

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

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## Introduction

Immediately following parturition, physiological demands for calcium increase substantially to support the onset of milk production. As a result, transitioning dairy cows may experience subclinical hypocalcemia (SCH) at some point during early lactation. Cows respond to this homeostatic challenge dynamically, such that serum total calcium concentrations (tCa) at 1 and 4 days in milk (DIM) can be used to classify cows into 4 calcium dynamic groups: normocalcemic (NC: SCH at no DIM), transient (tSCH: SCH at 1 DIM only), delayed (dSCH: SCH at 4 DIM only) and persistent (pSCH: SCH at both 1 and 4 DIM). Identifying cows in the pSCH and dSCH groups is important clinically because these groups are at greater risk of adverse health events compared to the NC and tSCH cows. Our objective was to describe the temporal patterns of milk constituents for cows in each calcium group using Fourier-transform infrared (FTIR) spectroscopic analysis of milk samples. Additionally, we hoped to ascertain whether these methods might be valuable as a diagnostic tool for grouping cows based on calcium dynamics at a clinically useful timepoint.

## Materials and methods

To conduct our prospective cohort study, we collected blood as well as health and production data from 343 multiparous Holsteins on a dairy farm in Cayuga County, N.Y. at 1 and 4 DIM, with proportional milk samples collected from 3 through 10 DIM. Serum was analyzed to determine tCa using commercial kits and milk constituents were determined through FTIR methods. Diagnostic tCa cut points were derived using receiver operating characteristic curves based on health and production outcomes, and individual milk constituents at 3 DIM were compared between calcium groups using linear regression with the fixed effect of parity and a parity-group interaction.

## Results

Diagnostic tCa cutpoints were 1.98 mmol/L at 1 DIM and 2.25 mmol/L at 4 DIM. Calcium group differences were found for daily milk yield ( $P < 0.001$ ), lactose % ( $P = 0.004$ ), protein % ( $P < 0.001$ ), de novo fatty acid (FA) g/100 g milk ( $P = 0.03$ ), de novo FA relative % (rel%.  $P < 0.001$ ), mixed FA rel% ( $P = 0.004$ ), preformed FA g/100 g milk ( $P = 0.01$ ), preformed FA rel% ( $P < 0.001$ ) and milk predicted blood non-esterified FA ( $P = 0.009$ ). Calcium groups differed by parity for milk urea nitrogen ( $P = 0.03$ ).

## Significance

Though our work may be limited by measurement on a single farm, our conclusions provide promising evidence that milk FTIR methods may be useful for identifying cows with unfavorable calcium dynamics.

