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Genetic parameters for milk calcium content predicted by MIR spectroscopy in three French breeds

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The aims of this study were to develop an equation to estimate calcium content (Ca) in bovine milk, using mid-infrared (MIR) spectroscopy and to determine Ca genetic parameters. To develop the Ca equation, 300 milk samples were selected from PhénoFinlait milkbank to cover a large range of breeding practices (3 breeds, different areas, seasons, lactation numbers, diets ...). Those samples were both analyzed by MIR and by atomic absorption spectrometry which is the reference method for Ca measurement. 210 out of the 300 samples were used as calibration dataset and the remaining 90 were used as independent validation set. The determination coefficient of validation of the equation (R_v^2) reached 0.79 and its residual standard deviation ($s_{y,x}$) was 4%. Genetic parameters of Ca were estimated for the three French major dairy breeds (Prim'holstein (HOL), Montbéliarde (MON), Normande (NOR)). Ca equation was applied to 35,326 spectral records collected from 6,723 first lactation HOL cows, 28,508 spectral records collected from 5,590 first lactation NOR cows, and 50,505 spectral records collected from 6,330 first lactation MON cows. Three different models were used to estimate genetic parameters (1) an individual test-day repeatability model, (2) a lactation model, where the trait is the average of test-day records and (3) a test-day random regression model. The heritabilities of Ca estimated with lactation model were 0.44 in HOL, 0.74 in NOR and 0.70 in MON. The coefficients of genetic variation were 3.6, 4.3 and 4.2% in HOL, NOR and MON, respectively. And data from more than 8000 cows in the 3 breeds will be used for the next step: analysis of genomic sequences to identify causal mutations for Ca.