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Within-day variation in milk and blood metrics for hyperketonemic and non-hypoketonemic dairy cows

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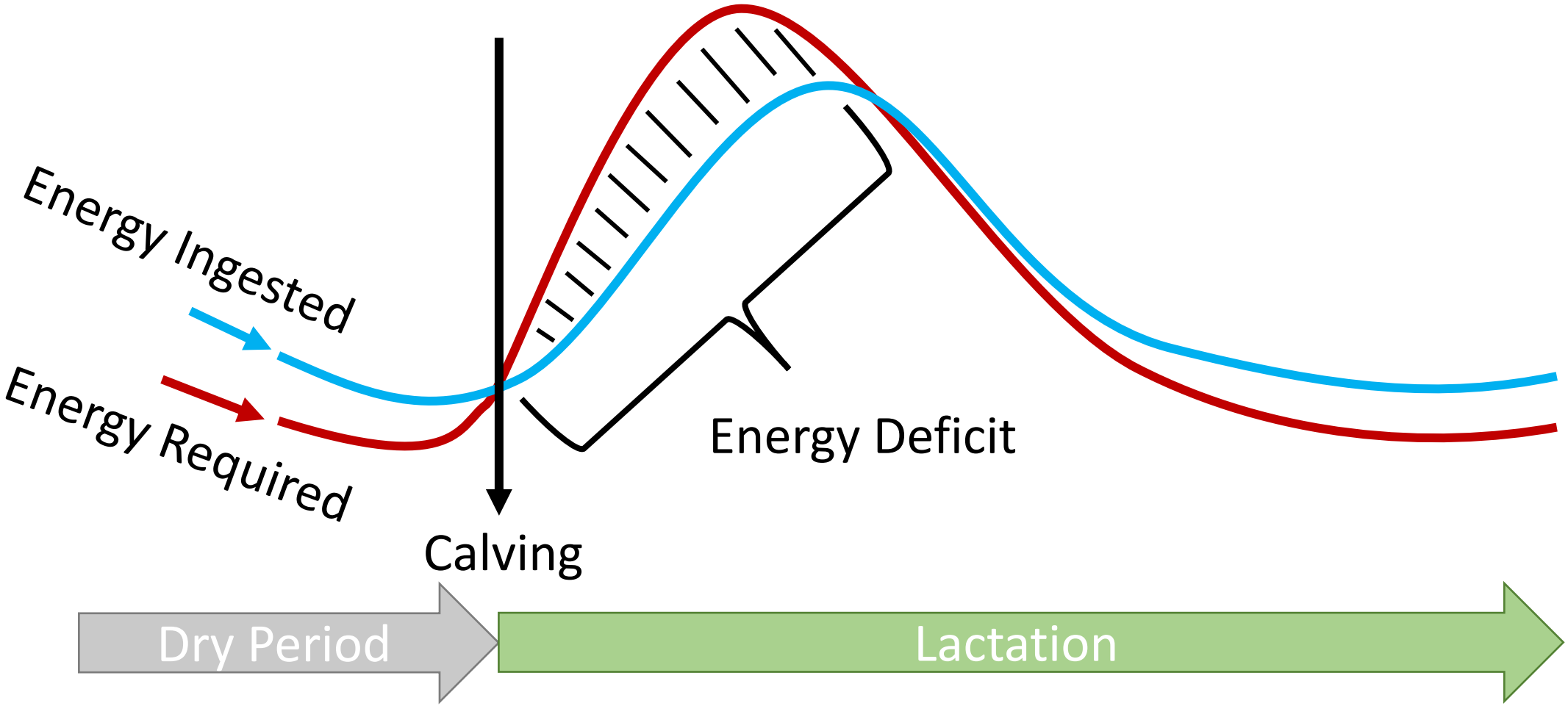
The Transition Period



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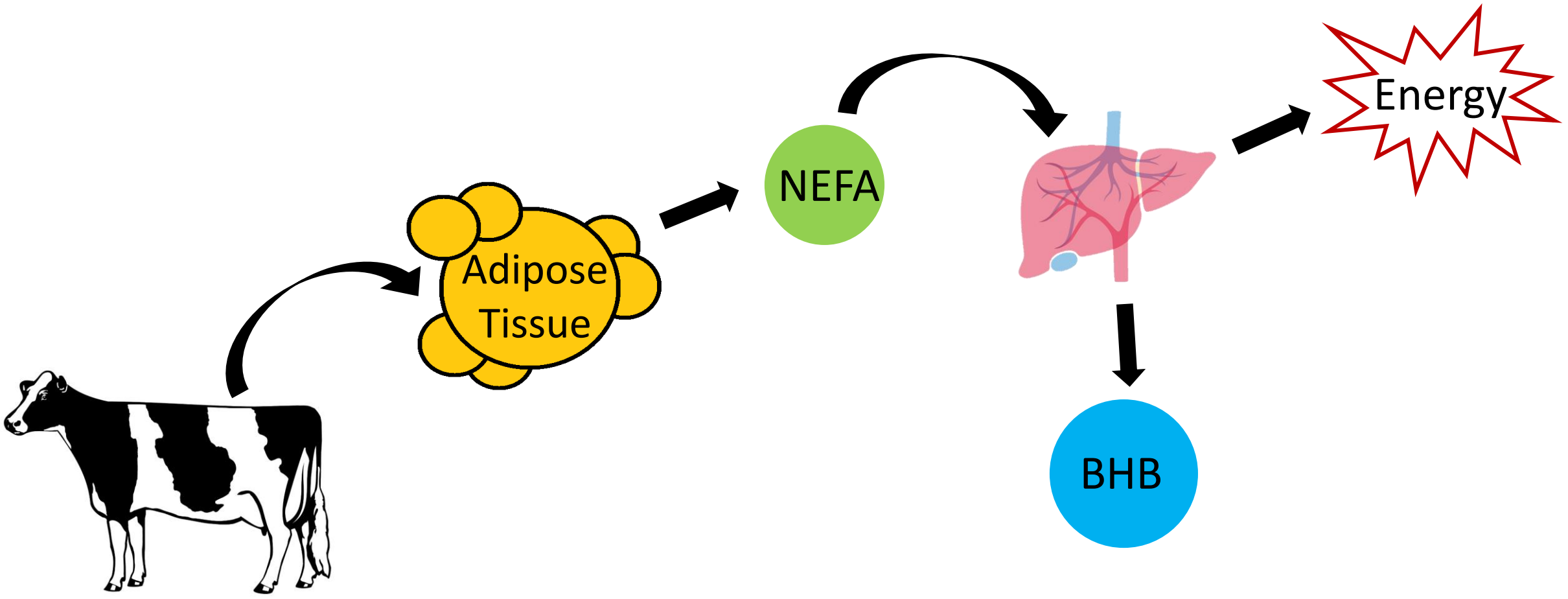
Energy Deficit



