UF | IFAS
UNIVERSITY of FLORIDA
Department of Animal Sciences

Dairy Update

Quarterly Newsletter | Vol. 17 No. 3 | Summer 2017

Thinking about Vitamins … Supplementing Rumen-Protected Choline during the Transition Period Improved Cow and Heifer Calf Performance

Marcos Zenobi, Jose Santos, and Charlie Staples

Choline is a water-soluble vitamin found in feeds, but the ruminal microbes destroy it so that very little choline from the diet is available for absorption from the small intestine. The cow can synthesize some choline in her tissues, but apparently not enough to optimize milk production. When ruminally-protected choline (**RPC**) was added to the diet starting in the close-up period, milk production per cow was increased an average of 4.4 pounds per day when averaged across 16 published experiments. In 14 of the 16 studies, a numerical increase in milk yield ranging from 1.6 to 9.7 pounds per cow per day was reported.

At the University of Florida, we fed 0 or 60 g/d of a RPC product called ReaShure (Balchem Corp) from 21 days before expected calving through 21 days after calving to 93 multiparous (2nd lactation or older) Holstein cows. Dietary methionine was at 2.3% of metabolizable protein and the lysine to methionine ratio was 3.1. Cows fed RPC tended ($P < 0.10$) to produce more milk (95.9 vs. 91.1 lb/day) without consuming more feed (52.5 vs. 51.1 lb/day) over the first 15 weeks of lactation.

We continued to follow each cow's milk production after they went back into the general herd. Again, milk production tended to be greater over the first 40 weeks of lactation (81.8 vs. 76.9 lb/day). Cows consuming RPC were in a more negative energy balance at 2 and 3 wk after calving but without greater mean concentrations of plasma fatty acids or ketones (beta-hydroxybutyric acid) in the first 5 weeks, and without greater liver fat (triacylglycerol) during the first 3 weeks.

Choline has reduced fatty liver in many species including dairy cows and it may have helped to prevent an increase in fatty liver in this experiment in the midst of a temporary, more negative energy state.

For the first time, several additional benefits of feeding RPC were documented in our study. The prevalence of subclinical hypocalcemia (< 8.0 mg of Ca/100 mL of plasma) was reduced from 25 to 10% during the first 7 days postpartum by feeding RPC. The immune status of the multiparous cows fed RPC appeared to be improved based upon 1) decreasing rather than increasing rectal temperatures the first 12 days postpartum, 2) a greater proportion of the blood neutrophils killing bacteria at 17 days fresh, and 3) a greater concentration and total production of IgG in colostrum. Using timed AI methods, pregnancy tended to be better (41.3 vs. 23.6%; $P < 0.10$) at first insemination but did not differ ($P > 0.10$) by 40 wk postpartum (69.8 vs. 62.5%). From weaning to 12 months of life, heifers born from dams fed RPC had significantly better average daily gains (1.95 vs. 1.85 lb/day).

Supplementing RPC for 6 weeks during transition (≈ $15 per cow) had long term benefits for multiparous Holstein cows and replacement heifers.

Contact Charlie Staples at chasstap@ufl.edu

Dairy Extension Agenda

- November 12-14, 2017. **Southern Regional Dairy Challenge**, Live Oak, FL. The Southern Regional Dairy Challenge allows dairy science students to apply theory and learning to a real-world dairy while working as part of a team. Approximately 60 college students from schools around the Southeast hope to learn and compete how to evaluate a Florida dairy farm and make recommendations. More information, Mary Sowerby, meso@ufl.edu, or Albert De Vries, devries@ufl.edu

Florida Students Learn Advanced Dairy Management at the US Dairy Education and Training Consortium

Albert De Vries

The US Dairy Education and Training Consortium (USDETC) in June wrapped up its 10th year of its Advanced Large Herd Management Program for college students with a passion for the dairy industry. This 6-week full time curriculum in Clovis, NM, offers strong research based dairy education in a welcoming, friendly environment.

The USDETC Class of 2017 included 55 students from 19 different universities. Seven students from the University of Florida attended the program this year. The program is ideal for students who want to broaden their dairy knowledge while experiencing the dairy industry in another part of the country. The program has a strong curriculum that often cannot be offered by the individual universities, such as UF, because the number of students with a dairy focus is too small.

