# Calcium dynamics and associated patterns of milk constituents in early lactation multiparous Holsteins

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At the onset of lactation, increased physiological demand for calcium creates a homeostatic challenge for transitioning dairy cows. Dynamic responses to this challenge classify cows into four groups based on serum total calcium concentrations (**tCa**) at 1 and 4 DIM. Cows with subclinical hypocalcemia (**SCH**) at 1 and 4 DIM or 4 DIM only, classified as persistent (**pSCH**) or delayed SCH (**dSCH**), respectively, are at a greater risk of adverse health events and suboptimal production, whereas cows not experiencing SCH at either DIM or at 1 DIM only, classified as normocalcemic (**NC**) and transient SCH (**tSCH**), respectively, are at reduced risk. Our prospective cohort study objectives were to 1) characterize milk constituent profiles for cows in each calcium group using Fourier-transform infrared (**FTIR**) spectroscopic analysis of milk samples and 2) investigate the potential of these methods for classifying cows into groups at a clinically useful timepoint. We collected blood from 345 multiparous Holsteins on a dairy farm in Cayuga County, NY at 1 and 4 DIM, with proportional milk samples collected from 3 through 10 DIM. Diagnostic cut points for SCH were derived using receiver operating characteristic curves based on health and production outcomes and were 2.03 mmol/L at 1 DIM and 2.25 mmol/L at 4 DIM. Milk constituent profiles at 3 DIM were compared between calcium groups using linear regression with the fixed effect of parity and a parity-group interaction. Calcium group differences were found for daily milk yield ($P < 0.001$), lactose % ($P < 0.001$), protein % ($P < 0.001$), milk urea nitrogen ($P = 0.03$), de novo fatty acid (**FA**) g/100 g milk ($P < 0.001$), mixed FA relative % (**rel%**, $P = 0.04$), preformed FA g/100 g milk ($P = 0.03$), and preformed FA rel% ($P < 0.001$). Calcium groups differed by parity for de novo FA rel% ($P = 0.03$) and milk predicted blood non-esterified FA ($P = 0.02$). Though further work is needed to overcome the limitation of measurement on a single farm, our conclusions provide evidence that calcium dynamic groups may be differentiated using milk FTIR methods.

**Keywords:** subclinical hypocalcemia, calcium, Fourier-transform infrared spectroscopy, fatty acids