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Hyperketonemia (HYK)

- Result of elevated ketone bodies in blood
  - Associated with negative health events
  - Decreased milk production
- Can quantify BHB in blood
  - Costly and labor intensive

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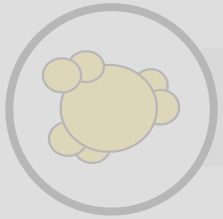
Monitoring HYK Through Milk

Fourier Transform mid-infrared (FTIR) milk analysis

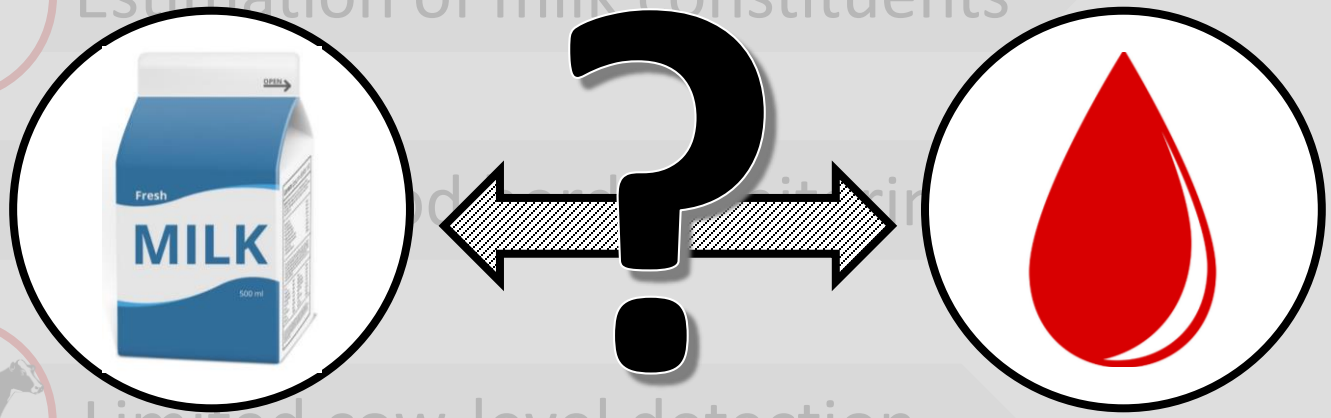
Estimation of milk constituents

Milk BHB

Limited cow-level detection



Inclusion of milk predicted blood NEFA (mpbNEFA)



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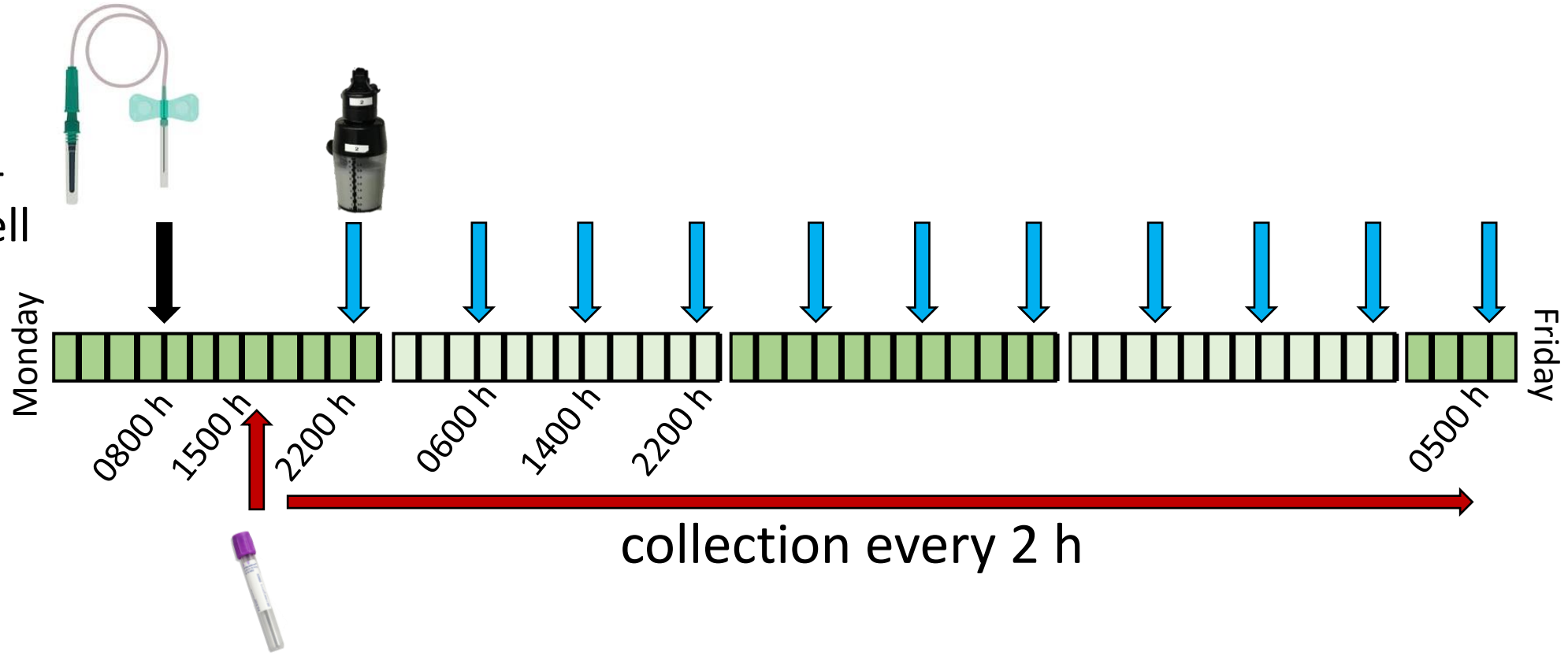
Objectives

1) Determine the diurnal variation in plasma BHB and NEFA, mBHB and mpbNEFA, and milk fatty acids