The USDETC program consists of two tracks: one for students with less dairy science background and one for students with more dairy experience. Some of the topics covered this year included genetic and GMO trends, data mining herd records, advanced herd economic analysis, dairy reproductive physiology, genetics, nutrition, facilities, milk quality, safety, and herd health. Instructors are invited from various universities and allied dairy industry partners. Typically, each instructor teaches for several days to a week, with classroom instruction in the morning, and farm visits and practicums in the afternoon. Your reporter (Albert De Vries) taught advanced herd economic analysis in the advanced track. We discussed and learned about dairy investment analysis including marginal economics.

The USDETC Class of 2017 included 55 students from 19 different universities, including seven from UF.

The USDETC program is a unique partnership among academia, allied industry and dairy farmers. Generous financial support from the dairy industry makes the program free for admitted students. The program is led locally by Dr. Robert Hagevoort (NMSU) and Dr. Mike Tomaszewski (Texas A & M). The website is http://usdetc.tamu.edu. For more information, contact Albert de Vries at devries@ufl.edu or (352) 392 5594 ext. 227.

Florida photo at the US Dairy Education and Training Consortium in Clovis, NM (May 2017). From left to right: Catalina Mejia, Michelle Taepakdee, Ruth Ann Galatowitsch, Albert De Vries, Sara Knollinger, Victoria Sichler, Huridises Torrealba, and Aimee Monek.

Why do Diets with Negative Dietary Cation-Anion Difference Depress Intake in Prepartum Dairy Cows?

Roney Zimpel and José E.P. Santos

In the US, it has been estimated that 5 to 7% of the dairy cows are diagnosed every year with milk fever, also known as clinical hypocalcemia, and a much larger proportion of cows are diagnosed with subclinical hypocalcemia. Hypocalcemia is considered a gateway disease because it is associated with increased risk of other periparturient problems that have long-term consequences to production, reproduction, and survival of cows.

There are multiple ways of preventing hypocalcemia in dairy cows. One strategy that is seldom used today, but was common in the past, is to reduce the dietary calcium content to less than the minimum needed by prepartum cows, such that they go into negative calcium balance and upregulate mechanisms to increase gut absorption and bone mobilization before calving. This strategy went in disuse because diets must contain no more than 0.25 to 0.30% calcium, which is very challenging to achieve given the typical concentrations of calcium in most dietary ingredients. Another strategy is to use chelating agents that bind calcium in the gut, thereby preventing absorption, making it less available to the cow, which would mimic a diet with very low calcium concentration. Zeolites are currently marketed to be included in prepartum diets to prevent milk fever, but the recommended inclusions are of 1 up to 2 lb/cow/day, and these aluminosilicates bind not only calcium, but also other minerals and result in diets with high ash content.

Probably the most common method of preventing hypocalcemia today is manipulating the mineral content of prepartum diets. Dietary cation-anion difference (DCAD) is considered in prepartum diet formulation as a means of preventing hypocalcemia immediately after parturition, particularly for those in second or greater lactations.

Manipulating the DCAD of prepartum diets has been investigated for many years. In 1971, researchers in Norway (Ender and Dishington, 1970) treated low quality forages with inorganic strong acids to improve quality and fed them to prepartum cows. The authors noticed that feeding acid-treated forages prevented milk fever. Later, in 1984, a pivotal paper (Block et al., 1984) was published that illustrated the ability of manipulating the prepartum DCAD by adding specific mineral sources to total mixed rations in North America to prevent hypocalcemia and improve postpartum performance. Since then, the concept of diets with negative DCAD fed to prepartum cows in the last 3 weeks of gestation has become very popular and widely used by dairy producers.

