Friday, March 8, 2024

Abstract Submission Form

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Preferred presentation Oral

Preferred session Session 2: SC Milk Analysis – New tools to extend the horizon of milk mid-infrared spectrometry

Email of corresponding author marine.gele@idele.fr

Title of your paper Predicting glutamate concentration in milk using mid-infrared spectrometry for routine detection of energy-deficient cows

Insert ABSTRACT text

Identifying energy-deficient cows is difficult on farm. To calculate their energy balance, it is necessary to know the feed intake of each cow and their requirements. The aim of the BIOMARQ'LAIT project was to identify molecules that could be measured in milk and used as a non-invasive approach to determine the capacity of dairy cows to cope with an energy deficit. In this project, the impact of feed restriction was studied on numerous milk components using several experimental protocols. These trials have led to the definition of a panel of candidate biomarkers for energy deficiency, consisting of metabolites, proteins, and microRNAs. Among the candidate metabolites, glutamate proved to be an interesting biomarker for identifying energy-deficient cows.
The project then led to predict the concentration of glutamate in milk based on the mid-infrared spectra. A total of 624 MIR spectra for which the associated measure of glutamate concentration is known were available. Of these, 536 data came from a 6-days feed restriction trial carried out in 2016 on 9 Holstein and

10 Montbéliarde cows in mid-lactation. The feed was restricted down to 50% of the energy requirements estimated during the previous ad libitum period. Samples were taken each day before (4 days), during (6 days) and after (8 days) the feed restriction using a fluorometric analysis. The 88 remaining data gather 28 Holstein cows that calved in autumn 2017. The feed restriction was based on a dilution of the diet with straw during spring 2018 at mid-lactation. Glutamate concentrations of those 88 data were analysed by a fluorometric method and were measured based on milk sampled at 22 ± 1 days in milk, during a physiological energy deficit, and then at Day-7 and Day+7 relatively to the initiation of the feed restriction. Two datasets were then created. A calibration set including 70% of the data (439 data, mean glutamate concentration = 319.8 µmol/L; standard deviation = 183.2 µmol/L) was used to develop the equation using spare partial least squares regression. A validation set comprising 30% of the data (185 data, mean glutamate concentration = 326.2 µmol/L; standard deviation = 150.5 µmol/L) was then used to apply the equation to calculate its accuracy (coefficient of determination (R^2) and root-mean-square error (RMSE)). Milk glutamate concentrations were predicted by the MIR spectra with a calibration R^2 and RMSE of 0.80 and 82.9 µmol/L, respectively. Validation R^2 and RMSE reached 0.67 and 87.5 µmol/L, respectively. This equation for estimating the glutamate concentration in milk is original. Its use as part of a panel of biomarkers paves the way for simple and more affordable use in detecting energy-deficient dairy cows.

Enter keywords

dairy cattle, feed restriction, milk metabolite, mid-infrared spectrometry