2) Explore the effects of HYK on diurnal patterns of blood and milk constituents

Materials & Methods: Study Timeline

- 28 multiparous Holstein cows
- Between 3 - 9 DIM
- Housed in tie-stalls at Cornell University Ruminant Center
- June & July 2019



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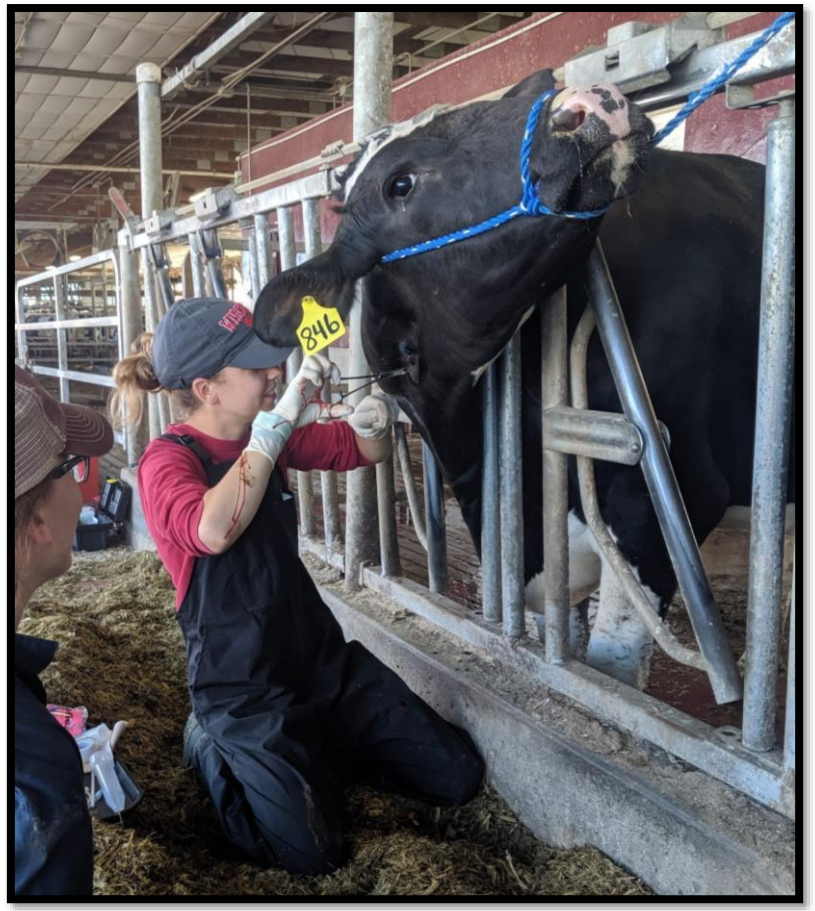
Materials & Methods: Sample Collection



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Materials & Methods: Sample Analysis

- Plasma samples analyzed for BHB and NEFA at NY State Animal Health and Diagnostic Center (Ithaca, NY)
- Milk samples (3X per day) analyzed for mBHB and mpbNEFA by FTIR at Barbano Lab (Cornell University)

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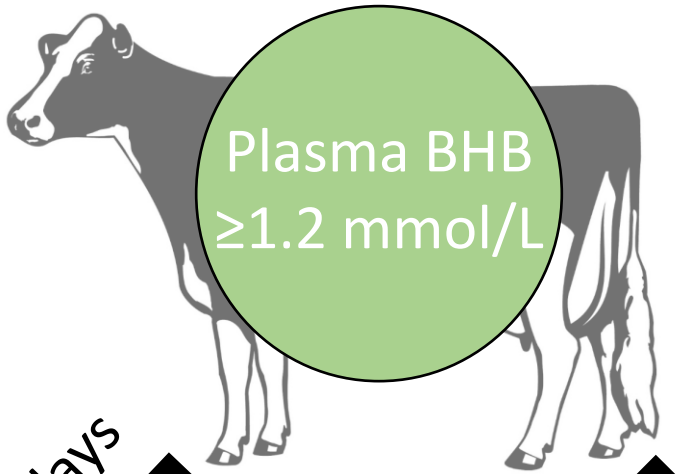
Materials & Methods: Statistical Analysis



≥3 study days

≤2 study days

HYK group
N = 13

Non-HYK group
N = 15

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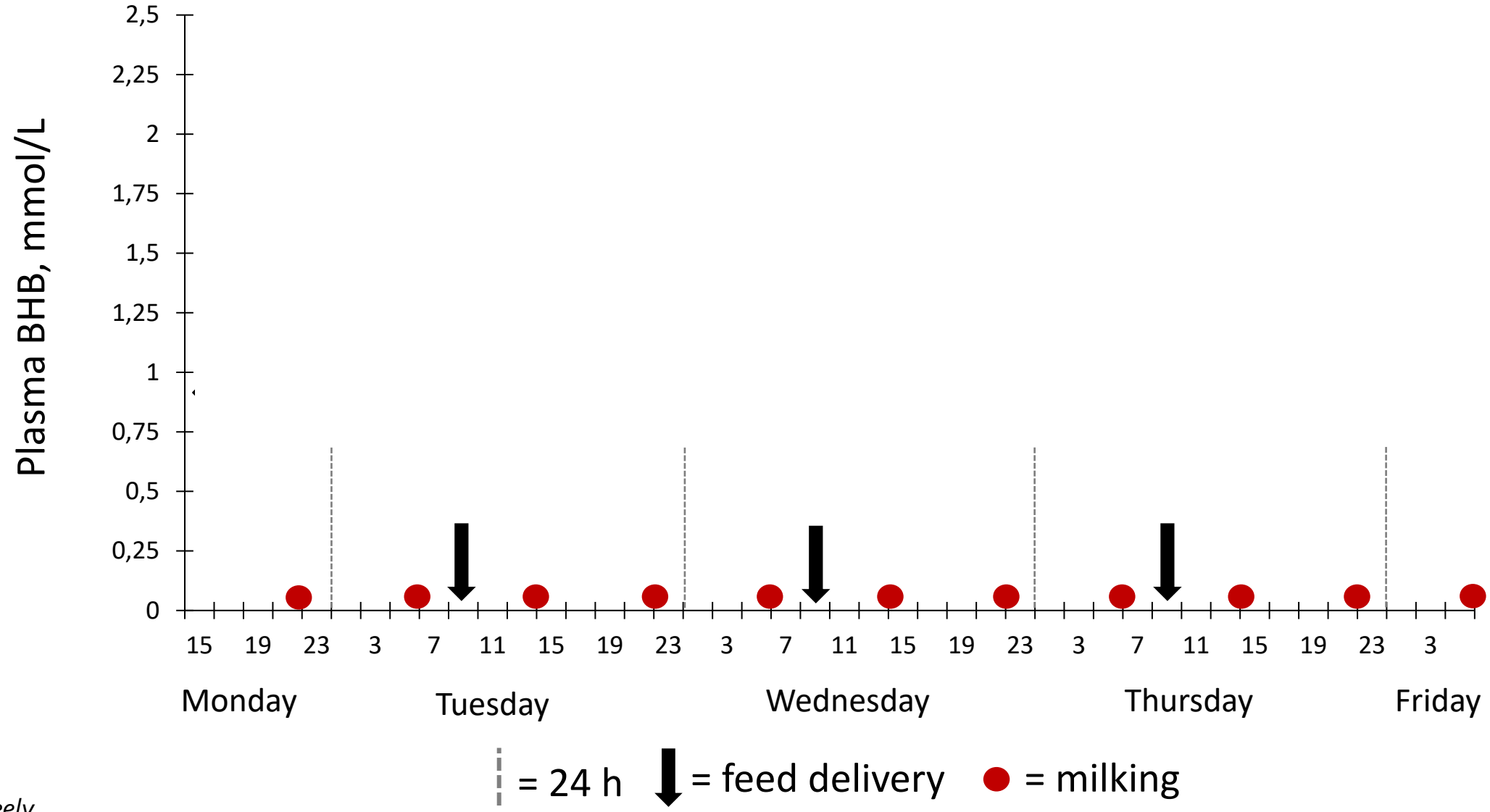
Results: Plasma BHB, all cows



