Use of Milk Lactose Concentration as an Indicator of Mastitis Following the Validation of a Novel In-Line Milk Analysis System Designed to Measure Milk Components

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Introduction

Mastitis, an inflammation of the mammary gland, continues to be the largest source of economic loss for the dairy industry. Often caused by a bacterial infection, this disease causes an increase in the milk somatic cell count (SCC) (Park et al., 2007). The milk SCC, an indication of intramammary infection (IMI), is typically measured by the Dairy Herd Improvement Association (DHIA) laboratory (Lukas et al., 2005). Many farms measure individual cow SCC values once a month and, therefore, cannot be used as the only method of identifying mastitis. The capability to measure not only SCC, but milk components on a daily basis could allow for early identification of disease with minimal labor input. Normal levels of each milk component have been determined for healthy animals. It has been reported that milk lactose concentrations decrease and SCC increases during clinical mastitis (Pyorala, 2003). Unfortunately, the timing relative to onset of clinical signs has not been evaluated. Furthermore, when they were used together results were slightly better than SCC alone. A new in-line milk analysis system (AfiLab) has recently been developed (AfiMilk, Israel). This system was previously evaluated and validated using a Holstein population. However, accuracy of the system was not tested for other breeds. This system measures milk fat, protein, and lactose concentrations as well as SCC at every milking. Due to bacterial utilization, we hypothesize milk lactose concentrations may decrease prior to the onset of clinical signs. Therefore, the objectives of this study were to first evaluate the accuracy and precision of the AfiLab system not only for Holsteins, but also for Jerseys and Crossbreds and to assess the drop in milk lactose concentration around clinical mastitis.

Materials and Methods

The AfiLab system is designed to measure milk components including fat, protein, and lactose concentrations. Values were collected for each cow at each milking and data were stored using the AfiFarm software. Composite milk samples were collected daily from Holstein, Jersey and Crossbred lactating cows at the Virginia Tech Dairy Center for an 8-wk period using Dairy Herd Improvement Association (DHIA) sampling bottles. All samples were preserved with bronopol and stored (4° C) until analysis. Milk analyses were conducted at the DHIA Laboratory (Blacksburg, VA) and components measured included fat, protein and lactose percent. Results from the AfiLab system were compared to that from the DHIA Laboratory (gold standard).

Results

All data were stored and analyzed in JMP (SAS Inc. Cary, NC). For preliminary analysis, R^2 values were calculated for each milk component/bred combination. The DHIA results were considered the gold standard. A final statistical evaluation will be conducted at the conclusion of the study. The R^2 values are presented in Table 1.

Table 1: R^2 values for milk components and breed.

R^2 Values	Fat	Protein	Lactose
Holstein	0.65	0.5	0.52
Jersey	0.76	0.52	0.31
Crossbred	0.64	0.45	0.19

Conclusions

The current study evaluated the validity of the AfiLab system in Holstein, Jersey and Crossbred cows. The correlation values ranged from 0.19 to 0.76 (Table 1). The AfiLab system was designed to give producers the ability to monitor daily milk component changes. It is our goal to examine ways to use this data to predict disease prior to clinical onset. Data generated from the AfiLab system appears more correlated for milk fat and protein concentration across three breeds, as compared to lactose. However, the algorithms for lactose concentrations need improvement. AfiMilk is currently working to improve the sensors for all milk components as well as SCC and therefore the calculated correlations are expected to increase. The use of daily milk component data may prove to be an effective way of identifying disease prior to clinical onset. One possible future study may involve examination of fat: protein ratios in milk to predict ketosis.

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