

The effect of prepartum housing on metabolic and reproductive health in dairy cows

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Introduction

The determinants of metabolic and reproductive health disorders and the degree to which housing and management can influence health are only partially understood. The objective of this randomized controlled study was to determine if a prepartum housing strategy of providing non-competitive feeding and lying access improves metabolic health and immune function and reduces reproductive disease.

Materials and Methods

Forty-eight primiparous and multiparous Holstein cows were randomly assigned to one of two treatment groups consisting of 6 to 10 cows per pen beginning three weeks prior to their expected calving date. One treatment consisted of 80% stall stocking density and 90 cm of feeding space/cow and the second treatment consisted of 120% stocking density and 45cm of feeding space/cow. Pen size and bunk space were adjusted to maintain space per cow as animals were removed for calving. Weekly coccygeal blood samples were analyzed for non-esterified fatty acids (NEFA), beta-hydroxybutyrate (BHB), calcium, glucose, albumin, aspartate aminotransferase (AST), bilirubin and haptoglobin from three weeks before to five weeks after calving. Neutrophil phagocytosis and oxidative burst were assessed at -2, -1, 1, 2, 3 and 5 weeks relative to calving. A modified glucose tolerance test to assess insulin resistance was performed one week before calving. Liver biopsies were performed at weeks +1 and +3 to assess liver triglyceride content and gene expression. Vaginoscopy was used to identify cows with purulent discharge (PVD) and uterine and cervical cytobrush samples were collected to assess endometri-

tis and cervicitis as well as uterine gene expression at weeks +3 and +5.

Results

Cows in the crowded treatment had significantly higher mean albumin ($P = 0.05$) and bilirubin ($P = 0.01$) but had lower BHB ($P = 0.01$) and NEFA ($P = 0.05$). There were no interactions of treatment with time with any of the weekly blood analytes. Overall there was no treatment effect on oxidative burst function throughout the study period. Multiparous animals tended to have higher oxidative burst function than primiparous animals ($P = 0.06$). There was an interaction of treatment and time such that phagocytosis was significantly higher in the prepartum period among crowded cows but lower at 3 to 5 weeks postpartum ($P < 0.01$). At 5 weeks postpartum, 7% of cows had PVD and 33% of cows were diagnosed with endometritis based on $> 5\%$ neutrophils. There was no significant effect of treatment on endometritis. Cows with endometritis at week 5 tended to have lower average glucose and bilirubin and higher albumin concentrations throughout the study period and lower oxidative burst function at week 2 ($P < 0.1$). Cows that had endometritis at week 5 tended to have lower phagocytosis throughout ($P < 0.1$), and had significantly lower phagocytosis at week -1 ($P = 0.02$).

Significance

These results indicate that metabolic and reproductive health is more complex than can be explained solely by exposure to what are understood to be best practices for feeding and lying space.