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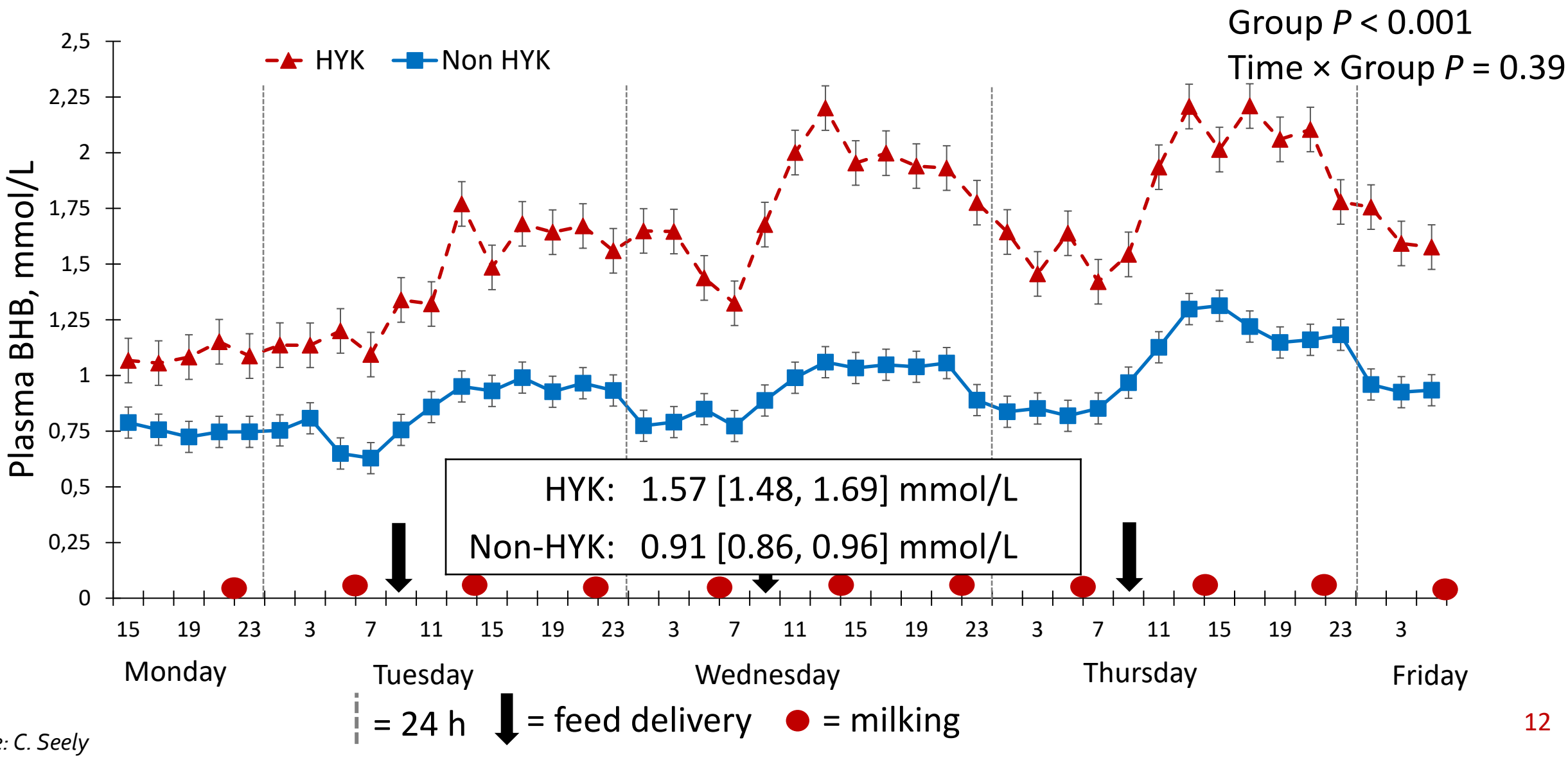
Results: Plasma BHB, by HYK group



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Results: Plasma NEFA, all cows

