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DAIRY NUTRITION PLUS™

COWS MAY BENEFIT FROM SLIGHT DIP IN BLOOD CALCIUM AT CALVING

What if a slight dip in blood calcium at calving followed by a quick recovery to normal blood calcium is actually good for cows? That's the question that is now top of mind given new research presented at the American Dairy Science Association meeting in July.

Traditionally hypocalcemia has been defined as a drop in blood calcium at calving. And given that cows with clinical signs of hypocalcemia can die if not treated, the primary focus has been to prevent that drop in blood calcium.

When a cow calves, her calcium requirement more than triples in less than a week, says Jessica McArt, assistant professor, Department of Population Medicine and Diagnostic Sciences at Cornell University. A dry cow's maintenance requirement for calcium is approximately 21 grams per day. To produce that first colostrum she needs 44 grams of calcium per day. And by 7 days in milk (DIM) a cow producing 100 lbs of milk would need 77 grams of calcium each day. That's a big jump in calcium demand at a time when the cow's dry matter intake declines by about 30% before calving. So it's easy to understand why the focus has been on making sure the cow has enough calcium.

Prevention is always better than treatment. The nutritional strategy of reducing the dietary cation-anion difference (DCAD) in close-up diets is a primary tool to prevent hypocalcemia, explains McArt. Negative DCAD diets fed for 21 days before calving create a mild metabolic acidosis which helps the cows' calcium homeostatic system better respond to the sudden increase in calcium demand. A meta-analysis of 42 published experiments by Santos et al. (2019) showed that negative DCAD diets minimize the incidence of clinical and subclinical hypocalcemia, improve lactation performance in multiparous cows and reduce the incidence of metritis and retained placenta.

Producers also routinely use supplemental calcium (bolus, drench, subcutaneous) after calving to help boost blood calcium levels of clinically and subclinically hypocalcemic cows. The idea is that if blood calcium is low, supplementation should help. Yes, clinical, down cows need immediate intravenous administration of calcium gluconate optimally followed by additional oral calcium supplements 4 to 8 hours later, with a second dose 12 to 24 hours later, says McArt. But standing cows that may be subclinically hypocalcemic do not need intravenous calcium. In fact, new research indicates that supplemental calcium can interfere with some cows' natural calcium homeostatic mechanisms and that a slight dip in blood calcium at calving followed by a quick recovery is actually beneficial for cows.

NEW RESEARCH

Work by Caixeta et al. (2017) showed that cows with total blood calcium concentrations ≤2.15 mmol/L at days 1, 2 and 3 in milk had 70% decreased odds of achieving pregnancy to first service and were 50% less likely to return to cyclicity after the voluntary waiting period compared to normocalcemic cows. Researchers termed cows with low blood calcium over the first 3 DIMs as having "chronic subclinical hypocalcemia." This was the first indication that perhaps the persistence of hypocalcemia—not the absolute concentration of calcium in the blood after calving—was detrimental to the immediate postpartum cow, says McArt. In that study they also identified that this chronic or persistent hypocalcemia occurred in all parity of animals with higher incidence rates in multiparous cows. The incidence rates reported for persistent hypocalcemia in the study were 20%, 32% and 40% for parities 1, 2 and ≥3 respectively.

Additional work by Neves et al. (2018a) and (2018b) showed that cows with low calcium concentrations at calving and at 1 DIM were less likely to develop early lactation disease and produced more milk in early lactation than even cows with normal blood calcium concentrations.

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And a new research study from Cornell with 407 Holstein cows in 2 New York herds evaluated the association of subclinical hypocalcemia (SCH) duration with the risk of early lactation negative disease events and milk production. In this study, cows were classified into 1 of 4 groups based on postpartum plasma total calcium:

- Normocalcemic >2.15 mmol/L at 1 and 2 DIM.
- Transient SCH ≤2.15 mmol/L at 1 DIM and >2.15 mmol/L at 2 DIM.
- Persistent SCH ≤2.15 mmol/L at 1 and 2 DIM.
- Delayed SCH >2.15 mmol/L at 1 DIM, ≤2.15 mmol/L at 2 DIM.

