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NUTRITION PLUS **NEWSLETTER**

DAIRY NUTRITION **PLUS**™

IN THIS **ISSUE**

IMPROVING LIVER FUNCTION CAN LEAD TO BETTER TRANSITIONS

Transition cow health: get it right, cows peak well and breed back quickly. Get it wrong and cows may leave the herd before they even reach peak milk.

"The transition to lactation is the most metabolically challenging period in a cow's life, but it also represents a period of great opportunity," says Heather White, assistant professor of nutritional physiology at the University of Wisconsin. Transition is also the time when the cow's liver is the most challenged. That's because the demand for glucose and energy dramatically increases at the same time when feed intake declines. The result is a shortage of energy and glucose precursors. When the body tries to compensate, ketosis and fatty liver may occur.

Research has already shown the value of feeding a diet with negative DCAD (dietary cation-anion difference) to pre-fresh cows to improve calcium metabolism and reduce the incidence of clinical and subclinical hypocalcemia. Now, new research is zeroing in on hepatic (liver) function and what can be done to help the cow meet that increase in demand for glucose and energy and have a more successful transition to lactation.

UNDERSTANDING LIVER FUNCTION

In the big picture, the liver makes glucose; which in turn, is used to make lactose to support milk production, explains White. During the transition to lactation, cows often experience a negative energy balance. To compensate, they mobilize stored body fat which is transported to the liver in the form of nonesterified fatty acids (NEFA) and glycerol. However, the liver does not have the capacity to completely oxidize all of the fatty acids being mobilized and turn them into energy.

The NEFAs that are not converted to energy are metabolized through alternate cellular pathways forming ketones or triglycerides. The result is often ketosis, fatty liver syndrome and cows that fail to reach their genetic potential for milk production and animal health.

In addition, the oxidation of fatty acids also produces reactive oxygen species which can accumulate at the cellular level and result in oxidative stress. While it is not yet known how much oxidative stress is too much for cows, research does show that oxidative stress is associated with decreased cellular function and inflammation in other species.

WHAT THE RESEARCH SHOWS

The liver's ability to synthesize triglycerides increases during transition. But its ability to export those triglycerides as very low density lipoproteins (VLDL) does not. VLDLs can be used as fuel for other tissues, including the mammary gland. Without the ability to export more VLDL, fat accumulates in the liver.

Feeding rumen-protected choline (RPC) may help. Research shows that cows fed RPC during the transition to lactation have reduced concentration of liver triglycerides (Zom et al., 2011; Goselink et al., 2013). Cows supplemented with RPC have more choline to make a key component (phosphatidylcholine) that is limiting in VLDL assembly and export. This suggests that the decreased triglyceride levels in the liver are the result of increased VLDL export (Goselink et al., 2013).

Choline is also considered a methyl donor, along with methionine, betaine and folate. Research by Pinotti et al., 2002, showed that due to rumen fermentation, cows are deficient in methyl donors. Methyl donors are needed to make milk protein, build muscle, export fat from the liver as VLDL, and at the cellular level for DNA to properly function and for the regeneration of methionine. When methyl donors are in short supply, one or more of these pathways will be decreased.

Researchers at the University of Wisconsin used a bovine hepatocyte cell culture model to better understand methyl donors' role in maintaining liver health and optimizing liver function during transition (Chandler et al., 2015; Chandler

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IMPROVING LIVER FUNCTION CAN LEAD TO BETTER TRANSITIONS

et al., 2016). Choline and methionine were both evaluated. Results showed:

- Increasing choline concentrations can increase VLDL export from the liver.
- The addition of choline tended to reduce oxidative stress.
- Methionine and choline have separate roles in the liver.
- The requirement for methionine needs to be met, either by dietary sources or through endogenous regeneration.
- Choline can be used to donate a methyl group for methionine regeneration and may support gluconeogenesis—creation of glucose in the liver.

Another area of research showing promise is feeding conjugated linoleic acid (CLA) to marginally depress milk fat production in early lactation. About 50% of the total energy used for milk production goes toward milk fat production. Temporarily depressing milk fat frees up energy for other body functions during a time of negative energy balance. When conjugated linoleic acid is removed from the diet, milk fat production quickly returns to normal. (CLA supplementation to dairy cows is not currently FDA approved in the U.S. except for research.)

White also suggests monitoring the prevalence of ketosis in the herd and promptly treating affected cows. Detecting and treating metabolic disorders is critical to enable cows to reach their genetic potential for milk production. For more on ketosis, please see "You Can Prevent Hyperketonemia," in the March issue of the Dairy Nutrition Plus newsletter.

"Any strategy that can improve the liver's efficiency or nutrient utilization can have a positive effect on milk production and animal health during the transition period," says White.

