From MIR predicted fatty acids on bulk tank milk to a health monitoring tool for farmer

S. Franceschini[1], C. Fastré[1], C. Nickmilder[1], D. Santschi[2], D. Warner[2], M. Bahadi[2], C. Bertozzi[3], D. Veselko[4], F. Dehareng[5], N. Gengler[1], and H. Soyeurt[1]

[1] ULiège Gembloux Agro-Bio Tech, 2 Passage des Déportés, 5030 Gembloux, Belgium, [2] Lactanet, Boul des Anciens-Combattants 555, H9X 3R4 Saint-Anne-de-Bellevue, Canada, [3] Walloon Breeder Association, Rue des Champs Elysées 4, 5590 Ciney, Belgium, [4] Comité du Lait, Route de Herve, 104, 4651 Battice, Belgium, [5] Walloon Research Centre, Chée de Namur, 24, 5030 Gembloux, Belgium

Previous research has established associations between the fatty acid (FA) profiles and parameters such as energy balance, heat stress and dietary composition. Consequently, FA profiles predicted from mid-infrared (MIR) spectra of bulk tank milk hold promise as valuable indicators of herd health. Leveraging routinely collected data from bulk tank milk, this study employs unsupervised learning techniques on a large dataset (N=803,411) to cluster herds based on their MIR-predicted FA composition, thereby assessing herd status.

Seven distinct clusters were identified, with one exhibiting associations with health issues, while at least two others were linked to management practices such as grazing. The health issue cluster has the lowest predicted milk yield, energy balance and protein efficiency, while having the highest predicted blood β-hydroxybutyrate and blood non-esterified fatty acid. These clusters were predicted from FA features using the random forest (RF) algorithm, achieving a cross-validation accuracy of 92% but also directly from spectra with an accuracy of 76%. By analyzing the dynamics of herds over time using these predicted clusters, we observed that herds categorized as having a "healthy" status never transitioned directly to a "sick" status; instead, they moved through an "intermediate" status. These intermediate stages serve as promising indicators to assist farmers in monitoring herd health using routinely acquired MIR data.