S07(T)-PP-03

„KetoMIR2“ – Modelling of ketosis risk using vets diagnosis and MIR spectra for dairy cows in early lactation

Andreas Werner[1], Fritz Gollé-Leidreiter[1], Klauss Droessler[1], Franz Josef Auer[2], Martin Mayerhofer[3], Astrid Köck[3], Christa Egger-Danner[3], Laura Monica Dale[1]

[1]Regional association for performance testing in livestock breeding of Baden-Wuerttemberg (LKV – Baden-Wuerttemberg), Stuttgart, Germany

[2]Regional association for performance testing in livestock breeding of Austria (LKV – Austria), Wien, Austria

[3]ZuchtData EDV-Dienstleistungen GmbH, Wien, Austria

Ketosis is a metabolic disorder in ruminants, it is producing indigestion and decreasing food consumption; as well it may increase milk fat percentages and induces a rapid decrease in milk yield. Because ketosis is associated with a wide range of characteristics that can be measured in milk and with recent advances in the estimation of milk components using mid- infrared (MIR) spectrometry, now exists the possibility to determine the composition of several additional milk or blood components such as: negative energy balance or ketone bodies: acetone and β-hydroxybutyrate and citrate milk components, or blood components, such as: BHB, NEFA, glucose und IGF1, etc. The underlying idea is currently to build spectrometric tools, for dairy cows‘ ketosis risk determination based on veterinary diagnosis and milk MIR spectra from routine milk recording. The first approach, KetoMIR1, was based on milk components predicted from standardised milk MIR spectra and is routinely applied by LKV Baden Württemberg and LKV Austria since 2015 respective 2017. The objective of this study was to improve the KetoMIR1 model by directly using the milk MIR spectra and other modelling approaches. The trial data set contains around

810,496 spectral data from around 10,079 LKV Baden Württemberg and LKV Austria herds participating in health monitoring programs. The spectral data set was first pre-processed by Savitzky-Golay first derivative to remove the offset differences between samples for baseline correction, before performing Legendre polynomial modelling. To identify the main variables that were positively or negatively associated with ketosis determination, the data was submitted to logistic regression in combination with lasso parameter optimization using the “glmnet” R package. For the non-healthy group the spectral data recorded within ±14 days around a ketosis diagnosis was used. For the healthy group only spectra which had no diagnosis associated within ±60 days were used. Furthermore the sampling moment, lactation stage and important breeds and the Legendre polynomial data based on DIM for the 212 OptiMIR wavenumbers of spectral data were considered as fix effects. The validation approach was first 10 fold cross validation and an external validation set from a lot of 11 representative farms was selected. The KetoMIR2 calibration model showed medium sensitivity (0.72) and good specificity (0.84). It has to be underlined that no information could be found in the literature of direct use of spectral data to predict the ketosis threat. The ketosis was usually detected using ketostix, blood analysis or by modelling of BHB, acetone or citrate in milk. The KetoMIR2 model shows better classification as KetoMIR1. KetoMIR2 model probability shows high correlation with NEB, BHB and milk yield. KetoMIR2 provides three classes of ketosis warning such as not, moderately and severely endangered. The moderately endangered class is a signal for the farmer. In that case the farmer would contact the veterinary and a control would be made in order to prevent the

ketosis diseases in time. The KetoMIR2 prediction can also be used in herd management to detect general feeding deficiencies in the late and early lactation transition period at herd level.

Keywords: KetoMIR, ketosis risk, ketosis detection, early lactation, MIR milk spectra, dairy cow, dairy farming