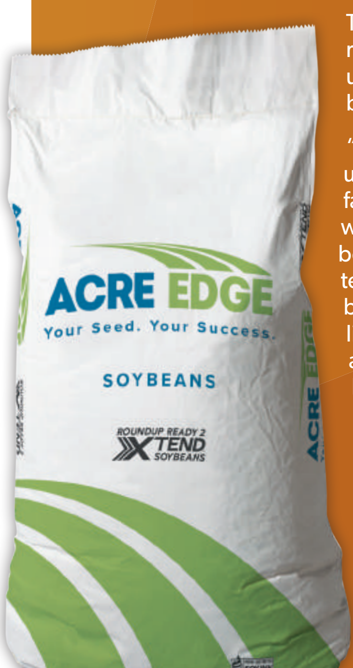
Talk to your nutritionist about using these strategies to improve liver health and liver function in your cows. Doing so can lead to a better transition to lactation.

HAPPENINGS

AcreEdge Soybeans Ensure Quality

SoyPlus is a member of the Dairy Nutrition Plus product line produced by Landus Cooperative. The company sources soybeans from 7,000 farmer-owners throughout Iowa and parts of Minnesota.

From the time the soybean seeds are planted in the ground, Landus Cooperative has an opportunity to touch every step in the supply chain, all the way to your dairy.



That supply chain advantage was recently enhanced as the company unveiled new branding for its own branded seed, AcreEdge.

"Our cooperative structure allows us direct access to the land and our farmers. AcreEdge is just one way we can help our producers grow the best beans, bred specifically for our territory, so that we can turn those beans into a value-added product like SoyPlus," said Mark Cullen, chief animal nutrition officer overseeing the Dairy Nutrition Plus product line.

Formerly known as FC Soybeans, the newly-named AcreEdge is a geographically-targeted soybean seed brand bred specifically for quality results in the fields of our local growers. For nearly three decades, the cooperative has been the only farmer-owned cooperative to sell branded seed with Monsanto-licensed traits.

FROM THE MATERNITY PEN

The Cost of Common Transition Cow Problems

How much does it really cost when a cow develops hypocalcemia or metritis? And how does that health issue affect cow performance, dairy profits and the future value of that cow?

Researchers at the University of Kentucky wanted to find out. They used a farm-level stochastic model with Monte Carlo simulation to estimate the total cost of seven common transition cow diseases. Their analysis included veterinary and treatment cost, farm labor, lost milk production, discarded milk, culling cost, extended days open and death. They also used market values to set the prices for milk, feed, slaughter and replacement cows. In addition, herd-performance factors—rolling herd average, heat detection rate and conception rate, and age at first calving—were also used to develop cost estimates for each disease studied. The model was constructed with the flexibility to input farm-level parameters instead of default values.

Disease cost was calculated separately for primiparous and multiparous cows. In general, disease cost was greater for multiparous cows than for primiparous cows. This was due, in part, to multiparous cows having greater average daily milk production. Only the cost of clinical disease was calculated. Results are listed in the chart at right.

To read the full paper, "Estimating U.S. Dairy Clinical Disease Costs with a Stochastic Simulation Model," in the February issue of the *Journal of Dairy Science*, go to: https://doi.org/10.3168/jds.2016-11565.

CLINICAL DISEASE	TOTAL COST
HYPOCALCEMIA	
Multiparous	\$246.23 ± \$52.25
KETOSIS	
Primiparous	\$77.00 ± \$24.00
Multiparous	\$180.91 ± \$63.74
LAMENESS	
Primiparous	\$185.10 ± \$64.46
Multiparous	333.17 ± \$68.76
LEFT DISPLACED ABOMASUM	
Primiparous	\$432.48 ± \$101.94
Multiparous	\$639.51 ± \$114.10
MASTITIS	
Primiparous	\$325.76 ± \$71.12
Multiparous	\$426.50 ± \$80.27
METRITIS	
Primiparous	\$171.69 ± \$47.88
Multiparous	\$262.65 ± \$56.15
RETAINED PLACENTA	
Primiparous	\$150.41 ± \$51.43
Multiparous	\$313.49 ± \$64.66

CONSULTANTS CORNER

The Facts About Choline and Methionine for Transition Cows

BY RIC GRUMMER
Professor emeritus, University of Wisconsin

In the field you hear a lot of claims about the benefits of feeding choline and methionine to transition cows. While each has its benefits, choline and methionine are not interchangeable in the diet. Many of the statements made are largely based on research findings in non-ruminant animals. Therefore, it is important to separate fact from fiction. Following is my list of facts from the research on feeding choline and methionine to transition cows in a form that protects them from ruminal degradation.

High-producing ruminants may be deficient in methyl donors (Pinotti et al., 2002). Cows need methyl donors to make milk protein, build muscle and export fat from the liver as very low density lipoproteins (VLDL), prevent oxidative stress and regulate gene expression. Choline, methionine, folate and betaine are all methyl donors. Research on the interrelationships between methyl donors in ruminants is in its infancy.

Choline is a key component of phosphatidylcholine (PC) which is present in every cell membrane in the body and is a component of milk fat globules. PC is also used in the assembly and export of VLDL from the liver. During the transition period cows cannot make enough PC to keep up with the amount of fat being mobilized. When the transition diet lacks adequate choline, fatty liver results (Grummer, 2012).

