

Overconditioned prepartum cows exhibit a greater magnitude of insulin resistance and mobilize more NEFA earlier compared with lean cows.

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Overconditioned transition cows are at greater risk of developing metabolic disease compared with lean cows. Severity of metabolic disease can be augmented by the magnitude of insulin resistance. Our objective was to identify the onset of insulin resistance in overconditioned prepartum cows to delineate the progression of the disease for future predictive biomarker discovery. Multiparous Holstein cows were allocated into two treatment groups according to their BCS at d-30 prepartum: lean (LEAN; BCS <3.25; n=21) or overconditioned (OVER; BCS >3.75, n=26). Diets were formulated to meet nutrient recommendations. Blood samples were collected at d-45, -30, -15 and -7, relative to expected calving, and at d1 and 4 postpartum. Plasma glucose, NEFA, insulin, and BHBA concentrations were measured, and the RQUICKI was calculated, as an insulin sensitivity indicator. The statistical model included the random effect of cow and the fixed effects of BCS and time (relative to calving). BCS was different for LEAN and OVER at d-30 postpartum (3.04 ± 0.042 vs. 3.91 ± 0.038 ; $P < 0.001$). With the exception of glucose, plasma variables were affected by time ($P < 0.001$). NEFA (mM) were higher for OVER relative to LEAN at d-45, -30, -15, and -7 (+54%, $P < 0.01$; +40%, $P < 0.05$; +116%, $P < 0.001$; and +91%, $P < 0.001$, respectively) and tended to be higher at d1 (+31%, $P = 0.07$). Insulin ($\mu\text{U/ml}$) was higher in OVER relative to LEAN at d-15 (+37%; $P < 0.05$). RQUICKI was lower for OVER relative to LEAN at d-30, -15 and -7 (-10%, $P < 0.05$; -18%, $P < 0.001$; and -9%, $P < 0.01$, respectively), and tended to be lower at d-45 and d1 for OVER relative to LEAN (-8%, and -7%, respectively $P = 0.08$). BCS affected NEFA and RQUICKI (+44% and -9%, respectively, OVER relative to LEAN; $P < 0.001$). Glucose and BHBA were not affected by BCS. Relative to LEAN, OVER showed a negative change in BCS from d-30 to d-7 (0.13 vs. -0.10 units, $P < 0.01$). BCS had no effects on BW or milk yield. Somatic cell score was higher in OVER at d10 (+18%, $P = 0.025$). Overconditioned cows experienced a greater magnitude of insulin resistance and mobilized more NEFA earlier compared with lean cows. Early detection of pre-onset insulin resistance in overconditioned dairy cows is needed to develop interventions aimed at reducing excessive NEFA mobilization. Recent advances in mass spectrometry techniques may aid in identifying predictive biomarkers for insulin resistance.

KEYWORDS

Insulin resistance
Overconditioned
Transition cow