

Induction of hypocalcemia in non-lactating, non-pregnant Holstein cows fed negative DCAD rations with low, medium or high concentrations of calcium

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Introduction

Parturum feeding of a negative dietary cation-anion difference (-DCAD) ration has proved to be an effective method of preventing hypocalcemia. However, the optimum Ca concentration to feed with -DCAD rations has not been determined. We conducted an experiment to assess the implications of feeding a low, medium, and high concentration Ca -DCAD ration on the ability of a cow to respond to an induction of hypocalcemia.

Materials and Methods

Three groups of non-lactating, non-pregnant Holstein cows were fed -DCAD rations (15.1 mEq/100g DM) for 21 d with low (LC=0.45% Ca;n=5), medium (MC=1.13% Ca;n=6) or high (HC=2.02% Ca;n=6) concentrations of dietary Ca and then subjected to a controlled induction of hypocalcemia to determine the ability of cows to respond to the challenge based on dietary Ca. On d 22, 23, and 24 hypocalcemia was induced using an intravenous infusion of 5% ethylene glycol tetraacetic acid (EGTA). During infusion, blood samples were collected every 15 min until 60% of pre-infusion iCa concentrations were achieved. Samples were collected post-infusion at 0, 2.5, 5, 10, 15, 30, and every 30 min thereafter until 90% of pre-infusion iCa was reached.

Results

HC cows maintained higher concentrations of iCa during the infusion period and had a longer average time of EGTA infusion to 60% iCa (414.2±38.9 min vs 242±28.0 min MC and 282±24.8 min LC; $P=0.03$). More EGTA was required to reach 60% iCa in HC cows (16.6±1.5 g vs 10.3±1.3 g in MC and 12.3±1.2 g in LC; $P=0.01$). Using a regression analysis and forced linearity to compare slopes of lines during EGTA challenge, MC cows reached 60% iCa faster than HC and LC cows in the first 145 min of infusion ($P<0.0001$). Total serum Ca decreased in all cows during infusion, but not differ between treatment ($P=0.59$). Total serum protein tended to be elevated in HC cows compared to MC and LC cows during EGTA challenge ($P=0.10$). Serotonin concentrations were elevated in MC cows (7076±914.5 ng/mL) compared to HC (5530.39±806.1 ng/mL) and LC (3621.34±890.9 ng/mL) cows during EGTA challenge ($P=0.05$), suggesting an interdependent relationship between iCa and serotonin.

Significance

Cows fed a high calcium ration had increased resistance to induction of hypocalcemia as measured by iCa, indicating potential metabolic benefits of feeding a higher Ca diet when using a -DCAD ration.