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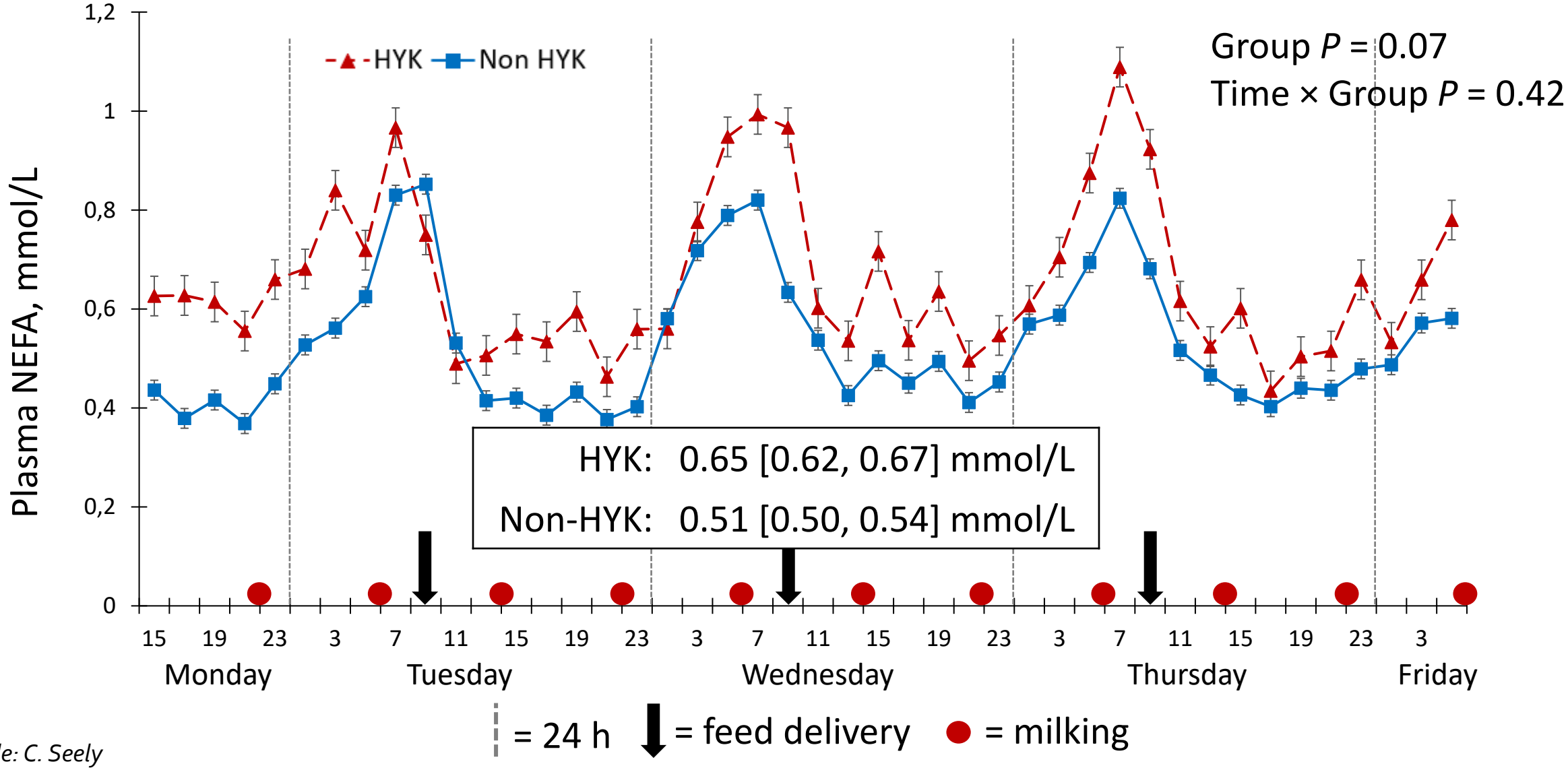
Results: Plasma NEFA, by HYK group



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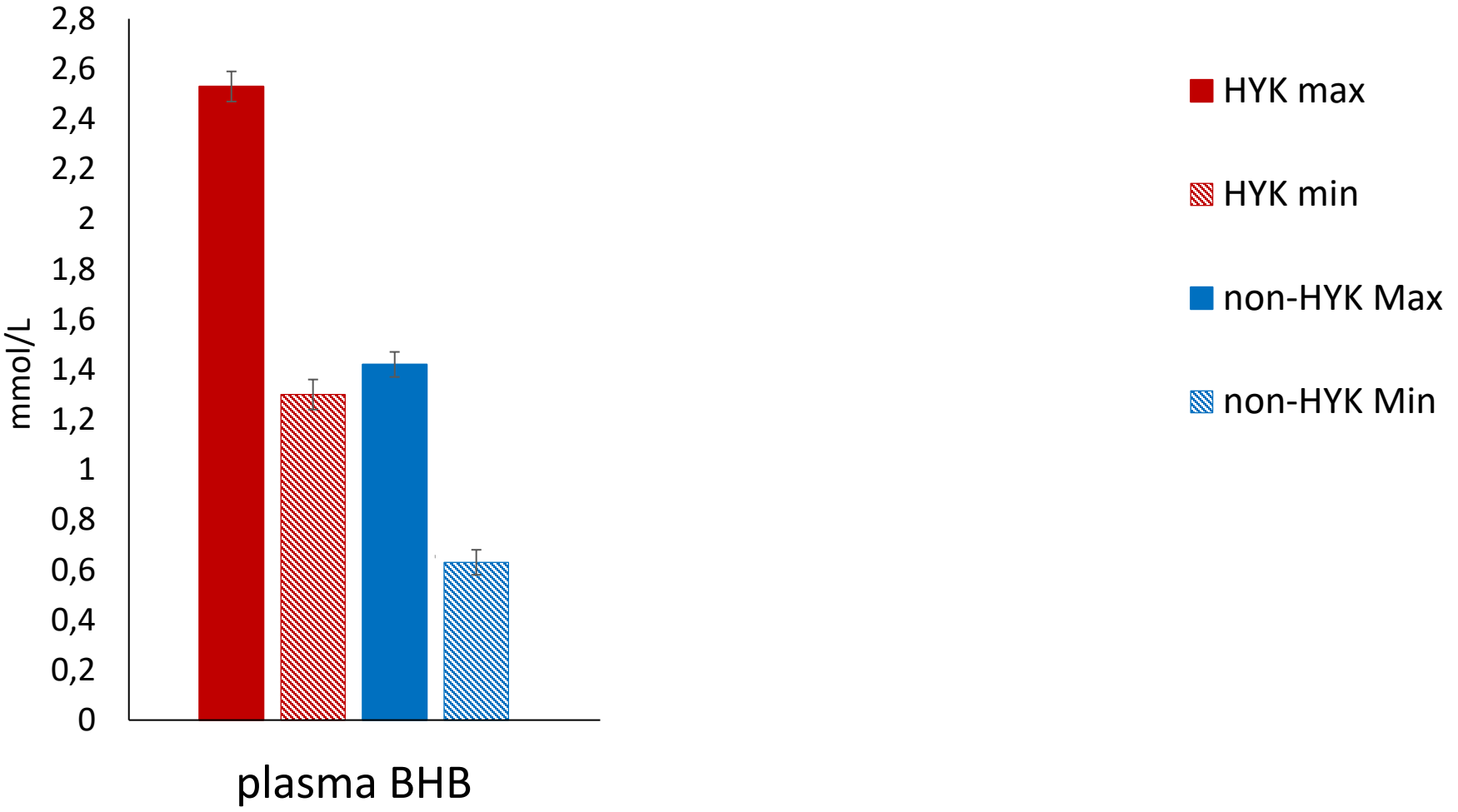
Results: Magnitude of Daily Change in Blood



