A randomized clinical trial assessing the effect of 3 different commercial oral calcium supplementation bolus on calcium dynamics and urine pH after calving: Interim findings

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Introduction

Calcium (Ca) homeostasis is one of the many metabolic challenges faced by a dairy cow during her transition from the dry period into lactation. The use of anionic salts during the dry period is an effective strategy to prevent clinical hypocalcemia, yet subclinical hypocalcemia (SCH) has been reported to affect up to 70% of multiparous cows. Although the use of oral calcium supplements immediately after calving is a commonly adopted method to prevent and treat SCH in multiparous cows, there is a shortage of information comparing different oral calcium products. Thus, the overall goal of this project is to evaluate the effect of different commercially available oral calcium products on postpartum serum calcium profiles of dairy cows. Additional objectives are: determine milk production, urine pH, and Ca concentrations during the first 5 days after oral calcium supplementation. This study is ongoing, with serum and urine samples currently being analyzed to determine Ca concentrations.

Materials and Methods

On the day of calving (d0), multiparous dairy cows at the Dairy Cattle Teaching and Research Facility on the University of Minnesota were blocked by parity and breed (Holstein – HO and Crossbred – XX) and randomly assigned to 1 of 4 groups: control (CON, no oral calcium supplementation), Bovikalc (BK, Boehringer Ingelheim Vetmedica), Quadrical (QC, Bio-Vet), and RumiLife CAL24 (RL, AgSource Cooperative Services). Treatments were administered by research personnel following manufacturer's recommendation. Blood samples were collected from the coccygeal vessels using an evacuated tube without anticoagulant immediately prior to calcium bolus administration and at 1, 2, 4, 8, 12, 24, 48, 72, and 96 h post treatment. Blood samples were allowed to clot at room temperature and centrifuged within 6 h of collection for 10 min at 800 × g for serum separation. Urine samples were collected once a day, approximately 2 hours after morning milking, for 5 days; urine pH was immediately measured using a pH meter (Oakton EcoTestr pH 2+ pocket pH meter, Oakton Instruments). Serum and urine samples were frozen at -4°F (-20°C) until further analysis. Serum and urine Ca analysis will be performed on a Randox Daytona Analyzer based on the Arsenazo III method. Milk production was measured daily by farm personnel. Serum and urine Ca, and urine pH will be analyzed by multivariable linear mixed models accounting for repeated measures. Average milk production during the experimental period was analyzed by ANOVA.

Results

Only interim results are reported. A total of 44 cows were enrolled in this study: 7 HO and 3 XX did not receive any treatment (n = 10), 9 HO and 2 XX received BK (n = 11), 8 HO and 4 XX received QC (n = 12); and 8 HO and 3 XX received RL (n = 11). Only a numerical difference (P = 0.32) was observed when comparing the average milk production of the 4 treatment groups within the first 5 DIM (mean ± SD; 51.6 lb ± 7.0, 60 lb ± 9.3, 54 lb ± 13.7, 52.5 lb ± 11.2 [23.4 kg ± 3.2, 25.4 kg ± 4.2, 24.5 kg ± 6.2, 23.8 kg ± 5.1] for CON, BK, QC, and RL, respectively). A treatment by time interaction was observed when analyzing the urine pH after administration of oral calcium supplementation (P = 0.03), especially during the day after treatment (d1). BK (6.9 ± 0.2) and RL (7.0 ± 0.2) had the lowest pH on d1, followed by QC (7.5 ± 0.2) and CON (8.1 ± 0.2). Urine pH values were not different between all 4 treatment groups for the remainder of the experiment.

Significance

Our interim results suggest that oral calcium supplementation continues to induce metabolic acidosis postpartum as indicated by the decreased urine pH after treatment. Data on serum and urine Ca analysis should reveal any potentially relevant information on calcium homeostasis following administration of oral calcium supplements, as well as any similarities and differences between boluses. Ultimately, we intend to equip dairy practitioners and producers with science-based information to better design herd-level management interventions.