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Prediction of body condition score for the entire lactation in Walloon Holstein cows

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Body condition score (BCS) is a subjective measure of stored energy reserves of dairy cows. Monitoring changes in body condition throughout the lactation is more valuable than identifying absolute measures of body condition. However, recording BCS values is a time-consuming process and usually there is one BCS record per animal per lactation. The aim was to investigate the ability of a random regression test-day model (RR-TDM) to predict BCS values for the entire lactation in Walloon Holstein cows. Milk yield, fat percentage, protein percentage and BCS records collected on the first-parity cows calved between 2012 and 2022 in 785 herds were used. Records from days in milk (DIM) between 5 d and 365 d were used. Number of test-day records on milk yield traits were 801,095 on 96,770 animals, while the number of records on BCS was 98,390 on 87,231 animals. The (co)variance components and breeding values for the considered traits were estimated based on the integration of RR-TDM using the a multiple-trait (four traits), single-lactation model. Gibbs sampling was used to obtain marginal posterior distributions for the various parameters using a single chain of 200,000 iterates with a burn-in period of 50,000 iterates. Predicted test-day BCS were compared with observed values. The Pearson and Spearman correlation estimated between the predicted and observed BCS values was 0.99 and 0.93, respectively. The root mean squared error (RMSE) and the mean absolute error (MAE) of the prediction were 0.17 and 0.14 BCS unit, respectively. In the next step, BCS records of 1,500 animals were replaced by 0, and were predicted and compared to the observed values. The Pearson and Spearman correlation estimated between the predicted and observed BCS values was 0.57 and 0.56, respectively. The RMSE and the MAE of the prediction were 0.69 and 0.51 BCS unit, respectively. This study showed that MT-RR-TDM has the potential to interpolate the trend of BCS of animals with a single BCS record across the lactation.

Conditions to develop successful mid-infrared (MIR) based BCS and BCS change predictions

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Usefulness of Body condition score (BCS) and BCS changes have been validated in many studies and the development of mid-infrared (MIR) based BCS and BCS change predictions is an ongoing effort. Literature shows the importance of several key factors. First type of reference data, quantity and quality, and measurement methods are important. Reference BCS needs also to be synchronized with MIR spectral measurements. Moreover, especially at the beginning of the lactation, closer repetitions yielded the best literature values but results obtained were only valid in the first 120 days. In the HappyMoo project two efforts were made to use existing data: (1) from an experience using the BodyMat system; and (2) from Walloon conformation recording (1 record / lactation). In both cases, reference values were not synchronized and therefore BCS values had to be imputed across the lactation using appropriate modelling strategies. Also 75 vs 25% calibration vs. validation data was used during the MIR calibration process. For 1) 26,207 BCS records on 3,038 cows (mainly Holstein and Montbéliarde breeds) were used. Partial least squares (PLS) were used as the reference method for prediction, achieving a performance of r=0.58. Machine learning (ML) methods were also assessed. Among them, Support Vector Machine (SVM) achieved best results (r=0.59). For Walloon data 129,870 MIR test-day records on 17,292 animals were available. PLS method achieved the best performance over tested ML methods with r=0.42. Studies showed the difficulties to get enough and synchronized BCS records. Imputations are always second-best options. Also observed variability was suboptimal, with little extreme animals. Therefore, conditions for successful future research will be to optimize selection of herds (i.e. most variable for BCS), of BCS recording (e.g. automatic device-based) and methods.