Summary

The objective of this study was to evaluate the ability of mid-infrared predictions of blood BHB concentration to serve as a tool for large-scale phenotyping and management tool in New Zealand dairy farms.

The study involved 553 cows (Holsteins and Holstein x Jersey crossbreds), from 2 farms located in the Waikato and Taranaki regions of New Zealand, operated under a seasonal-calving, pasture-based dairy system. Milk infrared spectra were collected once a week on all cows. A blood "prick" sample was taken from the ventral labial vein of each cow 3 times a week for the first 5 wk of lactation. The content of β-hydroxybutyrate (**BHB**) in blood was measured immediately using a hand-held device. All blood samples were collected at approximately the same time of the day (7 am, before a fresh allocation of pasture and supplementary feed were offered), between June and October 2016. Concentrations of blood BHB measured on the day before and after the milking where spectra data were acquired were averaged and used for developing prediction models. After outlier elimination, 1,910 spectra records and relative BHB measures were available for calibration.

Calibration models were developed by PLS regression using two-thirds of the cows (corresponding to 1,297 spectra records) and validated on the remaining one-third. Cows in the calibration and validation set were randomly selected. A moderate accuracy was obtained for prediction of blood BHB. The R^2 of calibration was 0.58, with a ratio of performance to deviation (**RPD**), calculated as the ratio of the SD of the PLS model calibration set to the SE of prediction, of 1.54. In validation, the R^2 was 0.49 with RPD = 1.39. The relatively low number of samples with high values of BHB is a limiting factor in development of infrared prediction models. Hence, as an alternative approach, part of the samples in the calibration set were excluded from the analysis, in order to obtain a more balanced distribution of the BHB values. The subset of samples excluded from the calibration set ranged from 25 to 50%. The R^2 in calibration increased (up to 0.63) as the proportion of samples excluded increased, but this led to a reduced R^2 in validation (0.42), indicating that this approach is not expected to improve the predictive ability of models when they are applied at the population level.

This study has shown that the prediction of blood BHB content from milk is possible and moderately accurate and can be potentially used as management tool at farm level. To evaluate the role of infrared predictions as indicator traits of blood BHB content in future selective breeding programs, genetic parameters of the infrared predicted blood BHB need to be estimated.

Keywords: infrared spectroscopy, blood β-hydroxybutyrate, ketosis, prediction model