Session 5.1: PLF Technology development and data accessibility

S05.O-06

FAT AND PROTEIN CORRECTION – ESTIMATING DAILY FAT PERCENTAGE FROM SINGLE SAMPLE IN AMS HERDS USING A REGRESSION MODEL

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Constant access to the automatic milking system (AMS) leads to varying milking frequency of cows and subsequently varying milking interval lengths and milk yield of single milkings. This influences milk production and can result in variable milk composition in individual milkings during the day and therefore affect daily percentage of milk components.
In this study, different effects of animal and milking frequency associated characteristics on the milk components fat and protein from herds milked with AMS were explored and analysed with respect to their influence on daily percentage. From this, a new regression model was developed to enable the estimation of daily fat percentage from single sampled milking on test day.
Collectively, 909,922 test day records from approx. 177k cows of more than 2k herds in Germany and Austria milked two to three times per day with AMS were assembled.
Protein percentage remained nearly unaffected by milk yield and milking interval length. A high correlation (r = 0.96, P < 0.001) between single sample and daily protein percentage and likewise a small average absolute deviation of 0.06 (SD = 0.07) indicated that a correction for daily protein percentage from single sample is unnecessary.
Contrary, for single sample and daily fat percentage, the correlation is lower (r = 0.85, P < 0.001). The complex process of fat production in the udder is highly affected by milking interval length and milk yield. Depending on these two main effects, fat percentage from single samples deviate from daily percentage by an average of 0.27 (SD = 0.28).
Common regression models addressing this issue mainly rely on fat%, milk yield and milking interval length of two preceding milkings. The new regression model increases the number of included preceding milkings up to four covering a timespan of more than 24 hours. The observed non-linear relation between milk yield and milking interval length was modelled as interaction of both. Furthermore, increase and decrease in fat percentage across lactation was approximated using 2nd degree polynomial of days in milk to express its effect. The non-linearity of fat% was modelled via a cubic function. Moreover, the model is complemented by parity and daytime of the sampled milking classified as 2- and 3-level variables, respectively.
After fitting and testing the new regression model, its performance was compared to two already known regression models. With a root mean squared error (RMSE) of 0.275, a mean absolute error (MAE) of 0.195 and R^2 = 0.816 the new model outperformed the reference models. For 62.6% of test day records, the developed model estimated a more precise daily fat percentage than the measured fat percentage from single milking.
Even though this model cannot replace the gold standard of sampling all milkings on a test day, it is an adequate solution for AMS herds which are not able to take more than one sample on test day.