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Conclusions - Blood

- Diurnal patterns of plasma metabolites
- HYK status affected daily amplitude of change for plasma metabolites
- What happened in milk?

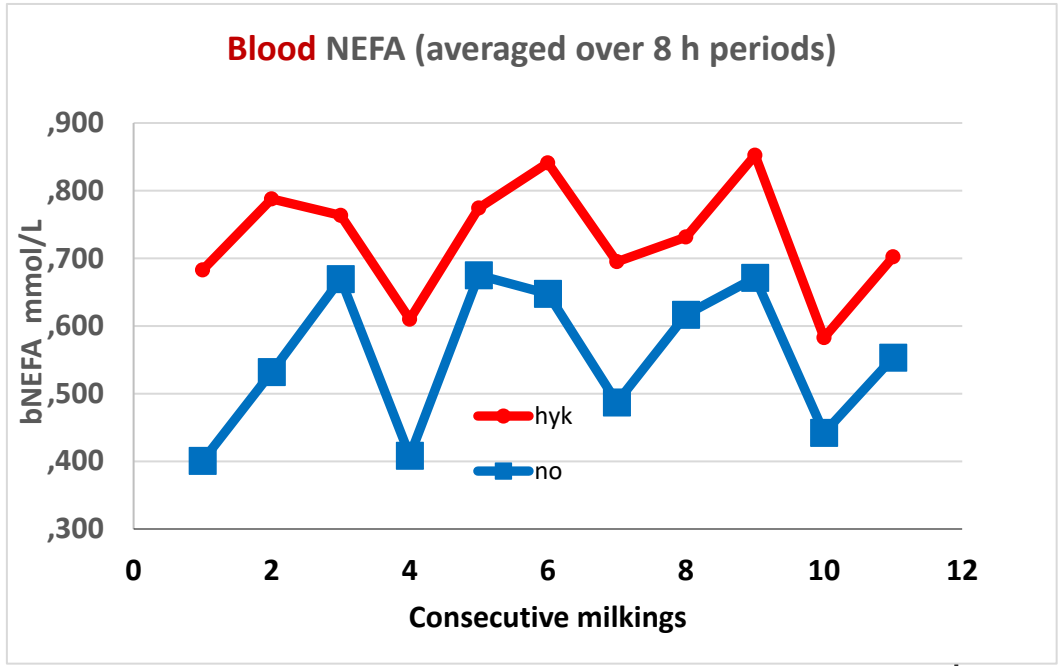
Results: Milk and Blood Metrics

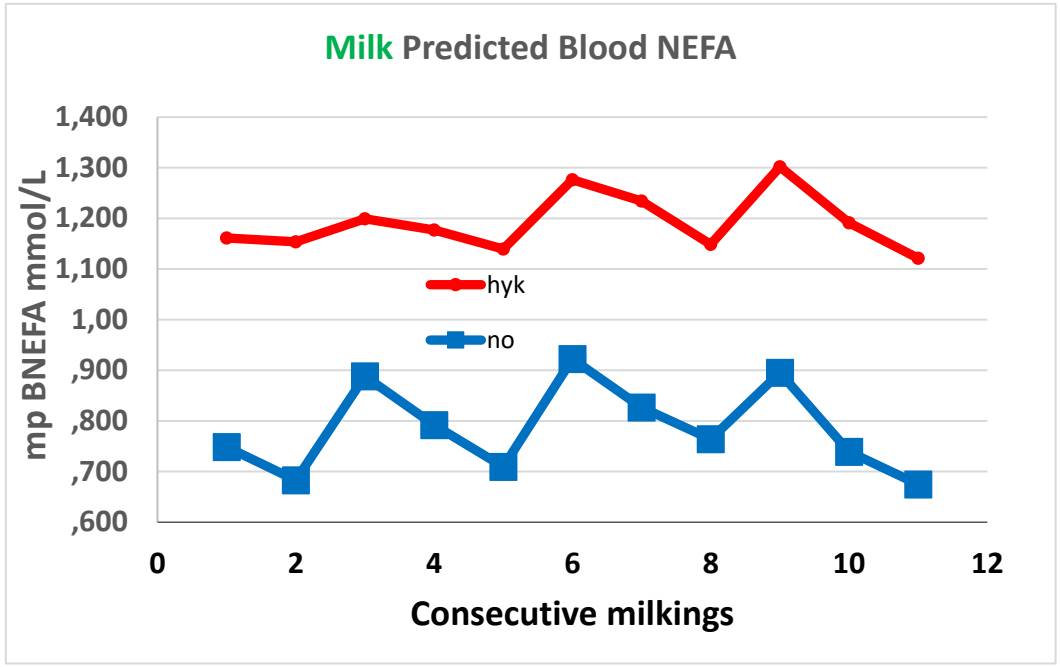
Blood samples were collected every 2 hours within each day, while milk samples were collected at 8 hour intervals within each day.