One of the issues with diets containing negative DCAD is that they suppress dry matter intake. It is not uncommon the claim that adding acidogenic salts or products to prepartum diets suppress appetite because of palatability issues or taste of these products. In fact, numerous commercial products containing large concentrations of chloride or sulfur have been designed with the appeal of minimizing the issues with dry matter intake, perhaps by masking the bitter taste and stinging sensation of the more common salts of chloride and sulfur. One of the issues with acidogenic products is that not only they add chloride and sulfur salts to the diet, but they also induce a compensated metabolic acidosis in dairy cows. Therefore, when reducing the DCAD of a particular diet depresses dry matter intake, it is unknown if the effect was mediated by the addition of the salts (palatability or taste) or by the change in acid-base status the diet induces in the cow. This becomes important because if the suppression in appetite is mediated by taste and palatability, then products that mask these issues should overcome the depression in intake.

Dr. Garry Oetzel and collaborators at the University of Wisconsin were some of the first to tackle these issues. They conducted three experiments to screen palatability of acidogenic salts and determine effects on dry matter intake. In the first experiment (Oetzel et al., 1991), the authors screened 6 different acidogenic salts containing chloride or sulfur. The control diet, without acidogenic salts, had a DCAD close to 0, whereas all six diets containing acidogenic salts had a DCAD of approximately -170 mEq/kg. Intake of dry matter did not differ among the different acidogenic salts, which led the authors to conclude similar palatability among the different sources evaluated. On the other hand, when acidogenic salts were provided as component fed only mixed with the concentrates, and not as a total mixed ration, then concentrate intake was more depressed with chloride than sulfate sources (Oetzel and Barmore, 1993), likely because chloride sources are more acidogenic than sulfate sources. On a follow up experiment, the same group (Vagnoni and Oetzel, 1998) showed that induction of a compensated metabolic acidosis with either traditional acidogenic salts or a commercial acidogenic product reduced dry matter intake of dry cows in similar fashion.

Therefore, it is unclear if the reduction in intake observed with feeding diets with negative DCAD is mediated by inclusion of salts that might be somewhat unpalatable or simply induced by the acid-base status of the cows. We recently completed an experiment in an attempt to understand if the depression in intake in diets with negative DCAD is mediated by the inclusion of chloride salts or by the metabolic acidosis induced by the diet.

Experiment at the University of Florida

The experiment was conducted at the University of Florida Dairy Unit from February to May of 2017 (Zimpel et al., unpublished results). We used 10 nulliparous pregnant non-lactating Holstein cows that were subjected to a replicated 5 x 5 Latin square design. The experiment was composed by 5 periods of 14 days each and all 10 cows received all 5 treatments. Diets were fed as total mixed rations and composed of corn silage, Bermuda hay, and concentrates. Diets were manipulated by replacing a portion of the grain in the concentrates with an acidogenic product or salts containing potassium (K), sodium (Na), and chloride (Cl). Dietary treatments were:

1. **T1** (K=1.42%, Na=0.04%, Cl=0.26% of dry matter) a base diet containing 55% corn silage, 10% grass hay, and 35% concentrate that resulted in a DCAD of +200 mEq/kg;
2. **T2 (**K=1.83%, Na=0.42%, Cl=1.23% of dry matter), the control diet with 2% added mixture of 1:1 NaCl and KCl to result in a DCAD of +200 mEq/kg;
3. **T3** (K=1.71%, Na=0.54%, Cl=0.89% of dry matter), the control diet with added acidogenic product and a mixture of K_2CO_3 and $NaHCO_3$ to result in a DCAD of +200 mEq/kg
4. **T4** (K=1.29%, Na=0.13%, Cl=0.91% of dry matter), the control diet with added acidogenic product to reduce the DCAD to -120 mEq/kg; and
5. **T5** (K=1.78%, Na=0.53%, Cl=2.03% of dry matter), the control diet with added acidogenic product, KCl, and NaCl to result in a DCAD of -120 mEq/kg.

Therefore, T1, T2 and T3 had different contents of Cl and addition or not of acidogenic product, but the same positive DCAD, whereas T4 and T5 had distinct amounts of Cl, but the same negative DCAD. Intake of dry matter and water was monitored daily and feeding behavior was evaluated for 48 h in each period. Blood and urine samples were collected multiple times from each cow in each period for measurements of acid-base status and urinary excretion of minerals.

