Multiple breeds and countries predictions of mineral contents in milk from milk mid-infrared spectrometry.

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Abstract

Measuring the mineral composition (calcium, phosphorous, sodium, potassium and magnesium) of milk is of major interest in the dairy sector. Minerals can be considered as biomarkers for udder health and used to manage the environmental impact of dairy herds relative to water eutrophication. The first objective of this study is to develop and validate robust multi-breeds and multi-countries models predicting the major cations through milk mid-infrared spectrometry. The second objective is to apply the models on the milk recording large-scale spectral database. A total of 1370 samples coming from five countries were analyzed on spectrometers to obtain the mid-infrared spectra and in ICP-AES for mineral references. Models were performed using partial least square regressions. The models provided validation RMSE of 53.52, 62.69, 49.05, 91.30 and 6.87 mg/L for Ca, P, Na, K and Mg respectively, and associated RPD were 2.31, 1.88, 1.16, 1.46 and 1.79. Developed models were applied on the Walloon spectral database including 3,510,077 spectra of 235,355 cows recorded between 2012 and 2020. Large-scale predictions on the real database provide new insight regarding content of minerals in the population, as well as the effect of parity, days in milk, stage of lactation, breeds and seasons among others.