

Diurnal variation of milk fatty acids in early-lactation Holstein cows with and without hyperketonemia

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Introduction

Estimates of milk constituents by Fourier-transform mid-infrared (FTIR) analysis offer a promising tool in identifying dairy cows experiencing excessive energy deficit (EED) in early lactation. Our objectives were to describe the diurnal variation of FTIR estimates of milk fatty acids (FA) and the effect of hyperketonemia on this variation.

Materials and methods

Blood samples were collected bihourly for 5 d from multiparous Holstein cows ($n = 28$) enrolled between 3 and 9 DIM. Cows were fed ad libitum once daily at 0900 h, and milk samples were collected thrice daily at 0600 h (M1), 1400 h (M2), and 2200 h (M3) for d 2, 3, and 4 of the study period. Cows were classified as hyperketonemic (HYK; $n = 13$) if their average daily blood BHB was ≥ 1.2 mmol/L for ≥ 3 d or HYK negative (non-HYK; $n = 15$) if their average daily blood BHB was ≥ 1.2 mmol/L for ≤ 2 d. Milk samples were analyzed via FTIR for de novo, mixed and preformed FA yield and relative percentage (g/100 g FA; rel%), and yield of C18:0 and cis-9 C18:1. Generalized linear mixed models were used to analyze concentrations of FA over time and differences between HYK groups.

Results

De novo FA rel% were greater in non-HYK cows than HYK cows ($P = 0.01$; $18.7 \pm 1.4\%$ and $15.8 \pm 1.5\%$, respectively) and differed by milking time ($P < 0.001$), with peak concentrations occurring at M1 and nadirs at M2. The HYK cows had a greater rel% of preformed FA than non-HYK cows ($P = 0.03$; $51.1 \pm 3.0\%$ and $46.2 \pm 2.8\%$, respectively) and differed by milking time ($P < 0.001$), reaching a nadir at M1 and peaking at M2. The yield of preformed FA was greater in HYK cows compared to non-HYK cows ($P = 0.05$; 336.0 ± 25.8 g and 298.0 ± 24.1 g, respectively) and differed by milking time ($P = 0.001$), with the greatest yields occurring at M2 and lowest yields at M1. Yields of C18:0 and cis-9 C18:1 varied by milking time ($P < 0.001$); both with nadirs at M1 and peaks at M2. The yield of C18:0 was greater in HYK cows than non-HYK cows ($P = 0.01$; 84.6 ± 5.6 g and 72.1 ± 5.5 g, respectively).

Significance

Our findings support the use of FTIR estimates of milk FA to identify cows experiencing EED, however time relative to feeding should be considered when analyzing milk FA.

