



16. New Milk Recording Methods and Services

Title presentation

Practical Application of Ketosis and Energy Deficit Milk MIR Spectral Predictions

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Abstract

During last 15 years different researchers were developing new calibration models linked to milk main components such as fatty acids or minerals, milk biomarkers such as ketone bodies in milk or inflammation indicators or complex components such as energy deficit, ketosis, mastitis, CH₄ or pregnancy with the help of mid-infrared (MIR) spectrometry spectral data.

A major provider of MIR services is European Milk Recording (EMR), an umbrella organisation created by former OptiMIR milk recording organisations (MROs), which offer MIR standardisation and predictions. EMR's members are continuously supporting the creation and maintenance of MIR models by collaborating and participating in research projects. MROs having access to milk MIR spectra and prediction models have been increasingly integrating these predictions into services for dairy farmers. Ketosis is a metabolic disorder in ruminants caused by extremely negative energy balance (EB) in early lactation. It may induce an increase in milk fat percentages and ketone bodies as well as a rapid decrease in milk yield, body weight and feed intake. It is also known for causing secondary diseases and fertility problems. Ketosis risk and negative EB can be determined on cow level by using ketone test kits, blood analysis or by milk MIR predictions such as BHB or acetone. The new idea of KetoMIR was the modelling of ketosis risk based on ketosis diagnosis from veterinaries as reference and milk MIR spectra absorptions as input in order to provide a better indicator in the milk recording service. The first implementation was KetoMIR1 developed by LKV Baden-Württemberg (LKV B.W.). It was based on milk components predicted from standardised milk MIR spectra and is routinely applied by the MROs LKV B.W. and LKV Austria since 2015 respective 2017. It has to be underlined that until then in literature no information could be found of direct prediction of ketosis risk based on routine MRO spectral and diagnosis data. Since 2018 KetoMIR2 is developed in both MROs within the D4Dairy project. It is a logistic regression model based on standardised milk MIR spectra, sampling moment, lactation number and breed as input and veterinary diagnosis as ketosis reference. The spectra has been pre-processed following the OptiMIR/EMR procedure and corrected for days in milk by Legendre polynom. The optimal selection of input parameter was done by using the glmnet R package with lasso method and 10 fold CV. Applied to an external validation set of 11 representative farms the model showed good specificity (0.84) and medium sensitivity (0.72). The KetoMIR2 risk probability shows high correlation with energy deficit, blood BHB and milk



yield. KetoMIR2 provides three classes of ketosis warning such as not, moderately and severely endangered and can also be used in herd management to detect general feeding deficiencies. Currently KetoMIR2 is evaluated by feeding advisors of LKV B.W. in a monthly EB report called EMIR. Here it is contrasted with other EB MIR predictions like KetoMIR-1, EB-NEL (as developed by LKV B.W., DLQ and optiKUH) and fatty acid groups. At LKV Austria KetoMIR-2 is on going evaluated additionally with blood ketotest kits.