Evaluation of a Hand-Held Meter for Cowside Evaluation of Blood Beta-Hydroxybutyrate and Glucose Concentrations in Dairy Cows

G.R. Oetzel, *DVM, MS*; **S.M. McGuirk**, *DVM, PhD*
School of Veterinary Medicine, University of Wisconsin-Madison 53706

Introduction

Ketosis, defined as blood beta-hydroxybutyrate (BHBA) concentrations greater than 1,400 umol/l, is an important problem in dairy herds. Prompt and accurate detection of ketosis may lessen its negative effects on milk yield and reproduction, and may help prevent subsequent displaced abomasum. Cowside tests are necessary for prompt diagnosis and treatment of ketosis; however, existing cowside urine or milk ketone tests are limited by their relatively low sensitivity (about 80%) compared to blood BHBA (the gold standard test for ketosis). Cowside blood glucose tests have not been commonly used but could be useful in helping clinicians determine if glucose treatments are indicated for early lactation cows with an unknown diagnosis or that have already been treated for ketosis. The objectives of this study were to evaluate the correlation of BHBA and glucose results from the hand-held meter with laboratory analysis results, and to evaluate the sensitivity and specificity of the hand-held meter for determining BHBA and glucose concentrations above established cut-points.

Materials and Methods

A hand-held meter (Precision Xtra, Abbott Laboratories) marketed for use in human patients was used for cowside determinations of whole blood BHBA and glucose. Different test strips were used on the meter for the BHBA and glucose determinations. The meter required less than a drop of blood for each test. Results were compared to serum BHBA (collected into tubes without additive) or plasma glucose (collected into tubes containing sodium fluoride and potassium oxalate). BHBA comparisons were made from 183 paired samples collected from 90 early lactation dairy cows in four different commercial herds. Cows were considered ketotic if serum BHBA determined by laboratory analysis was greater than 1,400 umol/l. Glucose comparisons were made from 305 paired samples collected from 65 pre- and post-fresh cows in two different commercial dairy herds. Cows were considered to have high glucose if plasma glucose determined by laboratory analysis was greater than 79 mg/dl (the upper limit of the normal glucose range established by the commercial laboratory). All cows tested were clinically normal.

Results

The overall prevalence of ketosis in cows tested was 16%. Results for BHBA from the hand-held meter were very highly correlated with laboratory results (R^2 = 0.90, P <0.01). The sensitivity of the hand-held meter in detecting ketosis was 90%, and the specificity was 93%. The slope of the regression equation for BHBA values from the hand-held meter compared to laboratory results was 1.075 (very near 1.000) and the intercept was 0.15 (very near 0.00). These results indicate that a re-calibration of the meter for bovine instead of human BHBA is not essential. The overall prevalence of high blood glucose in the cows tested was 7%. Results from the hand-held meter were not as well correlated with laboratory results for glucose (R^2 = 0.56, P <0.01). The sensitivity of the hand-held meter in detecting high blood glucose was 55%, and the specificity was 99%. The slope of the regression equation for glucose values from the hand-held meter compared to laboratory results was 0.954 (very near 1.000). However, the intercept was -4.68, suggesting that results would be improved by re-calibrating the meter for bovine instead of human glucose.

Significance

Results for blood BHBA using the hand-held meter were very highly correlated to laboratory results, and the test had excellent sensitivity and specificity for detecting ketosis. It is a considerable improvement over cowside urine and milk tests. The hand-held meter was not as useful in detecting cows with high blood glucose concentrations; however, this study was conducted only on cows that were clinically normal. Future evaluation of the hand-held meter for detecting high blood glucose in cows previously treated for ketosis or with disease conditions that could cause hyperglycemia is warranted.