were 39% and 96%, respectively.

Other prepartum findings were:

- Serum calcium concentration up to and including the day of calving had no association with RP or DA.
- Cows with NEFA concentration ≥ 0.7 mEq/L or cholesterol concentration ≥ 1.8 mmol/L were 1.8 ($p = 0.02$) and 1.9 ($p = 0.004$) times more likely to have RP, respectively.
- Conversely, cows with a circulating neutrophil count $\geq 5 \times 10^9/L$ were 40% less likely ($p = 0.02$) to have RP.

From 1 - 7 days postpartum (accounting for the effects of twins, milk fever, RP and metritis) cows with milk BHB concentration ≥ 200 $\mu\text{mol/L}$ measured by the cowside test were 2.6 times ($p < 0.001$) more likely to develop DA. The sensitivity and specificity were 44% and 80%, respectively.

- Serum BHB was a more specific test than NEFA concentration. Cows with serum BHB ≥ 1200 $\mu\text{mol/L}$ were 5.9 times more likely ($p < 0.0001$) to develop DA, whereas cows with serum calcium ≥ 2.2 mmol/L tended to be half as likely to have a DA (OR = 0.52, $p = 0.07$).

Energy balance is a key element in the pathogenesis of RP and DA. Application of these results will allow development of more specific transition cow monitoring programs in dairy herds.