Friday, March 8, 2024

Abstract Submission Form

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Preferred presentation Oral

Preferred session Session 6: SC Dairy Cattle Milk Recording – Presentation and evaluation of new analytical parameters in herd management for dairy farms

Email of corresponding author LDale@lkvbw.de

Title of your paper Predicting dairy cattle heat stress indicators using machine learning and mid infrared spectral data

Insert ABSTRACT text

Heat stress negatively affects the well-being, productivity, and profitability of dairy cows and farms. Previous studies have primarily focused on indicators such as respiration rate, skin temperature, rectal temperature, and milk yield, with limited research on the impact of heat stress on milk composition. Initial findings from various locations like Belgium, Tunisia, and Germany have explored the mid-infrared (MIR) responses to heat stress in dairy cows. This study aimed to investigate the effects of heat stress on LKV Baden-Württemberg (LKVBW) farms within a 20 km radius of weather stations using all available datasets related to milk production traits and predicted milk biomarkers derived from MIR spectra. Additionally, the study sought to determine if there are differences in heat stress indicators between data collected from

barn weather stations versus public weather stations. Meteorological data from public weather stations in Baden-Württemberg (BW) and barn weather stations from MobiMets and Pessl Instruments devices, including temperature and humidity, were combined with data collected by the milk recording organization. THI values were calculated using mathematical calculations for daily averages, and a three-day average was linked to farm data based on the day of milk recording collection. These datasets were then linked to each animal using monthly spectral data for each cow from 500 selected LKVBW farms. The model was developed as part of the HappyMoo project using MIR spectral data from Bentley Instruments devices collected in the LKVBW database from 2012 to 2019, with external validation conducted on a dataset containing MIR spectral data from 2020 to 2022. Barn weather data was collected in Projekt KlimaCO, with MobiMets data from 2020 to 2022 and Pessl Instruments data from 2021 to 2023. A machine learning algorithm was implemented in R using the "glmnet" package. The spectral data were standardized using the EMR method and preprocessed with the first derivative algorithm using the Savitzky-Golay filter. Differences were observed in MIR spectra recorded under THI and thermoneutral conditions, with certain wavenumbers of the MIR spectrum showing varying responses. The THI index was established based on the relationship between the THI value of individual cows and the mean THI value of the farm. Pearson correlations were calculated using the THI index and milk parameters in the R environment with the "corrplot" library. The THI index showed negative correlations with milk yield (0.15), lactose (0.12), acetate (0.33), blood NEFA (0.2) and positive correlations with fat content (0.59), protein content (0.40), blood BHB (0.25), blood glucose (0.30), blood calcium (0.21) and fatty acids (0.35). No differences were found between public weather stations and barn weather stations. Additional analysis is required within the scope of upcoming projects like HoliCow and ResKuh to identify possible MIR heat stress phenotypes derived from milk. These phenotypes could be utilized for herd management and breeding purposes to pinpoint animals that are resilient to heat stress.

Enter keywords MIR, spectral data, dairy cows, heat stress