

Research Summaries 2

Evaluation of a cow-side calcium test for determination of subclinical hypocalcemia in early postpartum cows

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Introduction

Clinical hypocalcemia is an important and prevalent metabolic disease of dairy cows. Subclinical hypocalcemia (SCH) has been defined as animals that do not have clinical signs, but serum concentrations of either total calcium <2.2 mmol/L or ionized calcium (iCa) <1 mmol/L. Recent work has shown that SCH in the first week of lactation is associated with reduced milk production and increased risk of displaced abomasum. Currently, various calcium products are marketed to maintain blood calcium levels. A rapid cow-side iCa test would allow targeted treatment of cows with SCH. The primary objective was to evaluate the performance of a new cow-side blood calcium meter for test characteristics and usability in the field. Additionally, we aimed to describe the relationship of SCH at different time points with postpartum diseases, including hoof lesions.

Materials and Methods

Two venous blood samples from 206 Holstein cows of all lactations were collected at calving. One sample was collected aerobically then separated and frozen. The second was collected using a sodium heparin additive and immediately tested using the novel iCa meter. This meter uses technology based on electrophoresis. A second aerobic sample was taken 8 to 32 hours post-calving.

Postpartum diseases were diagnosed and recorded by farm staff. In addition, cows 3 to 14 DIM were tested weekly for β -hydroxybutyric acid (BHBA) concentrations and blood glucose levels. Prior to calving, cows were evaluated for lameness using a 5-point locomotion scoring system. At >80 DIM cows were evaluated for hoof lesions following functional trimming. All aerobic frozen samples were sent for iCa testing by selective calcium electrode at Michigan State University. This test was validated using serum from 60 cows

collected both aerobically and anaerobically. The relationship between the meter and laboratory was evaluated using correlation coefficients, and by performing a receiver operator curve (ROC) analysis to determine the optimum cut-points for maximum sensitivity and specificity. The association between SCH and the measured outcomes were compared using Fisher's exact test.

Results

The prevalence of SCH was 11% when defined as adjusted iCa <1.0 mmol/L. Average time to complete the cow side test was 11 minutes. The concordance correlation coefficient was 0.07 (95% CI = 0.00-0.15). A ROC analysis showed the optimum cut-point was 1.28 mmol/L; the resulting sensitivity was 45% (95% CI = 23.1-68.5%) and a specificity of 69% (95% CI = 61-76%). At the average prevalence, the resulting positive and negative predictive values were 14.8% and 91.2%, respectively. Lactation group and lameness status prior to calving were associated with a risk of having SCH at calving, but not at 8 to 30 hours post calving. No associations were found between SCH status and the outcome measures for lameness or postpartum disease. Post-calving samples were taken an average of 21.6 hours (95% CI = 20.9-22.3) and 20/206 developed SCH post calving.

Significance

In summary, the meter did not have good correlation or diagnostic test characteristics with the reference laboratory. On a pilot basis, no significant association between iCa status and postpartum diseases were found. Lactation group and lameness status pre-calving were associated with the risk of SCH at calving. This initial evaluation identified several concerns, and the iCa meter company is continuing to refine this technology.