

The effect of different treatments for early lactation hyperketonemia on blood β -hydroxybutyrate, plasma non-esterified fatty acids, glucose, insulin, and glucagon in dairy cattle

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Introduction

Despite increased efforts in preventing the occurrence of metabolic disorders in transition cows, hyperketonemia remains a frequent early lactation metabolic disease affecting an average of 40% of cows in herds in the US. Despite the demonstrated economic impact of this disorder there is a lack of controlled clinical trials comparing different treatment strategies in affected cows. The objective of our study was to investigate the effect of treatment with intravenous glucose, oral propylene glycol (PG), or a combination of both on the reduction in blood β -hydroxybutyrate (BHB) concentrations of early lactation hyperketonemic dairy cows.

Materials and Methods

Multiparous Holstein cows on 1 dairy farm in New York State were screened for hyperketonemia between 3 to 9 d in milk using a hand-held meter 3 times per wk and enrolled at whole blood BHB concentration ≥ 1.2 mmol/L to 1 of 4 treatment groups: 1) 500 mL of a 50% dextrose solution intravenously (i.v.) once daily for 3 d (GLU, n = 9), 2) 300 mL propylene glycol as a drench once daily for 3 d (PG, n = 9), 3) a combination treatment of a 500 mL of 50% dextrose solution i.v. and 300 mL PG orally once daily for 3 d (GLU+PG, n = 8), or 4) an untreated control group (CTRL, n = 8). Blood samples were collected immediately before as well as at 1, 2, 4, 8, 12, 24, 36, 48, 60, and 72 h after administration of the first treatment through a jugular catheter and 3 times per wk thereafter from coccygeal vessels. Concentrations of BHB were measured in whole blood and plasma samples were analyzed for glucose, fatty acids (NEFA), insulin, glu-

cagon, and electrolyte concentrations. EDTA-anticoagulated blood samples were assessed for red blood cell (RBC) indices and smears were made for evaluation of RBC morphology. Outcomes were analyzed using repeated measures analysis.

Results

Overall least squares means (95% CI) of whole blood BHB concentrations between 1 h and d 11 relative to first treatment were 1.11 (0.95 to 1.30), 1.26 (1.07 to 1.47), 0.96 (0.81 to 1.13), and 1.53 (1.30 to 1.80) mmol/L for the GLU, PG, GLU+PG, and CTRL groups, respectively. Treatment with both glucose and PG led to a greater magnitude and more prolonged decrease in BHB concentrations compared with individual treatments. Non-esterified fatty acid and glucagon concentrations were lower immediately after treatment in group GLU and GLU+PG compared with CTRL, and treatment with both glucose and PG was associated with a greater increase in glucose and insulin concentrations immediately after treatment compared with CTRL and glucose treatment alone. Treatments did not lead to differences in plasma mineral concentrations.

Significance

We conclude that treatments varied in the magnitude of decreasing blood BHB concentrations in hyperketonemic postpartum cows, with the greatest decline after treatment with a combination of intravenous glucose and oral PG.