Event Montreal (CA), ICAR 2022 Annual Conference
Subject Abstract presented manuscript as ORAL presentation

Title of the presentation

Predicting body condition score change in early lactating Irish dairy cows using milk mid infrared spectra

Presenter: Maria Frizzarin, Teagasc, Ireland
E-mail: maria.frizzarin@ucdconnect.ie

Session: Milk Analysis – New developments in using MIR Spectra

Authors: Maria Frizzarin Isobel Claire Gormley Donagh P Berry Sinead McParland

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ABSTRACT

Body condition score (BCS) is a subjective metric used worldwide to reflect the fat stored in mammals. BCS, as well as its change in early lactation, has been associated with productive, reproductive, and health traits. The objective of the present study was to predict BCS change (ΔBCS) in early lactating dairy cows using milk mid infrared (MIR) spectra using different statistical techniques. A total of 73,193 BCS records from 6,572 cows were collected in 5 research farms. To generate daily ΔBCS, splines with 6 knot points across days in milk (DIM) were fitted through individual test-day records of BCS. Daily BCS was interpolated from the splines and used to calculate daily ΔBCS. ΔBCS observations were merged with MIR spectra recorded on the same week. Data in the first 120 DIM of lactation were retained. Three statistical methods were used to predict ΔBCS from the spectra; partial least squares regression (PLSR), generalized additive mixed model (GAMM), and neural networks (NN). Spectra and DIM were used as predictors in PLSR and NN, while the first 20 principal components of the spectra and a spline fitted through DIM were used as predictors in GAMM. Tuning parameters of PLSR were determined using 10 fold cross-validation. The NN model had two hidden layers and a Bayesian regularization applied to the input layer. To compare predictive ability across the approaches, the dataset was divided in 4 sub-datasets, and iteratively 3 sub-datasets were used to train the methods, while the remaining sub-dataset (the test dataset) was used to test the methods. Prediction accuracy was evaluated according to the root mean square error of the test dataset (RMSEV; here multiplied by 1000) and the correlation (r) between the actual and the predicted ΔBCS. The RMSEV and r obtained from the four test datasets were averaged and the standard deviation (SD) is following reported in brackets. The most accurate prediction method was NN with a RMSEV of 1.02 BCS units (0.010) and r of 0.87 (0.004); the SD of actual ΔBCS was 2.05 units. Partial least squares regression and GAMM performed similarly with a RMSEV of 1.11 (0.006) and 1.10 (0.010) BCS units, respectively, and an r of 0.84 (0.003 and 0.004) for both PLSR and GAMM. Results from the present study demonstrate the potential to use milk MIR spectra to predict ΔBCS, which can be used to support farm decisions and can be incorporated in genetic breeding programs. :

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