Methionine does not fulfill the same role as choline to reduce fatty liver in transition cows. In six studies conducted so far, (Socha, 1994; Bertics et al., 1999; Piepenbrink et al., 2004; Preynat et al., 2010; Osario et al., 2013; Zhou et al., 2016), none have reported a reduction in liver fat due to methionine supplementation. On a weight basis, choline contains 4.3 times more methyl groups than methionine, so it is possible that the doses of methionine used in the studies were not enough to reduce the accumulation of fat in the liver.

Feeding rumen-protected choline (RPC) to transition cows consistently increases milk yield. A meta-analysis of 13 studies (Grummer, 2012) where feeding RPC was initiated prepartum resulted in postpartum increases in dry matter intake (1.6 lb/day), milk yield (4.9 lbs/day), fat yield (0.254 lb/day) and protein yield (0.167 lb/day). Milk fat and protein percentage was not altered.

A common misconception is that cows only respond to choline when diets are not balanced for methionine. Four studies have shown this is clearly not true. In trials balanced for methionine, Piepenbrink and Overton, 2003; Ardalan et al., 2011; Lima et al., 2012; and Zenobi et al., 2016; all showed a milk yield response to RPC that was consistent with the milk yield response demonstrated in the meta-analysis.

In trials monitoring production responses to feeding rumen-protected methionine to transition cows the milk yield response has been inconsistent. Decreasing metabolizable lysine:methionine ratio to less than 3.0 may increase the likelihood of observing a milk yield response (Osario et al., 2013; Zhou et al., 2016). However, increasing milk protein percentage has been consistently observed.

So far, the evidence clearly shows that choline and methionine are both essential nutrients and should be fed in a rumen-protected form to transition cows. Each plays a unique role and can't simply be substituted for one another. Methionine increases milk protein percentage. Choline decreases fat accumulation in the liver and increases milk yield. Research does not show that their effects are additive.

To read the full paper: "Choline and Methionine for Transition Cows: Separating Fact from Fiction," which was presented at the Florida Ruminant Nutrition Conference, go to: http://dairy.ifas.ufl.edu/rns/2017/Grummer.pdf.

BEYOND BYPASS

Early-Lactation Cows Need More Potassium

Research shows that early-lactation cows often suffer from a negative potassium balance. During the first 75 days in milk, cows tend to secrete more potassium in milk and excrete more potassium in their waste. And during heat stress cows lose even more potassium from increased perspiration. Potassium ions participate in many essential biological processes. Therefore, having enough in the diet is critical.

Potassium also plays a role in altering a cow's acid-base status through a dietary cation-anion difference (DCAD) diet. In the lactating cow, a positive DCAD, as opposed to a negative DCAD pre-calving, is desired, explains Tom Jenkins, professor emeritus Clemson University. His current recommendations include feeding a DCAD of >35 meq/100g of DM with 1.6% potassium on a dry matter basis. During heat stress, increase potassium to 1.8 to 2% on a dry matter basis. This recommendation is higher than the 2001 NRC recommendation because:

- Early-lactation cows eat less than mid-lactation cows.
- Most macro mineral research has been conducted on low- and medium-producing cows. High-producing cows secrete more potassium in milk and generate more acid in the rumen and blood.
- Higher concentrations of sodium and potassium represent an additional role that these nutrients play in rumen buffering and acid-base balance.

With the inclusion of a higher amount of potassium in the early lactation diet, some studies have shown an increase in milk yield and milk fat yield that was not associated with an increase in dry matter intake. This positive lactation response to increased potassium in the diet supports the role of potassium ions in many essential biological functions.

To read the full paper, "The Benefits of Getting More Potassium into Lactating Cows," go to: http://dairy.ifas.ufl.edu/rns/2017/Jenkins.pdf.

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QUALITY CORNER

Meet Snider Farms

For Scott Snider, reducing milk fevers by 40 percent meant an easy change: partial DCAD with SoyChlor.

The simplified approach to DCAD allowed the Indiana dairyman to significantly reduce incidences of milk fever while combatting other costly metabolic issues.

The Indiana dairyman found close-up dry cow success with his 178-head Jersey herd with a simplified partial-DCAD approach and SoyChlor, a palatable anionic supplement for close-up dry dairy cows.

"We tried almost everything to minimize milk fevers so that we can have a more comfortable life and healthier cows. SoyChlor is the thing that worked," said Snider. "I can finally get a decent night's sleep!"

Scott had previously attempted a DCAD program with a different anionic supplement, but low palatability and demanding management only worsened his transition challenges. So Scott's Vita Plus nutritionist, PJ Neff, suggested he try SoyChlor with a partial-DCAD approach instead.

Since then Scott's not only seen a sharp decline in milk fevers, but other metabolic issues like metritis and retained placentas have nearly disappeared.

"We can easily get the pH right with SoyChlor. It's an easy transition for the cows and the producer too," PJ said.

Scott and PJ check urine pH monthly, aiming to keep the Jersey herd between 5.8 – 6.0 to reach their desired results with the Jersey herd.

"DCAD can be as easy or as hard as you want to make it. It can be a small, easy change like we made—it doesn't have to be difficult to get worthwhile results. For us, it's a breeze," said Snider.