Below you'll find short summaries highlighting publications impacting ruminant and other species nutrition in the US. Please feel free to reach out with any questions or if seeking specific follow-up information.

**Comparing oral versus intravenous Ca administration on alleviating markers of production, metabolism, and inflammation during an intravenous lipopolysaccharide challenge in mid-lactation dairy cows (Opgenorth et al., 2025):** In this study, hypocalcemia was induced in the cows to investigate the metabolic and inflammatory responses to calcium supplementation via either oral or IV Ca supplementation methods. Mid-lactation Holstein cows were assigned to one of four treatments: saline control, LPS control, LPS with oral Ca bolus, and LPS with intravenous Ca infusion. Both supplementation methods successfully alleviated hypocalcemia but the results show that IV calcium led to temporary hypercalcemia immediately after infusion, whereas oral calcium provided a more gradual increase in ionized calcium levels. Both supplementation methods increased glucagon levels (signaling mobilization of energy) but affected other metabolic parameters differently. For instance, cows receiving oral calcium decreased blood urea nitrogen response compared to the intravenous group, potentially indicating less skeletal muscle mobilization. Inflammatory responses varied slightly between treatments. Both routes elevated acute phase proteins and cytokines, but oral calcium tended to enhance certain markers, such as IL-36RA, which may have anti-inflammatory effects. Overall, while both calcium delivery methods ameliorated hypocalcemia, the study suggests differences in their metabolic and inflammatory effects.

**Asparagopsis taxiformis supplementation to mitigate enteric methane emissions in dairy cows – effects on performance and metabolism (Angellotti et al., 2025):** This study investigated the effects of supplementing dairy cow diets with Asparagopsis taxiformis (AT), the now famous anti-methane seaweed, at 2 different feeding rates (0.15 or 0.30% of DMI) for 13 weeks. Supplementation of AT decreased methane emissions by up to 30% in the high-AT (0.3% of organic matter) group, but this effect diminished over time. This reduction in methane was accompanied by an increase in

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hydrogen emissions, highlighting a shift in rumen fermentation patterns. Additional negative effects were observed in the high-AT group, including a 7% reduction in DMI and a 2-4% decrease in milk yield and ECM yield compared to the control group. They also found significant accumulation of bromine and iodine in milk from cows fed the high-AT diet, in line with previous concerns about these elements accumulating in tissues and affecting animal and human health. Additionally, plasma metabolic profiling revealed decreased antioxidant capacity, suggesting increased oxidative stress in the high-AT group. Long term AT supplementation has potential negative effects on animal health and production efficiency that require consideration when evaluating methane mitigation strategies on farm.

**Live Presentations:**

Dr. Kirby Krogstad's presentation at the Vermont Dairy Producers Conference explored the impact of high-starch diets on rumen health and systemic inflammation in dairy cattle. He emphasized that while reduced rumen pH and SARA are associated with: changes in fiber digestibility, shifts in the ruminal microbiome, altered VFA profiles, and increases in LPS, starch itself does not consistently lead to systemic inflammation. Instead, his opinion is that inflammation appears more closely linked to abrupt dietary changes and the fermentation *rate* of starch rather than the absolute amount included in the diet. Starch can drive increases in milk and protein yield but finding the optimal concentration is crucial. Too little starch limits production potential, while excessive starch can lead to milk fat depression and acidosis. The variation in individual cow responses to starch feeding remains an area of uncertainty, and Kirby highlighted some of the key questions that remain unanswered, such as how much starch can be safely fed in low-forage diets, how the rumen wall adapts to diet, and the role of other dietary components like sugars in rumen fermentation. Practical management strategies to optimize starch feeding include improving bunk and feed hygiene management, controlling stocking density, using well-mixed TMRs, and incorporating feed additives that can improve rumen pH and intake. Kirby is quite active on LinkedIn if you'd like to follow him for more data on this topic.

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Balchem hosted the pre-conference at the Florida Ruminant Nutrition Symposium in late February. The full proceedings from the symposium can be accessed here but we will cover additional talks in Issue 10. A few highlights from the Monday pre-conference:

- Dr. Tara Felix (Penn State University) covered very similar topics to her recent webinar with Balchem onbeef x dairy calves.
    - She highlighted the use of Angus and Charolais semen for high gain and efficiency, and yield grades while Angus brought in better rib eye areas.
    - Beef calving ease EPDs may not have much value in a dairy application as most bulls probably generate easier calving situations than a Holstein option.
    - She used the term “heterospermic” to highlight the blending of multiple sires into a single semen straw – an unknown uptick in fertility where a cow may favor one bull over another.
    - The term “black box” was used to describe what happens to calves between 250 lbs and the feedlot. This is where Tara believes we can have the most positive effect in management.