Using these classifications, 41.4% of cows in the study were normocalcemic, 19% were transient SCH, 12.9% were persistent SCH and 23.1% were delayed SCH. Results showed that cows classified as transient SCH, both primiparous and multiparous cows, were no more likely to suffer a negative disease event than cows that were normocalcemic. In terms of milk production, transient SCH cows produced 10 lbs more milk per day than normocalcemic cows during the first 10 weeks of lactation. Cows classified as delayed SCH or persistent SCH were 3 and 4 times more likely to have a negative disease event and produced less milk than normocalcemic cows.

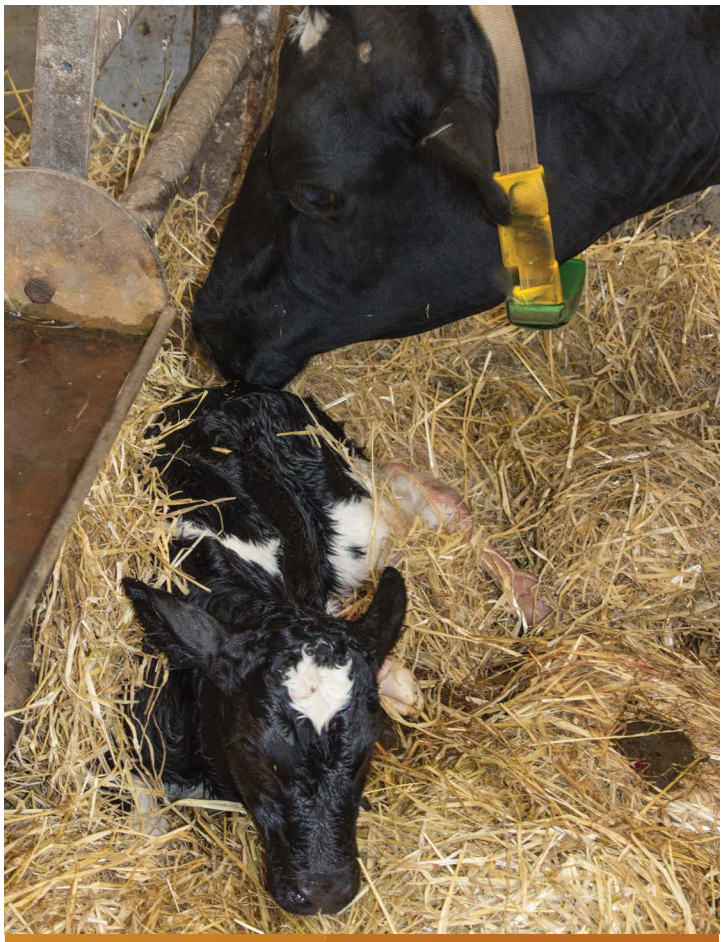
Given these results, "it is hard to believe that this slight drop followed by a quick recovery to normal blood calcium concentration is bad for the cows," says McArt. "I believe that slight drop in calcium is normal and necessary in early lactation in order to start and improve cows' calcium homeostasis." The cows that McArt worries about are those that don't recover quickly, or that start with normal blood calcium and then decline.

Several research studies have concluded that blanket calcium supplementation does not benefit all cows (Oetzel & Miller, 2012; Domino et al., 2017; Leno et al., 2018). Older cows, cows that experience a difficult birth and cows that are lame do benefit from oral calcium supplementation. But with this new research McArt says she has to wonder if the reason blanket oral calcium supplementation doesn't provide benefit to all cows is that it interferes with some cows' natural calcium homeostatic mechanisms. It may be that a slight decline and quick recovery of blood calcium is what triggers the cows' natural calcium homeostatic mechanisms to kick in.