Reduction in intake is mediated by metabolic acidosis and not by the acidogenic product

Table 1 summarizes some of the key finding of the experiment. Adding chloride salts, including the acidogenic product without altering the acid-base status of cows did not affect dry matter intake (see T1, T2 and T3); however, when the acidogenic product reduced the DCAD from +200 to -120 mEq/kg in treatments T4 and T5, then cows experienced a compensated metabolic acidosis with reduced blood and urinary pH, increased respiratory rate, and reduced blood bicarbonate (HCO_3^-) and partial pressure of CO_2 (pCO_2), which reduced dry matter intake. It is important to note that addition of acidogenic product per se, as in T3, did not reduce dry matter intake. In fact, if one compares intake in treatments T1, T2 and T3, it is clear that not only they did not differ statistically, but they were numerically very similar, 22.5 to 22.7 lb/day (or 1.76 to 1.74% of body weight). On the other hand, when adding the acidogenic product induced metabolic acidosis, such as in T4 and T5, regardless of Cl level, then dry matter intakes decreased to 21.3 and 20.9 lb/day (1.68 and 1.64% of body weight), respectively. These results demonstrate that depression in intake is not necessarily related to the inclusion of acidogenic products, but caused by the metabolic acidosis induced by the acidogenic diet.

Why do these results matter?

It is well accepted that feeding diets with negative DCAD, usually between -50 to -150 mEq/kg benefits postpartum health and performance by reducing the risk of clinical and subclinical hypocalcemia. Although diets with negative DCAD suppress intake prepartum, the benefits observed in prevention of milk fever usually outweigh those concerns. Nevertheless, there is a notion that feeding certain acidogenic products eliminates the reduction in dry matter intake in diets with negative DCAD, which is unlikely to be true.

Selecting what acidogenic salt or product to feed to prepartum cows should be based on price, availability, handling characteristics, and the relationship with the supplier which might provide added value from their research or technical support, but not based on the notion that it will not depress intake. If the dietary intervention with added acidogenic salts or product induces the desired compensated metabolic acidosis, as planned to reduce hypocalcemia, then it is anticipated that intake will be reduced, independent of the product used. Nevertheless, our experiment cannot completely rule out that under the same acid-base status, some salts or products might be more depressive on intake. The key aspect here is that by inducing metabolic acidosis, intake is expected to be reduced.

Perhaps, more important than exactly what salt or product a producer uses is the continuous chemical analyses of dietary ingredients used in prepartum diets for their mineral composition such that the desired formulated DCAD value is close to what is actually fed to cows. Most forage and feed laboratories offer mineral analyses for an affordable price and result turnaround is usually within 48 h of receiving the sample in the laboratory. Producers should take advantage of this information if they want to minimize errors with dietary formulation to prevent hypocalcemia. Furthermore, measurements of urinary pH twice weekly should be used as an alert system for further investigation such that errors in diet mixing and composition can be diagnosed before hypocalcemia and associated problems increase in the herd. Producers should evaluate and discuss the feeding program for prepartum cows with their consultants and consider the use diets with negative DCAD prepartum to achieve the desired goals for hypocalcemia and postpartum health.

Roney Zimpel is a PhD student and José E.P. Santos is a professor in the Department of Animal Sciences, Institute of Food and Agricultural Science, University of Florida, Gainesville, FL 32611. For more information, contact José E. Santos at jepsantos@ufl.edu.

References

Block, E. 1984. Manipulating dietary anions and cations for prepartum dairy cows to reduce incidence of milk fever. J. Dairy Sci. 67:2939-2948

Ender, F., and I. Dishington. 1970. Etiology and prevention of paresis puerperalis in dairy cows. Parturient Hypocalcemia. Edited by J. J. B. Anderson. New York. Academic Press, pp 71-77.

Oetzel, G. R., M. J. Fettman, D. W. Hamar, and J. D. Olson. 1991. Screening of anionic salts for palatability, effects on acid-base status, and urinary calcium excretion in dairy cows. J. Dairy Sci. 74:965-971.