- Dr. Brad Johnson (Texas Tech University) spoke on the feedlot market’s transition from Holstein calves to a larger percentage of beef x dairy crossbred calves.
    - Brad highlighted an interesting study that appears in JAS (Fuerniss et al., 2023) where beef semen was used on dairy cows, or embryos were transplanted into dairy cows in an attempt to separate the “dam effect” from that of beef genetics.
    - In that study, beef genetics (regardless of dam being Angus, Holstein, or Jersey) ate and grew roughly the same way in the feedlot (and similar to Angus x Holstein). Most carcass characteristics were also similar except ETs into Holsteins grew slower and had higher internal fat than other Angus genetics.
    - Liver abscesses ranged from 6% in the Angus x Jersey (poor growth performers) or 7% in pure Angus to 33% in the Angus x Holstein on the same diets. While not significant, this could point to a genetic aspect (metabolism or days on feed) that influences abscessing.

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- Angus x Holstein weigh more at harvest (~40 lbs in this case) but carcass weights are the same. Holsteins have more gut weight that contributes to lost weight (and value) that should be considered when you are debating differences relative to feeding performance.

**From the archives:**

1. A 2023 study (Goetz et al.) imposed different transport times (up to 16 h) on calves of different ages – simulating the experience of calves sold in the first week after birth from dairy farms to calf raisers or veal facilities. The authors reported that calves shipped over 7 d of age had better outcomes, including less negative health effects and improved growth in the first 50 days. To no surprise, the transport length also negatively affects calf well-being, especially in the calves only a couple days old. This work highlights the significance of providing adequate management strategies, such as using electrolytes, to mitigate the negative effects of prolonged transport on calf health. Our Feedworks Lytes program fits into early calf transport routines and should have measurable impact on calf morbidity post-transport.
2. Another 2023 study (Ravelo et al.) utilized dual-flow continuous culture fermenters to simulate the effect of byproduct feeds (and their sugars) on rumen microbial communities when a substitution of roughly 4% of starch was changed for soluble sugars. This study has some interesting correlation graphs between acetate:propionate or pH and specific bacterial genera. However, the general summary reaffirms what has been written previously: adding sugars for starch replacement increases some fiber-digesting bacteria (e.g. *Lachnospiraceae* spp.) in exchange for some Prevotella (generalists).

**Other notes:**

1. A recent study in Canada evaluated the efficacy of Agolin in a 12-week dairy cow feeding study where they used chambers to measure gas production. There were no effects of Agolin feeding (methane, ECM, etc.) with the exception of improved DMI. The authors bring to light the wide variation in the literature of Agolin feeding rates scaled to DMI when all cows are fed 1 g/d and suggest that ration-dependent feeding rates may

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need to be considered to maximize efficacy of the product. Current data ranges from 35 mg/kg DMI to over 50 mg/kg DMI when fed at 1 g/hd/d.

2. In many of our summaries, we've highlighted how decreased $CH_4$ production can often spike $H_2$ emissions – representing uncaptured energy lost to the environment. This increase in environmental $H_2$ represents an unknown side-effect on climate change that Hristov and Solomon (2025) try to discuss in their recent paper. Many assumptions have to be made on the ultimate effect of additional hydrogen in the atmosphere but this initial estimate claims that the ultimate GHG net benefit of decreasing ruminant $CH_4$ emissions by 6% globally would only be 0.5% after hydrogen escape was accounted.
3. Galyon et al. (2024) challenged the viewpoint of uNDF or NDFd driving passage rate in their recent paper. The authors fed cows either an alfafa-based or orchardgrass-based diet with varying uNDF and dNDF. Even though the ALFA diet had greater uNDF and similar rumen uNDF pool size, the passage rate of uNDF was also greater; thus, cows with ALFA treatment ate more uNDF daily (5.9 lb vs 5.1 lb/d for ORCH). This contrasts with our general understanding that uNDF is limiting for daily feed intake in cows. Alfalfa also had a much shorter lag phase and greater digestion rate than orchardgrass hay (both were shorter than corn silage). This paper is a reminder that it's important to contrast uNDF within a feedstuff to judge intake or quality effects rather than to take a simple uNDF value and apply it across different types of diets or diets from different regions within the US.
4. With a litany of authors, it pays to be first: Bulnes et al. (2025) evaluated a novel probiotic for efficacy in improving milk production of dairy cows. This product is especially novel because it actually involves new species isolated from the rumen and cultured for implementation in a probiotic supplement. Cows produced more milk between parturition and peak, highlighting the potential for the product to improve nutrient utilization, with lower blood glucose and higher BHBs raising questions as to how this milk production increased. However, the retail price of a product this specialized may limit its ROI.
5. Perez-Calvo et al. (2024) looked at the effect of adding 25-hydroxycholecalciferol (25(OH)D3) and triterpenoids in a calcium (Ca)-reduced, phosphorus (P)-adequate diet containing phytase during the

