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IN THIS **ISSUE**



# ACTIVITY MONITORS MAY PROVIDE INSIGHT ON COWS' CALCIUM STATUS

A good cow person just seems to know when a cow feels off or acts different and needs to be checked. Whether it is a keen eye for detail, the ability to quickly pick up on subtle changes or just an innate ability, a good cow person is an asset to any dairy, especially when caring for transition cows.

The introduction of new technologies allows those who use them to become better cow persons, too. These tools can detect small differences in rumination, cow activity and lying time, just to name a few. Activity monitors have provided producers with new tools to help manage cows. And researchers continue to look for behavioral differences that can be quantified and used as early-warning indicators to improve cow health.

Two articles in the November *Journal of Dairy Science* used activity monitors to study transition cow behavior as it relates to blood calcium status during the transition period. The new data is encouraging. It indicates that behavioral differences can be quantified and correlated to blood calcium concentration, which may provide a new avenue for the early identification of cows at-risk for hypocalcemia.

## NEW ZEALAND RESEARCH

In the first study, Hendriks et al. (2020), multiparous transition cows from grazing dairies were used. The New Zealand researchers conducted a retrospective analysis using data from two previous studies Roche et al. (2015, 2017) from which they selected 72 multiparous cows for further analysis. All animals had blood samples collected weekly from 4 weeks prior to 5 weeks post calving and daily for 5 days starting on the day of calving. Total plasma calcium was used to separate the cows into three groups of 24 cows each: Clinical ≤ 1.4 mmol/L from 1 or more tests within 48 hours of calving; Subclinical > 1.4 mmol/L and < 2.0 mmol/L from 2 consecutive tests within 48 hours of calving; and Normal ≥ 2.0 mmol/L from 3 consecutive tests within 72 hours of calving. The cows classified as clinical and subclinical by blood test did not display any signs of paresis (muscle weakness).

The researchers examined cows' lying behavior and daily step counts to determine if there was a correlation with blood calcium levels that could be used as a possible indicator of cows at risk for subclinical or clinical hypocalcemia. Results showed that cows classified as clinical (≤ 1.4 mmol/L) without evidence of paresis were less active on the day of calving. Daily step counts were 3,118 for clinical cows, 3,853 for subclinical cows and 4,448 for cows classified as normal. That's a difference of 1,330 steps/day between clinical and normal cows.

In addition, on the day of calving clinical cows spent 9.4 hours lying down compared to 6.8 hours for subclinical and normal cows—a difference of 2.6 hours/day. There also was a difference in the number of lying bouts; clinical cows had 19.2 vs. 18.2 for subclinical cows and 16.3 for normal cows.

Prior to calving a difference in step count that could be positively correlated to blood calcium concentration was detected. An increase of 1,000 steps/day from 2 weeks prepartum to the day of calving was associated with an increase of 0.07 mmol/L in blood calcium concentration within 24 hours of calving.

"We found a consistent theme that cows experiencing hypocalcemia are more restless and less active," explains Stacey Hendriks, postdoctoral fellow at Massey University in New Zealand. "The extent of the decline in activity depends on the extent of hypocalcemia" as measured by total blood calcium. The changes in step count and lying time were short-lived and non-detectable by 2 days post-calving.

## UNIVERSITY OF EDINBURGH RESEARCH

In a second study by Barraclough et al. (2020), researchers also used activity monitors to track animal behaviors and

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# FROM THE MATERNITY PEN

## *Vitamin E Provides Many Benefits to Transition Cows*

A new study in the July *Journal of Dairy Science* shows that supplementing transition cows with vitamin E decreases the incidence of retained fetal membranes, improves cows' reproductive performance and provides a slight increase in milk production. Researchers used data from 36 scientific papers that included 53 trials to conduct a comprehensive meta-analysis of the effects of vitamin E supplementation during the transition period. Variables included in the meta-analysis were selenium supplementation, method of vitamin E administration, number of days treated pre- and post-partum and parity and breed of cows.

Results from the meta-analysis confirmed that prepartum vitamin E supplementation increased the blood concentration of vitamin E at parturition, which normally declines by 47% at calving. An analysis of the results by dose showed that the response was linear—the more vitamin E administered the greater the increase in serum vitamin E concentration at calving.

While previous individual research studies have shown a large variation in reproductive performance, the meta-analysis revealed that vitamin E supplementation decreased the risk of retained fetal membranes, reduced the number of services per conception and decreased the number of days open.