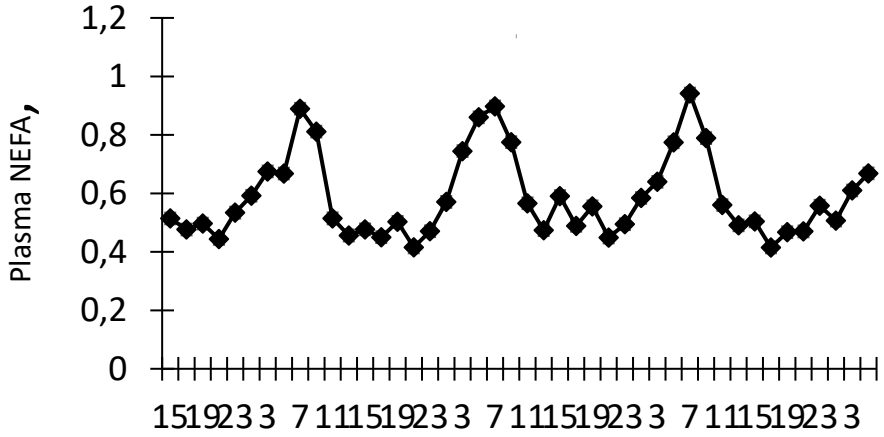
We hypothesize that the milk on an every 8 hour 3X milking system would reflect the characteristics of the blood for the 8 hour period prior to milking.

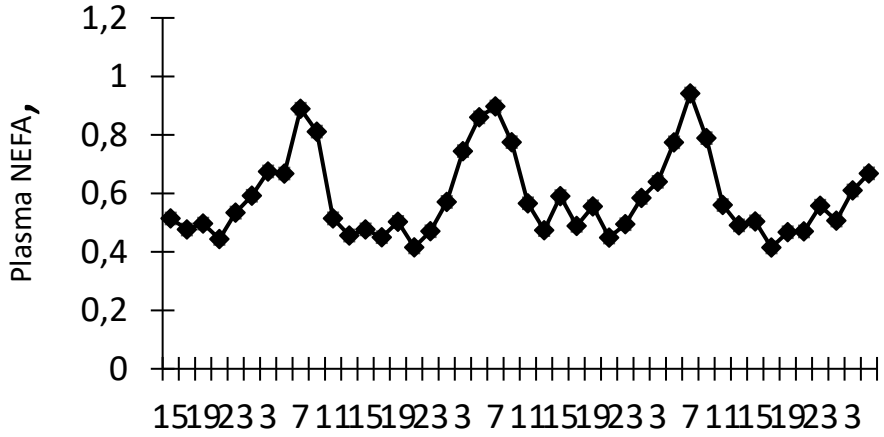
Thus, every two hour blood data was averaged to reflect the mean blood NEFA and BHB for the 8 hour period prior to each milking.

