

Effects of treatment with propylene glycol and cyanocobalamin on disease, milk production and reproductive outcomes of dairy cows diagnosed with hyperketonemia and hypoglycemia

A. Hubner,¹ DVM, PhD, DABVP; I. Canisso,² DVM, PhD, DACT; W. Coelho,³ BS; L. Ribeiro,² BS; B. Aldridge,² BVSc, PhD, DACVIM, MRCVS; F. Lima,³ DVM, PhD, DACT

¹Veterinary Clinical Sciences, Purdue University, West Lafayette, IN 47907

²Veterinary Clinical Medicine, University of Illinois, Urbana, IL 61802

³Population Health and Reproduction, University of California, Davis, CA 95616

Introduction

Almost all periparturient dairy cows experience a period of negative energy balance, and despite improvements to fresh cow management, some dairy cows still experience clinical disease associated with the periparturient period (Duffield et al., 2009; Taylor et al., 2004). Hyperketonemia (HK) remains an important production and animal welfare concern (McArt et al., 2012; Tatone, Duffield, Capel, et al., 2016; Tatone, Duffield, LeBlanc, et al., 2016), and recently several handheld meters which measure beta-hydroxybutyric acid (BHBA) have been validated in dairy cows and can be used to detect pre-clinical HK (Bach et al., 2016; Tatone et al., 2015). Several studies have explored the screening of post-parturient cows to detect HK and administer treatment in order to ward off clinical disease and increase milk production (Capel et al., 2021; Gordon et al., 2017; McArt et al., 2012). However, these studies have been inconsistent in their findings, and treatment may not be economically beneficial for farms with a relatively low incidence of HK (McArt et al., 2014). A 2017 study indicated that cows may have variable production responses to HK treatment based on blood glucose concentration (Gordon et al., 2017). Because blood glucose can also be measured cow-side, measurement of blood glucose concurrent with measurement of blood BHBA may be a means to target treatment to cows that will respond to current treatments. Therefore, our objective was to explore the effects of treatment with propylene glycol and cyanocobalamin in early post-partum cows based on both HK and glycemic status. We hypothesized that improvements to health, milk production, and reproduction would be greatest among cows that were hypoglycemic.

Materials and methods

This study was conducted on 3 commercial dairy farms and each farm was visited once weekly. Whole blood was collected from cows between 3 and 9 DIM and tested cow-side for BHBA and glucose. Cows were randomly allocated to receive treatment (IM injection of 10 mg of Vitamin B12 on day 1, and 300 mL propylene glycol for 5 days, once per day starting on day 1) or remain as the untreated control within the three metabolic categories. Those categories were HK (BHBA \geq 1.2 mmol/L and

glucose \geq 2.3 mmol/L; hyperketonemic but normoglycemic), hypoglycemic (HG; BHBA \leq 1.1 mmol/L and glucose \leq 2.2 mmol/L; normoketonecemic but hypoglycemic), and concurrent hyperketonemia and hypoglycemia (HKHG; BHBA \geq 1.2 mmol/L and glucose \leq 2.2 mmol/L; hyperketonemic and hypoglycemic). Individual cow data was collected from herd software programs and included health events, reproductive outcomes and milk production. Health events included culling, metritis, clinical ketosis, left displaced abomasum, clinical mastitis and lameness. Statistical analysis was carried out using SAS version 9.4 (SAS; SAS Institute Inc.) using multivariable linear and logistic regression. Statistical models included the fixed effects of farm, parity, season of parturition and body condition score.

Results

Cows with hyperketonemia without concurrent hypoglycemia demonstrated no improvements to health, production, or reproductive outcomes when treated with propylene glycol and Vitamin B12. Conversely, cows with hypoglycemia with or without hyperketonemia had improvements in health and milk production.

Significance

Concurrent blood glucose testing may provide a way to target labor-intensive treatments after cow-side testing for BHBA. Furthermore, because cows with hypoglycemia showed positive responses to treatment regardless of hyperketonemia status, and because cows with HK only showed no response to treatment, farms may elect to adopt a testing strategy that includes only cow-side testing for glucose. This strategy would decrease testing costs and could decrease treatments for some farms. Further work is needed to identify a treatment that could benefit cows with HK only, as these cows did not respond to a typical treatment with vitamin B12 and propylene glycol.

This research was supported by an AABP Foundation grant.

