Materials and Methods

A convenience sample of 269 multiparous Holstein cows with repeated measurements of blood NEFA and BHBA (3 wks before to 3 wks after calving) was used in this study. Data originated from 4 separate studies carried out by our research groups and were combined into a single dataset. To represent data over time, area under the curve (AUC) was calculated for all prepartum, postpartum, and combined prepartum and postpartum time-points (total) using the midpoint rule. Pearson correlation coefficients for NEFA and BHBA AUC were analyzed using Proc CORR in SAS (v. 9.3, Cary, NC). Day of maximum concentration for both analytes and the incidence of hyperketonemia (blood BHBA ≥ 1.2 mmol/L) were determined during the postpartum period for each animal. In addition, cows were dichotomized based on their average milk production during weeks 1 through 3 and body condition score (BCS) in the first week postpartum.

Results

Prepartum AUC of NEFA and BHBA were not correlated (r=-0.07, P=0.31). Postpartum and total AUC for NEFA and BHBA showed only a weak correlation (r=0.26 and 0.21, P<0.001). The mean (± SD) of day of maximum NEFA and BHBA concentration was 6.8 (± 5.3) and 9.6 (± 6.1). The peak incidence of hyperketonemia was on day 4 postpartum. In 16.5 % of cows maximum NEFA and BHBA occurred on the same day. Although the correlation of postpartum NEFA and BHBA was smaller in cows with a postpartum BCS ≤ 3.25 (n=201, r=0.10, P=0.14) compared with those that had a BCS > 3.25 (n=67, r=0.38, P=0.002), and smaller in cows with an average milk production >84 lb (>38 kg)(n=140, r=0.16, P=0.06) than in cows that produced less milk (n=127, r=0.39, P<0.001), correlations remained weak.

Significance

Using longitudinal data of NEFA and BHBA by computing AUC did not improve correlations compared to values previously reported in a cross-sectional sample. Although there is evidence that production and body condition characteristics have an effect on the relationship between both markers, there was no meaningful improvement in correlations when taking these into account. Overall, the correlation between the commonly used markers of negative energy balance in peripartum dairy cattle is poor. In conclusion, caution should be exerted when extrapolating the relationship between concentrations of NEFA and BHBA in transition dairy cows.

A comparative evaluation of 2 cow-side meters and a milk test for the diagnosis of subclinical ketosis

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Introduction

Subclinical ketosis (SCK) is a metabolic disease of dairy cows that has significant economic effects on dairy farms due to its effect on reproductive performance, milk production, and future risk of disease. Subclinical ketosis has been defined as being present when serum β-hydroxybutyrate (βHB) concentrations are ≥1.2 mmol/L. Currently there are 2 electronic hand-held meters marketed for cow-side determination of βHB levels. One meter, the Nova Vet Blood Ketone and Glucose Monitoring System, is a new veterinary specific entrant to the market, and no performance data on it exists. The other, Precision Xtra, is a human meter validated for use in cows. The objective of this study was to evaluate the diagnostic test performance of 2 different cow-side handheld meters and a milk βHB test to a reference laboratory testing method.

Materials and Methods

This study was conducted on 13 herds in southeastern Minnesota. Blood samples on cows 3 to 14 days in milk (DIM) were collected immediately after milking on the same day as milk samples were taken. Milk samples were collected by Minnesota Dairy Herds Improvement Association and analyzed for βHB concentrations using fourier transform infrared technology. Whole blood samples were tested immediately cow-side using both the meters. A second blood sample was taken and the separated serum was sent to a reference laboratory for analysis of serum βHB concentrations using colorimetric methods. Performance was evaluated by calculating sensitivity (SE), specificity (SP), and concordance correlation coefficient. The optimum cut-points for each βHB method were determined using receiver operator curve analysis.