Results: Milk Predicted Blood NEFA and Blood NEFA

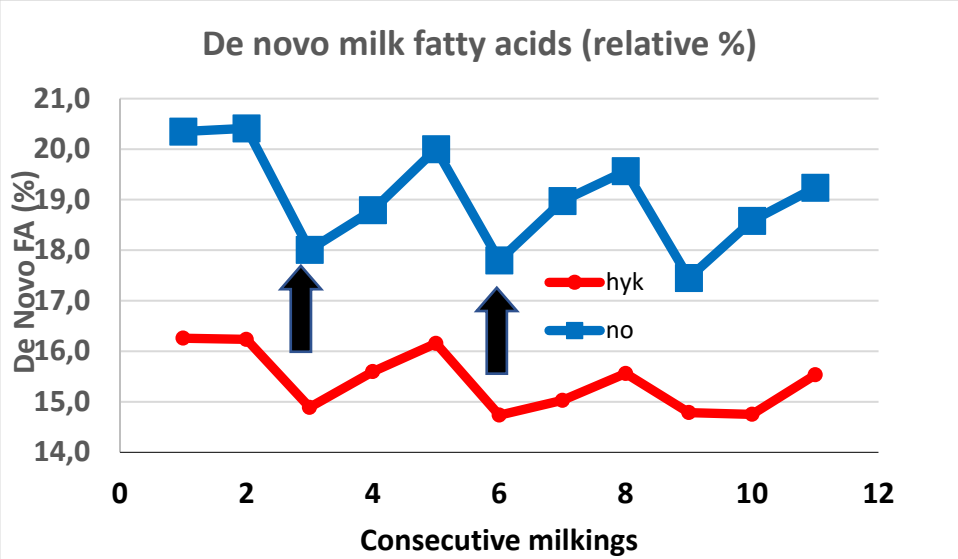


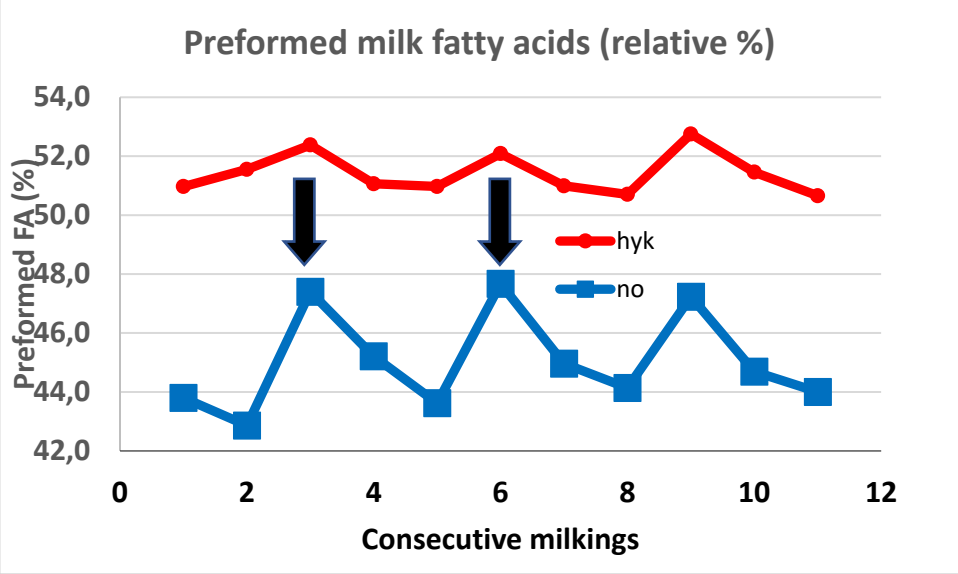


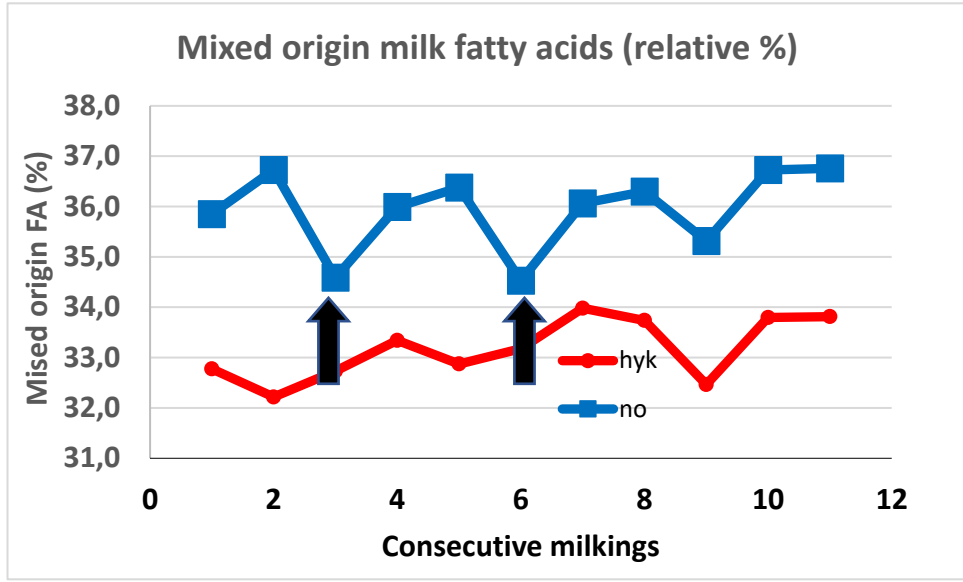




Results: Milk De novo, mixed origin, and preformed FA







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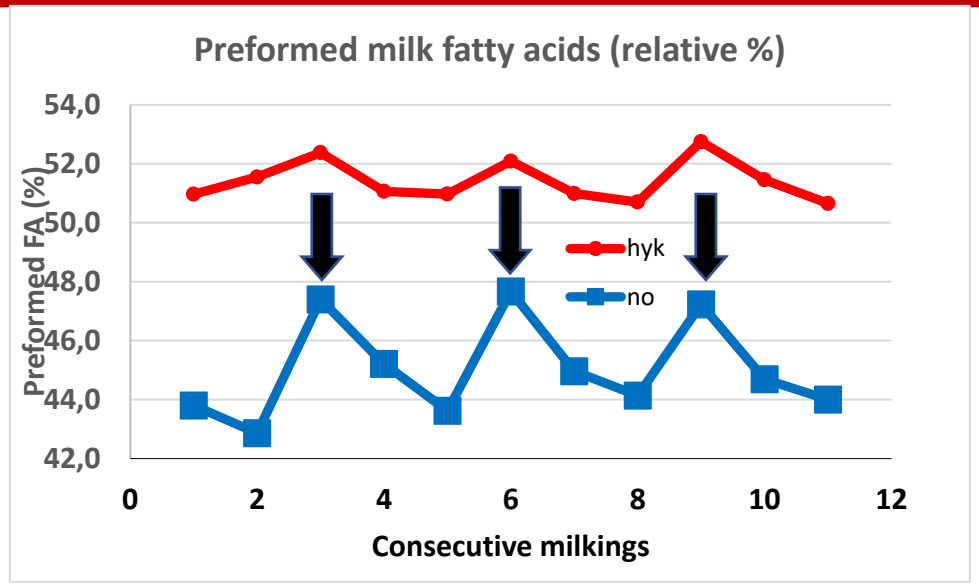

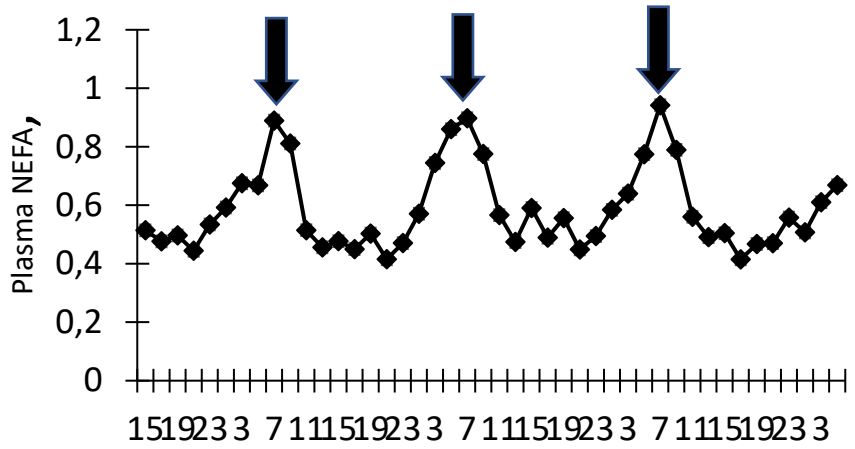

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Conclusions - Milk

- Diurnal patterns of milk estimated blood NEFA and milk fatty acids were consistent with patterns in the blood.
- HYK status affected daily amplitude and overall relative percentage of milk fatty acid groups.

Implications & Future Directions

- FTIR estimates of mBHB and mpbNEFA as a tool to diagnose HYK
- Milk constituents provide more stable estimate during a 24 h period of energy status than a single blood sample.

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Acknowledgements

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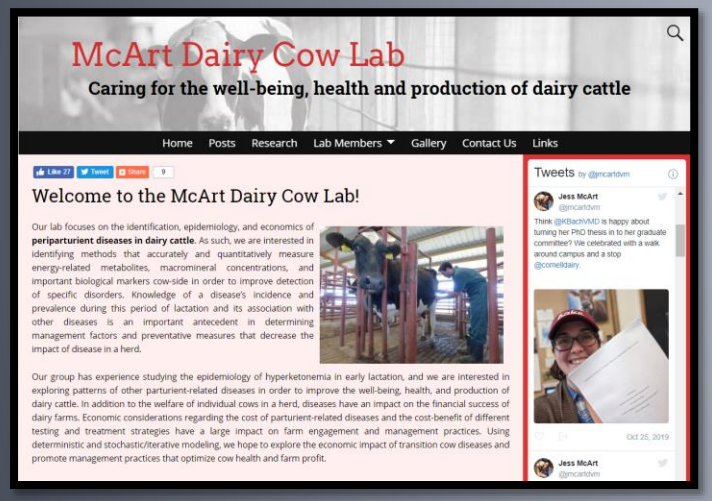

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