In terms of milk production, there was a tendency for vitamin E supplementation to provide a slight increase in daily milk yield. While the average increase was 2.3 lbs of milk per day, the meta-analysis showed that higher doses of vitamin E had a greater effect on milk yield. Results suggest that vitamin E supplementation has a linear effect on both milk production and reproduction. Researchers concluded that transition cows should be fed up to 3,600 IU/day of vitamin E to produce the benefits listed above.

Moghimi-Kandelousi et al., 2020. J. Dairy Sci. 103:6157-6166.

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# ACTIVITY MONITORS MAY PROVIDE INSIGHT ON COWS' CALCIUM STATUS

tested blood calcium concentration of transition cows. Multiparous and primiparous cows entered the close-up pen approximately 3 weeks prior to predicted calving date. Blood samples were taken within 24 hours of calving. Cows were classified by their blood calcium concentration as either normal ≥ 2.0 mmol/L or subclinical < 2.0 mmol/L without any clinical signs. Cows classified as clinical had signs of milk fever, required treatment and recovered. Blood samples were not always collected from clinical cows. The final data set for analysis included 51 multiparous cows and 21 primiparous cows.

Researchers found that blood calcium status had an effect on some of the behavior variables tracked and that results differed by parity. With primiparous cows, steps/day decreased by nearly half from 842 steps/day at 2 weeks prior to calving to 427 steps/day on day of calving for normal cows. Subclinical cows' daily step count remained steady.

After calving, daily step counts for normal cows and subclinical cows both declined from 1 day in milk to 21 DIM. However, the decrease for subclinical cows was three times greater than for normal cows. This decline in step count could be from primiparous cows getting used to a new environment, social hierarchy and new rations and then settling into their new routine.

With multiparous cows during the prepartum period researchers found no statistically significant interaction between blood calcium status and step count or lying time. But there was a difference in postural transitions (cows getting up or lying down) with normocalcemic cows having fewer transitions (18.5/day) compared to subclinical and clinical cows with 23.5/day.

During the 21-day post-calving period blood calcium status affected lying time, step counts and the number of postural transitions per day. The lying time of clinical cows averaged 10.7 hours/day compared to 9.2 hours/day for subclinical and 8.6 hours/day for normocalcemic cows. During the first 21 DIM step counts for clinical cows averaged 503 steps/day compared to 774 steps/day for subclinical cows and 948 for normocalcemic cows.

While this study needs to be replicated with a greater number of animals, it did show that blood calcium status affects cows' activity levels and that even when clinical cows are treated with successful resolution, differences in the behavioral variables studied still remained at 21 DIM.

Barraclough et al., 2020. J. Dairy Sci. 103:10604.
Hendriks et al., 2020. J. Dairy Sci. 103:10546.

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# CONSULTANTS CORNER

## *Researchers Gain Insight Into NEFA, BHB Patterns*

Our results showed a clear and consistent daily cyclic pattern in plasma BHB and NEFA as well as in FTIR estimates of milk BHB and milk predicted blood NEFA, with the daily amplitude of change being much greater in hyperketonemic cows than in non-hyperketonemic cows. This greater amplitude of change in BHB and NEFA in hyperketonemic cows may increase the difficulty of an accurate disease diagnosis from a single blood sample. Differences were more predictable when analyzing milk. Our results indicate that mid-FTIR milk analysis is a potentially useful tool for diagnosing excessive energy deficit, but until it becomes more readily available, we recommend that the diurnal pattern of BHB and NEFA, as well as feeding time relative to blood collection, be considered when diagnosing hyperketonemia.

Seely et al., 2021. J. Dairy Sci. 104:818.

# CONSULTANTS CORNER

## *Researchers Gain Insight Into NEFA, BHB Patterns*

***JESSICA MCART***
*Cornell University*

***CLAIRA SEELY***
*PhD Candidate*
*Cornell University*

The transition into lactation takes cows through a brief period of energy deficit. Cows respond by mobilizing fat to meet energy needs which results in a temporary increase in the concentrations of circulating blood non-esterified fatty acids (NEFA) and β-hydroxybutyrate (BHB). However, when BHB concentrations become excessively elevated, greater than 1.2 mmol/L, cows are at greater risk for negative health events and decreased milk production.