Oetzel, G. R., and J. A. Barmore. 1993. Intake of a concentrate mixture containing various anionic salts fed to pregnant, nonlactating dairy cows. J. Dairy Sci. 76:1617-1623.

Oetzel, G. R.., and D. B. Vagnoni. 1998. Effects of dietary cation-anion difference on the acid-base status of dry cows. J. Dairy Sci. 81:1643-1652.

Table 1. Effect of manipulating the dietary cation-anion difference on acid-base status and intake in dry cows. For dietary treatments (T1 to T5), see the text.

Item	T1	T2	T3	T4	T5	SE[1]
Intake DM, lb/d*§	22.7	22.5	22.5	21.3	20.9	0.4
Intake DM, % of BW*§	1.76	1.75	1.74	1.68	1.64	0.03
Intake of water, L/d§‡ †	25.4	31.0	30.5	26.5	32.3	0.8
Urine pH*§‡	8.1	7.9	7.9	5.7	5.6	0.06
Blood						
pH*§‡	7.450	7.436	7.435	7.420	7.416	0.005
Base excess, m*M* *§	1.85	1.20	1.45	-0.20	-0.95	0.32
HCO_3^-, m*M* *§	25.9	25.5	25.8	24.3	23.7	0.3
pCO_2, mm Hg§	37.4	38.2	38.4	37.0	36.6	0.7
Respiratory rate, n/min§	27.6	27.3	26.8	28.4	29.0	0.4

[1] SE = standard error.

* Effect of adding acidogenic product: T1 vs. T4 ($P < 0.05$).

§ Effect of metabolic acidosis: T2 + T3 vs. T4 + T5 ($P < 0.05$).

‡ Effect of adding Cl salts to alkalogenic diet: T1 vs. T2 ($P < 0.05$).

† Effect of adding Cl salts to acidogenic diet: T4 vs. T5 ($P < 0.05$).

Prediction of the Future Florida Mailbox Price and Future All Milk and Feed Prices: July 2017 – June 2018

Table 1. Forecast of the future Florida Mailbox Price and Future All Milk and Feed Prices: July 2017 – June 2018

		2014 Farm bill formulas	
Month	Forecast FL mailbox price ($/cwt milk)	Forecast All-Milk price ($/cwt milk)	Forecast feed cost ($/cwt milk)
Jul-17	20.88	17.26	8.17
Aug-17	21.42	17.86	8.25
Sep-17	21.58	18.03	8.33
Oct-17	22.05	18.81	8.41
Nov-17	22.05	18.82	8.48
Dec-17	21.75	18.55	8.55
Jan-18	20.69	18.14	8.60
Feb-18	20.69	18.13	8.65
Mar-18	20.73	18.16	8.69
Apr-18	19.96	17.66	8.72
May-18	19.99	17.68	8.76
Jun-18	20.05	17.76	8.80

Based on futures prices of July 7, 2017.

The forecast All-Milk price and the forecast feed cost have been added to the table since the Fall 2014 issue of Dairy Update (see http//dairy.ifas.ufl.edu/dairyupdate). These forecast are based on the formulas in the 2014 Farm Bill. Daily updated Florida mailbox price forecasts are found at http://future.aae.wisc.edu/predicted_mailbox/?state=Florida Feed costs are found at http://future.aae.wisc.edu/tab/costs.html#94.

For more information, contact Albert de Vries at devries@ufl.edu or (352) 392 5594 ext. 227.

Sign up for **UFL-DAIRYUPDATE-L**: Receive *Dairy Update* and other announcements of UF Dairy Extension events by email. Subscribe and unsubscribe by visiting http://dairy.ifas.ufl.edu/dairyupdate-L.shtml

UF UNIVERSITY of FLORIDA

Dairy Update is published quarterly by the Department of Animal Sciences, Institute of Food and Agricultural Sciences, University of Florida. Please address any comments to Albert De Vries, Editor, Dairy Update, PO Box 110910, Gainesville, FL 32611-0910. Phone: (352) 392-5594 ext. 227. E-mail: devries@ufl.edu. Past issues are posted on the UF/IFAS Florida Dairy Extension website at http://dairy.ifas.ufl.edu. This issue was published on **July 8, 2017.**