Results

A total of 213 blood samples were collected at an average of 9 DIM. Prevalence of SCK as determined by the reference laboratory was 10.3%. The concordance correlation coefficient between the serum reference lab values and Nova Vet meter was 0.96 (95 CI: 0.95-0.97). The SE and SP of the Nova Vet meter at a cut-point of 1.2 mmol/L were 100% (95 CI: 83.9-100.0%) and 98.4% (95 CI: 95.5-99.7%) in whole blood, respectively. At a prevalence of 10%, the positive predictive value (PPV) and negative predictive value (NPV) were 87.6% (95 CI: 69.7-95.6%) and 100%, respectively.

For the Precision Xtra, the concordance correlation coefficient between the serum reference lab values and meter values was 0.94 (95 CI: 0.93-0.95). Sensitivity and SP of the Precision Xtra meter at a cut-point of 1.3 mmol/L were 95.5% (95 CI: 77.2-100.0%) and 98.4% (95 CI: 99.5-99.7%) in whole blood, respectively. The PPV and NPV at the 10% prevalence were 87% (95 CI: 68.5-95.4%) and 99.5% (95 CI: 96.6-99.9%), respectively. For the milk test, the optimum cut-point was 0.23 mmol/L. Sensitivity and SP at this cut point was 88.2% (95 CI: 63.6%-98.5%) and 89.9% (95 CI: 83.7-94.4%), respectively. The PPV and NPV at this 10% prevalence were 49.3% (95 CI: 36.5-62.2%) and 98.6% (95 CI: 94.9 -99.6%), respectively.

Significance

In conclusion, the Nova Vet has similar test characteristics compared to the Precision Xtra meter. Its use would allow for rapid and accurate measures of βHB concentration on farm for detection and monitoring of SCK in postpartum dairy cattle.

The effects of sample temperature on the concentrations of glucose and β-OH butyrate measured by the Precision Xtra meter in plasma from periparturient dairy cattle

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Introduction

Early and accurate diagnosis of hypoglycemia and hyperketonemia is helpful in the diagnosis and treatment of ketosis in periparturient dairy cattle. The results of a preliminary study recently indicated that the glucose concentration [gluc] and β-OH butyrate concentration [BHB] measured by the Precision Xtra meter was impacted by sample temperature when temperature <89.6° (< 32°C). The objective of this study was to fully characterize the effects of sample temperature on the accuracy of the Precision Xtra® for measuring [gluc] and [BHB].

Materials and Methods

Ten plasma samples with [gluc] at 98.6°F (37°C) ranging from approximately 30 to 409 mg/dL, and 14 plasma samples with [BHB] at 98.6°F (37°C) ranging from approximately 0.5 to 7.5 mmol/L, were obtained from periparturient Holstein-Friesian cattle. Plasma samples were placed in a water bath at 44.6, 53.6, 62.6, 71.6, 80.6, 89.6, 98.6, and 107.6°F (7, 12, 17, 22, 27, 32, 37, and 42°C) for 30 minutes and then immediately analyzed in duplicate using the Precision Xtra meter. Linear regression was used to characterize the relationship between $[gluc]_{meter}$ and temperature, and between $[BHB]_{meter}$ and temperature.

Results

Plasma $[gluc]_{meter}$ was minimally affected by the variation in sample temperature from 44.6 to 107.6°F (7 to 42°C) when the plasma $[gluc]_{meter}$ was < 160 mg/dL; however, $[gluc]_{meter}$ increased linearly with temperature when plasma $[gluc]_{meter}$ > 160 mg/dL. Variation in sample temperature from 44.6 to 107.6°F (7 to 42°C) had no effect on the measured value for plasma $[BHB]_{meter}$ when plasma $[BHB]_{meter}$ was < 2.6 mmol/L; however, $[BHB]_{meter}$ increased linearly with temperature when plasma $[BHB]_{meter}$ > 2.6 mmol/L.

Significance

Sample temperature should be taken into the consideration whenever plasma $[gluc]_{meter}$ > 160 mg/dL or plasma $[BHB]_{meter}$ > 2.6 mmol/L as measured by Precision Xtra meter. We anticipate similar findings would occur when blood at different temperatures was measured by the meter.