

Differential effect of a single dose of oral Ca based on postpartum plasma Ca concentration in Holstein cows

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Introduction

Even with multiple physiological adaptations in place to maintain normocalcemia, many cows fail to meet this demand without compromising systemic Ca status. As a result, these cows can experience clinical hypocalcemia or, in the absence of clinical symptoms, be categorized as having subclinical hypocalcemia based on blood Ca concentration. Our objectives were to determine: 1) the effect of a single dose of an oral Ca bolus within 24 h after parturition on blood Ca concentration, 2) the response of primiparous (PP) and multiparous (MP) cows to this supplementation strategy, and 3) differential responses to supplementation based on blood Ca concentration at enrollment.

Materials and Methods

For objective 1, cows from 1 commercial dairy in New York State were enrolled within 19 h after parturition (mean \pm SD = 8.3 \pm 5.3 h) and randomized within parity group (1st, 2nd, and \geq 3rd) to control [CON (n = 25); no placebo] or a single dose bolus treatment [BOL (n = 25); 3 oral Ca boluses supplying 53 to 63 g of Ca]. Blood Ca concentration was measured repeatedly between 1 and 24 h following treatment. For objectives 2 and 3, cows on 6 commercial farms in New York State were assigned to treatment as described for objective 1 (CON n = 1,973; BOL n = 1,976). Records for health events, culling, reproduction and milk production for the first 4 Dairy Herd Improvement test days were recorded. Repeated measures analysis was used to analyze data for objective 1 and baseline Ca, parity, treatment, hour and treatment by hour were included as covariates with cow as the subject of repeated measures. Mixed effects multivariable models were developed for dichotomous outcomes using Poisson regression, for time to conception using a proportional hazard model and for test day milk production using repeated measures analysis with cow as the subject of repeated measures. All models for objective 2 included treatment, periparturient risk factors, relevant interactions and the random effect of

farm. For objective 3, Ca status was dichotomized at several thresholds and included as a predictor as well as the interaction with treatment. The model resulting in an interaction between treatment and SCH with the smallest probability of type I error is presented.

Results

Blood Ca between 1 and 24 h after treatment administration was not different between CON and BOL. Primiparous cows assigned to BOL with higher age at first calving (> 712 d) had reduced risk of one or more health disorders (≤ 30 DIM; risk ratio (RR) = 0.65, 95% confidence interval (CI) = 0.51 to 0.84) and those calving with higher body condition score (>3.5) responded to BOL with increased milk production (CON = 31.7 \pm 1.1, BOL = 35.1 \pm 1.1 kg/d), as did PP cows with days carried calf >277 d (CON = 31.9 \pm 1.0, BOL = 34.7 \pm 1.0 kg/d). Differential responses based on Ca status were minimal. Reduced risk of health disorders was observed in cows of parity ≥ 3 (one or more disorder; RR = 0.85, 95% CI = 0.81 to 0.89) and MP cows with body condition score >3.5 (retained placenta; RR = 0.70, 95% CI = 0.58 to 0.84) or that were lame (displaced abomasum; RR = 0.49, 95% CI = 0.32 to 0.75). For MP cows with low plasma Ca, BOL decreased risk of additional Ca treatment (≤ 1.8 mmol/L; RR = 0.57, 95% CI = 0.40 to 0.80) as well as risk of one or more health disorder (≤ 2.15 mmol/L; RR = 0.90, 95% CI = 0.85 to 0.95). Decreased risk for MP cows with low plasma Ca receiving BOL was observed when retained placenta, metritis and displaced abomasum were analyzed separately.

Significance

Supplementation with a single oral dose of Ca could be targeted to periparturient risk groups for improved postpartum health. Calcium status did not differentiate responses of PP cows, but MP cows with low Ca at parturition had improved health status when supplemented.