To diagnose hyperketonemia, a blood sample is analyzed in a lab or with a handheld BHB meter. Because previous research has shown that NEFA and BHB concentrations change throughout the day in response to feed (Blum et al., 1985; Eicher et al., 1999) one blood test may not provide an accurate assessment of the cow's energy balance. In our latest study, we sought to gain a better understanding of the daily variation in blood NEFA and BHB. We enrolled 28 multiparous Holstein cows between 3 and 9 days in milk. Blood samples were collected every 2 hours for 96 hours. Feed was delivered once daily at 9 a.m. Cows were milked 3 times a day with the first milking at 6 a.m. Milk samples were collected for analysis at each milking.

### BLOOD RESULTS

Results showed that plasma NEFA consistently peaked 2 hours before morning feeding while its low point occurred late evening. In comparison, plasma BHB was at its low point in the morning before feeding and peaked 4 hours after feeding.

Cows with a daily plasma BHB average of ≥ 1.2 mmol/L for 3 consecutive days were assigned to the hyperketonemia group. Cows with a daily average of ≥ 1.2 mmol/L for 2 or fewer days were considered non-hyperketonemic. Several differences were identified. Hyperketonemic cows had blood BHB concentrations ≥ 1.2 mmol/L for 71% of the study period compared to just 18% of the time for non-hyperketonemic cows. In addition, when calculating the daily amplitude of change in BHB concentrations, hyperketonemic cows had a 20% greater difference; 1.20 vs 0.95 mmol/L for non-hyperketonemic cows. However, the daily amplitude for blood NEFA concentrations was similar for both groups.

### MILK ANALYSIS RESULTS

Given the cost of hyperketonemia, estimated at $289 per case (McArt et al., 2015), and the laborious nature and cost of blood sampling groups of cows, we also examined milk samples using Fourier transform mid-infrared analysis (mid-FTIR) to determine milk BHB and milk predicted blood NEFA concentrations.

Results showed that milk BHB and milk predicted blood NEFA concentrations were lowest at the morning milking just prior to feeding. In both groups the blood NEFA and milk estimated blood NEFA followed a 24-hour cycle with milk having a slight lag in the timing. However, when blood NEFA was averaged over 8 hours to simulate milking times, the pattern of highs and lows were similar. In addition, results comparing milk BHB and blood BHB averaged over 8 hours showed a similar cyclic pattern.

We hypothesize that the difference between peak and nadir blood and milk metabolites is due to milk having a higher correlation with an 8-hour average of blood metabolite concentrations rather than a single blood sample. This suggests that milk analysis might be an improved method to determine a cow's overall energy status.

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# BEYOND BYPASS

## *Fatty Acids Fed Postpartum Boost Peak Milk*

New research from Michigan State University shows that feeding a blend of palmitic and oleic acids during the first 24 days in milk can increase milk yield during the next 6 weeks without negatively affecting dry matter intake or body weight.

Researchers enrolled 56 multiparous cows in the study. Cows were fed either a control diet with no supplemental fat, or a diet supplemented with a blend of calcium salts (60% palmitic and 30% oleic acids). Cows received supplemental fat either during the first 24 days in milk, or from 25 to 67 days in milk. The supplemental fat was fed at 1.9% of diet dry matter and replaced soyhulls in the control diet.

During the first 24 days in milk cows fed supplemental fat had increased milk fat content, 4.95% compared to 4.62% for control cows. Milk fat yield increased 4.32 vs 3.97 lbs/day; and energy corrected milk increased by 6.2 lbs/day for supplemented compared to control cows. There was no effect on DMI, milk yield or body weight change.

During the peak milk period, 25 to 67 days in milk, cows fed supplemental fat produced 5.5 lbs more milk per day than control cows. In addition, increases were seen in milk fat, 3.63% vs 3.52%; milk fat yield, 4.5 lbs/day vs 4.0 lbs/day; and energy corrected milk increased by 8.2 lbs/day in supplemented compared to control cows. There was no effect on DMI or body weight change.

Results also showed that cows fed supplemental fat during the first 24 days in milk produced more milk during the peak milk period even though they were no longer receiving supplemental fat. The carryover effect of fat supplementation fed during the first 24 days in milk increased milk yield by 6 lbs/day and energy corrected milk by 6.4 lbs/day during the next 6 weeks of lactation.

ADSA Abstract #180, J. Dairy Sci. 103 Suppl. 1, p 69.

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PO Box 68 · 406 1st Street
Ralston, IA 51459

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## HAPPENINGS

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