"I think there is a place for calcium supplementation but what we need to find out is where that place is," says McArt. More research is needed to better define which cows and when calcium supplementation should be used. It may be that cows with persistent or delayed SCH will be good candidates, but at this point "we don't have all the answers."

What is known is that clinical hypocalcemia is becoming a rare occurrence on farms that practice good nutritional and cow comfort management strategies. Feeding a negative DCAD diet to close-up cows and keeping cows comfortable are proven prevention methods for both clinical and subclinical hypocalcemia. Cows that have been nutritionally prepared for lactation respond to the slight dip in blood calcium at calving and produce more milk and suffer less disease incidence than even cows with normal blood calcium at calving. Perhaps the time has come to stop trying to prevent any blood calcium drop and focus on nutritionally preparing the cow to respond to the increase in calcium demand that lactation brings.

For more information on the latest calcium research please see McArt's paper "Being a mom is hard: calcium demands of early lactation dairy cows," at https://wcds.ualberta.ca/wp-content/uploads/sites/57/2019/05/p-173-184-McArt-WCDS-2019-Calcium-Demands-of-Early-Lactation.pdf



FROM THE MATERNITY PEN

Stillbirths Increase When Urine pH Below 6.0

Feeding prepartum cows a negative DCAD diet to reduce urine pH to between 6.0 and 7.0 has been proven to minimize the incidence of hypocalcemia. However, it has been suggested that if a little decrease in urine pH is good then lowering urine pH to below 6.0 might provide better control of hypocalcemia.

Researchers at the University of Georgia and the National University of La Pampa Argentina, teamed up to examine the association between urine pH of prepartum cows and the incidence of postpartum disorders. Cows were fed a prepartum diet with a calculated DCAD that ranged from -50 mEq/kg to -90 mEq/kg DM. Researchers tracked the incidence of stillbirths, dystocia, retained fetal membranes, metritis, ketosis, displaced abomasum and mastitis of 200 prepartum cows on a commercial dairy in Argentina. Disease incidence was tracked by three groupings of urine pH: <6.0, between 6.0 and 6.9 and ≥7.0.

Results presented at the ADSA meeting in July showed that the level of urine pH was associated with stillbirth, but not with the other health issues tracked. Cows with a urine pH <6.0 were 2.39 times more likely to have a stillborn calf compared to cows with a urine pH ≥6.0. These findings reinforce the importance of not using anionic products to lower urine pH below 6.0.

"The marginal gain in the reduction of milk fever gained by lowering the pH to <6.0 is minimal, compared with the increase in the incidence of stillborn," says Pedro Melendez, associate professor and field investigator, College of Veterinary Medicine at the University of Georgia.

CONSULTANTS CORNER

Hypocalcemia Affects Rumination Activity, Too

JESSE GOFF
Professor Emeritus,
Iowa State University

We just completed a study comparing the rumination activity of periparturient cows fed a diet to either prevent or induce hypocalcemia. Close-up cows fed a negative DCAD diet ruminated longer the day before calving and following calving than cows fed a positive DCAD diet.

Twenty-six cows entering their third or greater lactation were enrolled in the study. Half were fed a negative DCAD diet (-9 mEq/kg DM), and the other half were fed a positive DCAD diet (+ 196 mEq/kg DM). After calving, all cows received the same lactation diet. Dry matter intakes were measured daily from 14 days prior to calving to 5 days after. Blood samples were collected daily the week before calving, at calving and at 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4 and 10 days after calving. Urine pH of the anion-supplemented cows averaged 6.99 compared to 8.26 for non-supplemented cows.

The anion-supplemented cows had significantly higher blood calcium concentrations from 24 hours before calving thru the first 36 hours of lactation. Four cows that were on the no anion diet developed milk fever and were treated with an intravenous calcium solution.

On the first and second days of lactation the anion-supplemented cows consumed significantly more feed than non-supplemented cows—8.5 lbs more feed on day 1 and 7.5 lbs more feed on day 2.

