An Evaluation of Rumen-Protected Choline and Monensin Controlled-Release Capsule on Milk Production, Health and Metabolic Function of Periparturient Dairy Cows

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Introduction

During early lactation, dairy cows undergo a phase of negative energy balance which may lead to metabolic disorders and subsequent losses in production. To help reduce this, ionophores may be administered. Administration of monensin controlled-release capsules (CRC) prior to calving improves energy balance, while choline aids in fat metabolism and transport. Choline may be a limiting nutrient in lactating dairy cows. The objective of this study was to determine whether there is an interection between these two supplements on metabolic parameters and milk production.

Materials and Methods

Three weeks prior to expected calving, 185 Holstein cattle were randomly assigned to receive one of the following: a monensin CRC; a daily top-dress of 56 g rumen-protected choline (RPC; Reashure" choline, Balchem Encapsulates, New Hampton, NY) until 28 days post-calving; both supplements; or neither. Blood samples were collected at enrollment, one week before calving, and in the first and second weeks post-calving. Liver biopsies were obtained from multiparous cows within 48 hours after calving and repeated three weeks later. Daily feed dry matter intake (DMI) from three weeks before calving to 28 days postpartum and daily milk production to 60 days in lactation were measured. Linear regression analyses were performed for each outcome (PROC MIXED in SAS 8.0), accounting for repeated measures with an autoregressive correlation structure.

Results

For all outcomes, there was no significant interaction of the effects of the two treatments. Therefore, the main effects of CRC and RPC were examined. In all models, the results account for covariates for parity, season, BCS at enrollment, week, and herd if the variable was significant. Beta-hydroxybutyric acid (BHBA) concentrations were lower ($P < 0.05$) in the first (1076 and 1470 mmol/L) and second (1187 and 1557 mmol/L) week postpartum in cows that received CRC than in those that did not. Similarly, CRC increased ($P < 0.05$) glucose concentrations in week 1 (2.80 and 2.51 mmol/L) and week 2 (2.68 and 2.48 mmol/L) postpartum, decreased ($P < 0.05$) aspartate aminotransferase (AST) activity at week 2 postpartum (93 and 105 U/L), and increased urea concentrations across samples (4.33 and 4.11 mmol/L), relative to cows that did not receive monensin. There were no treatment effects on concentrations of non-esterified fatty acids (NEFA), or on dry matter intake pre- or postpartum. Cows that received CRC tended ($P = 0.12$) to have lower liver fat accumulation (12.6% and 17.5%) and had higher ($P < 0.05$) liver glycogen content (13.4 and 9.5 mg/g wet liver) at three weeks postpartum than cows that did not receive CRC. Accounting for parity, BCS, week, and genetic index for milk production, cows that received RPC produced 2.6 lb (1.2 kg) more milk/day (70.5 and 67.8 lb [32.0 and 30.8 kg], $P = 0.01$) in the first 60 d of lactation than cows that did not receive RPC. There were no treatment effects on milk fat or protein percentages.

Significance

CRC improved several measures of energy metabolism and liver function. RPC was associated with increased milk production in early lactation, but a mechanism for this effect was not found in this study; further investigation is warranted. No synergistic effects of CRC or RPC were detected in the outcomes measured.