Evaluation of a Milk Strip Test for Detection of Subclinical Ketosis at Cow Level

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Introduction

Subclinical ketosis is a metabolic disease that has been associated with reduced milk production, and impaired fertility. Duffield *et al* (2001) have reported a median prevalence of subclinical ketosis of 41% among 25 Ontario Holstein herds, and a within-herd prevalence ranging between 8 and 80%. Our study was designed to evaluate the use of a milk strip test as a cow-side test for detection of subclinical ketosis, and to discuss its potential practical application to a herd health-monitoring program.

Materials and Methods

Milk and blood samples were collected from 55 Holstein cows between two and 21 days in milk (DIM) at the Veterinary Teaching Hospital of the University of Montreal, St-Hyacinthe, Québec, between September 2002 and February 2003. Serum samples were kept frozen until the analyses were performed as a batch for beta-hydroxybutyrate (BHB) using an enzymatic method (B-HBA 310-UV; Sigma Chemical Co, St. Louis, MO). Milk samples were immediately tested for BHB after collection, using Keto-Test strips (Elanco Animal Health, Guelph, Ontario) as recommended by the manufacturer. Cows were classified as ketotic if the serum BHB concentration was ≥1400 µmol/L (14.4 mg/dL). The sensitivity and specificity of the Keto-Test were calculated at two different threshold levels (100 µmol/L and 200 µmol/L) of the milk strip test.

Results and Conclusions

The overall prevalence of ketotic cows based on the selected serum BHB threshold was 25.4%. The sensitivity and specificity of the milk Keto-Test were 92.9% and 68.3%, respectively, at the 100 µmol/L cut-off value. Sensitivity and specificity were 71.4% and 87.8%, respectively, at the 200 µmol/L threshold level. The likelihood ratios (LR) of a positive result with the Keto-Test were 2.9 and 5.8, respectively, for the threshold levels of 100 and 200 µmol/L. This result indicates that the threshold level of 200 µmol/L is the best cut-off level to use at the individual level since a positive test is 5.8 times more likely to come from cows affected with subclinical ketosis than normal ones. In herds with a prevalence of subclinical ketosis of 25%, the predictive values of positive and negative tests would be 66.7% and 90.4%, respectively, when using this threshold level. Moreover, when this diagnostic tool is used on individuals with high prior odds of disease such as subclinical ketosis, the posterior odds of ketosis, when using Keto-Test based on a threshold level of 200 µmol/L (with a LR of 5.8), would be substantially increased and would favor its utilization as a valuable cow-side test.

On the other hand, if one considers using milk Keto-Test as a screening test in a herd health-monitoring program, a threshold value of 100 µmol/L would be more appropriate given its higher sensitivity, which would minimize the false negative results. When using this threshold, the herd apparent prevalence of subclinical ketosis is generally higher than the true prevalence, but if the apparent prevalence is monitored over time using a control chart, the information can be used as an alarm system in order to determine when to make a change if the process is out of control.