Rumination activity was the same for all cows until 24 hours before calving. All cows' rumination activity decreased at parturition. However, during the 24-hour period before calving, anion-supplemented cows spent 101 more minutes ruminating—457 minutes compared to 356 minutes for non-anion supplemented cows. That's a 22% decrease in rumination activity for non-anion supplemented cows. The difference in rumination activity continued through the first 2 days in milk (DIM). At 1 DIM the difference was 127 minutes, and at 2 DIM the difference was 115 minutes more rumination activity for anion-supplemented cows compared to non-anion supplemented cows.

We also examined the rumination activity data by 2-hour blocks starting at 12 hours before calving until 36 hours after calving. The four cows that developed milk fever had several 2-hour periods where there was no detectable rumination activity. Even after intravenous calcium treatment and blood calcium levels had returned to normal, the milk fever cows still had no detectable rumination activity for several hours.

When rumination activity declines cows eat less and that makes it difficult to meet the nutritional demands of lactation. When rumination activity is undetectable those cows generally are not eating at all. Anion-supplemented cows, fed negative DCAD diets, were properly prepared for the challenge of calving and starting lactation. Their blood calcium levels were higher, they ate more, they ruminated longer and they had a better transition into lactation.

This research was presented at the ADSA meeting in July.
You can read abstract #167 at https://bit.ly/2HqgUVa

BEYOND BYPASS

New Research on Crude Protein, Lysine in Lactating Diets

Researchers at the University of Guelph conducted a feeding trial to determine the effects of rumen-protected lysine supplementation in lactating cow diets with different amounts of crude protein. Multiparous mid-lactation cows were fed diets with and without rumen-protected lysine with either 15% or 17% crude protein. Cows acclimated to each diet over 14 days followed by a 3 day sampling period. Daily milk yield and dry matter intake (DMI) were recorded, and urine and feces were collected.

No significant interaction between crude protein content and lysine supplementation was found. DMI was affected by crude protein, but not by lysine supplementation. Milk yield and the yields of milk fat and milk protein were all increased by both crude protein and lysine supplementation.

When researchers compared the outcomes of each of the four diets fed they found that cows fed the 15% crude protein (CP) diet with lysine supplementation had similar results for milk production as the 17% CP diet without lysine supplementation. Milk production for cows fed 15% CP with lysine was 80.7 lbs/day compared to 79.6 lbs/day for cows fed 17% CP without lysine. Similar results were seen with energy corrected milk; the 15% CP plus lysine diet yielded 81.7 lbs/day compared to 80.9 lbs/day for the 17% CP without lysine supplementation. Cows that received the 17% CP diet with lysine averaged about 3 lbs more milk per day than the 15% CP with lysine diet. However, the 17% crude protein diet also increased milk urea nitrogen and the amount of nitrogen excreted in manure, but lysine did not.

The good news is that if you want to reduce the amount of CP fed to reduce the amount of N excreted as waste, or reduce feed cost, you can without hurting milk production by using rumen-protected lysine. The research was reported at the ADSA meeting in July.

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

QUALITY CORNER

Webinar Available Now: Post-Partum Calcium Therapies for Transition Cows

Interested in hearing more from Dr. Jessica McArt DVM, PhD, about her exciting new work from Cornell University? SoyChlor is proud to bring Dr. McArt's recent research directly to you with the exclusive new webinar, Postpartum Calcium Therapies for Transition Cows.

In the webinar broadcast by SoyChlor last month, Dr. McArt reviews recent literature showing how postpartum calcium supplementation may help subgroups of cows, but might also be detrimental to the health and production of others. Her commentary reveals how postpartum calcium therapies impact blood calcium, how they impact health and production of the cow, and why negative DCAD diets are so important in preparing the cow for calcium demand at calving.

Watch the full presentation now at https://www.youtube.com/watch?v=8Srpe6O1X4k&t=1s