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grower-finisher phase of swine feeding. Pigs (n = 60) were divided into 3 groups: a positive control (PC) with standard Ca levels, a negative control (NC) with reduced Ca, and a treatment group (TRT) that received the NC diet plus 25(OH)D3 and triterpenoids. The TRT group had greater ADG and ADFI compared to the NC and PC groups, with a 7.8% increase in final BW compared to lower Ca NC. Additionally, bone mineral density and content were maintained in the TRT group despite the reduced Ca intake, and plasma levels of 25(OH)D3 and phosphorus were significantly higher in the TRT group, combining to indicate enhanced mineral absorption. Gene expression analysis revealed that 25(OH)D3 and triterpenoids activated biological pathways related to muscle growth, particularly those regulating mTOR, a key central regulator of cell metabolism and growth.

6. Fregulia et al. (2024) used autoclaved (dead/destroyed microbes), bacteria-enriched, or protozoal-enriched rumen fluid from donor cows to test rumen microbe influence in young calf (0-9 weeks of age) epithelial gene expression. They demonstrated more than a hundred different genes upregulated by the exposure of rumen tissue to either enriched culture (or both). While most of this paper is very technical in discussion, the implication is clear: early exposure of calf rumen epithelia influences gene expression that can alter their metabolism. We need to prioritize rumen development and stability during young calf development.
7. A pair of Hoard's Dairyman articles may give some ideas into how to use Calmin (a sustained buffer) successfully in cattle diets. First, this paper from last summer highlights the high occurrence of liver abscesses, especially in cattle with high starch/low forage diets prone to acidosis. Although liver abscesses can heal, scars still form that will leave the carcass with an "A" score at harvest. In another article in the print copy of Hoard's from January 2025, Dr. Hutjens highlights the difference between buffers and alkalizers in the diet with a nice shout-out to Calmin for its highly available Ca. This differentiation between buffering and alkalizing is something that will get more attention in a future issue.
8. Caution: Rabbit Study. Yes, this is a bit outside our norm but an interesting result. Shalaby et al. (2024) crosslinked Berberine (a Chinese herbal extract) with chitosan nanoparticles (used as drug delivery

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mechanism) to attempt to reduce heat stress in newly weaned rabbits. They found that the inclusion of BER-CNPs, especially at a concentration of 40 mg/kg of the diet, significantly improved liver health by reducing damage caused by heat stress. In the liver of heat-stressed rabbits, the control group showed signs of inflammation and hepatocellular degeneration, such as enlarged central veins, vacuolated cytoplasm, and sinusoidal dilatation. However, these pathological changes were alleviated in the groups supplemented with BER-CNPs. Histological analysis revealed reduced inflammatory cell presence and more intact hepatic structures in the BER-CNPs-treated groups. Lastly, biochemical analyses indicated improved liver function, marked by reduced levels of liver enzymes such as ALT, AST, and LDH, and lower bilirubin levels.

9. Bottegal et al. (2025) evaluated the combined effects of carob pulp (Ceratonia siliqua L.; fed to increase %CP) and vitamin E supplementation on the growth, rumination activity, and gastrointestinal health of light lambs. Weaned lambs (n=72) were divided 12 small pens receiving diets with either 0% or 20% carob pulp (CP) and either low or high doses of vitamin E (40 vs. 300 IU/kg of concentrate). The combination of 20% CP and high vitamin E boosted rumination activity, which could indicate improved digestive health. Additionally, this combination led to changes in the gene expression of gastrointestinal immune markers, downregulating pro-inflammatory cytokines (IFN-γ) in the jejunum. High vitamin E reduced the expression of inflammatory cytokines (TNF-α and TGF-β) and upregulated antioxidant genes in the ileum, suggesting its potential to improve gastrointestinal redox balance and immune function.

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