Comparison of Protocols to Estimate 24-Hour Percent Fat and Protein

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Milk recording programs and genetic evaluation programs require 24-hour estimates of fat and protein yield. The Canadian milk recording system is based on a Test Day Model (TDM). Accurate and reliable 24-hour fat and protein yields in herds with an automatic milking system (AMS) poses a challenge.

Various protocols/methods have been suggested to reduce the sampling period and number of samples collected (Lazenby et al, 2002; Galesloot and Peeters, 2000). Ideally, while protocols to estimate 24-hour fat and protein yields save on time, effort and costs, the estimates need to accurately represent the actual 24-hour yields. The objective of this study was to examine the agreement between observed and estimated 24-hour fat and protein yields from AMS herds. Four different protocols were analyzed.

Materials and Methods

The protocols investigated for estimation of 24-hour fat and protein yield are summarized below.

Table 1: Descriptions of protocols under investigation.

Protocol	Description
P1	Use single samples unadjusted for covariates where milk intervals must be greater than or equal to 8 hours.
P2	Use single samples for fat and protein with only fat adjusted for covariates where milk intervals must be greater than or equal to 4 hours.
P3	Use all samples adjusted for covariates for test days of lengths 10, 12, 14, 16 and 18 hours
P4	Use all samples unadjusted for covariates for test days of lengths 10, 12, 14, 16 and 18 hours

The covariates in P2 included % fat and % protein of sampled milking, milking interval of sampled milking and previous milking as well as milk yield of sampled milking and previous milking. The covariates in P3 included parity, DIM, season (1 = October to April 2 = May to September), test day milk yield, log(test day percent fat), log(test day percent protein) and a random component due to herds.

Test day milk records and samples were collected from 12 robotic herds in Ontario, Canada over 94 test days for a total of 12,980 sample records. For each animal in the herd on test day, 24-hour percent fat and protein was observed. Following protocols P1 to P4, 24-hour percent fat and protein was then estimated. Agreement was assessed by calculating concordance correlations (Lin, 1989) between observed and estimated yields, estimation of the agreement line (regression

of observed yields on estimated yields), Bland-Altman (1986) plots and 95% tolerance intervals for the difference between observed and predicted means (D). All analyses were performed using SAS (1990).

Fat

Confidence intervals for the slope of the agreement line show only P4 to include 1, although the estimated values are close to one for P1. Confidence intervals for the intercept of the agreement line include 0 only for P4. All protocols have estimated concordance correlations approaching 1. Tolerance intervals for D were smallest for P3 (16 and 18 hours) and P4 (16 and 18 hours). Bland-Altman plots did not reveal systematic bias.

Protein

None of the confidence intervals for the slope of the agreement line include 1, although, the estimated values are close to one for P1, P2 and P4. Confidence intervals for the intercept of the agreement line include 0 only for P1, although, the estimated values are close to 0 for P2 and P4. All protocols have estimated concordance correlations approaching 1. Tolerance intervals for D were smallest for P3 (16 and 18 hours) and P4 (16 and 18 hours). Bland-Altman plots did not reveal systematic bias.

Discussion

For producers using AMS, there is a need to reduce the cost and effort involved in milk sample collection and analysis to estimate 24-hour fat and protein yield. However, it is imperative before adopting any protocol, to ensure these protocols lead to estimates that are unbiased and reliable. Upon examination of the above tables, it is clear that not all protocols are similar in their abilities to provide reliable estimates. Concerning protein yields, there do not appear to be great discrepancies between protocols. The limiting criterion therefore is the estimation of 24-hour fat yield.

With respect to % fat, P4 is the only protocol with no bias and with no discernible over/under estimation of fat yields. P4 also results in one of the smallest tolerance intervals for D. Clearly, estimating 24-hour fat and protein yield by collecting all milk samples on a 16-hour test day provides the best and most reliable estimates. Furthermore, a 16-hour test day would decrease the amount of effort and expense for the producer.

References

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