FEEDINFO
PERSPECTIVES

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Adisseo Urges for 'Gold Standard' Evaluation of Amino Acid Contribution of Rumen-Protected Products

Adisseo, with its more than four decades of experience in dairy amino acid nutrition, continues to raise awareness of the significant benefits of meeting requirements for these essential nutrients. However, Adisseo also believes there is still work to do when it comes to providing accurate numbers industry-wide on the metabolizable amino acid contribution of rumen-protected products.

Today, we talk to Dr. Chuck Schwab (Professor Emeritus, University of New Hampshire, and Principal, Schwab Consulting) and Dr. Brian Sloan (Global Director of Ruminant Amino Acids and Protected Nutrient Business, Adisseo). Drs. Schwab and Sloan advocate for a robust, accurate, and precise technique to measure the metabolizable contribution of each commercial rumen-protected product for dairy cows.

[Feedinfo] In a nutshell, what is the issue you are facing?

[Brian Sloan] The use of rumen-protected amino acid products (RP-AA) is growing annually. Prominent among the reasons why is an increasing list of nutritional benefits; a better understanding of amino acid requirements for performance, health, and reproduction; the continued refinement and improvement of dairy nutrition models; the desire to reduce nitrogen excretion; and the sustainability of the dairy footprint.

Overall, however, the available information on commercial products is highly inconsistent. The range runs from brief product descriptions with little or no efficacy data to very detailed information. The detailed information provides product characteristics and efficacy with respect

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to the metabolizable amino acid contribution when fed under commercial feeding situations.

A concern is how little information exists on many products. Should claims of product efficacy be overstated, disappointment follows when expected production benefits and research outcomes are not obtained.

Reliable estimates of the proportion of the amino acids being absorbed should be a given. This information is required to successfully balance the amino acid levels in rations and to realize least-cost solutions for the predicted amino acid supplies.

Some companies provide milk production response data comparing results from their product to results from other products. This, however, does not substitute for the required estimates of metabolizable amino acid contribution.

Cows respond to the increased absorption of a nutrient only when that nutrient is the most limiting factor for production. In a comparison of different sources of the same nutrient, all cows fed the best product must remain deficient in that nutrient and no other factor can be limiting production. If this is not the case, the superiority of the best product will not be seen. Instead the inferior product(s) relative to the superior product will always look better than they are. Therefore, a gold standard methodology is needed to confirm claims of product efficacy.

[Feedinfo] Dr. Schwab, what kind of challenges do you see?

[Chuck Schwab] The commercial production of high-quality RP-AA supplements with both excellent protection from ruminal degradation and high intestinal release is not easy, and current products are far from being created equal. Achieving high-quality and consistent products takes extraordinary refinements of encapsulation/ protection technology. In addition, product stability must be maintained when mixing with other feeds, both in the feed mill and on the farm. This includes product stability in wet total mixed rations (TMRs).

A research study conducted by Ji et al. (2016) at the Miner Institute clearly uncovered the weaknesses of some of the protection technologies that are or were being used. Researchers assessed how lysine release from six different rumen-protected lysine products was affected by on-farm feeding conditions related to 1) changes in TMR moisture and 2) mixing of the TMR. Of particular interest were the large differences among products in how much of their lysine was released just by being exposed to a typical TMR containing 50-60% moisture. This study provided unequivocal evidence of the difficulty in producing high-quality RP-AA supplements and was a reminder that methods of product evaluation must start with putting the products in the type of rations that will be fed.

Dr. Chuck Schwab
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[Feedinfo] Which evaluation methods are most commonly used?

[Chuck Schwab] Various in vitro, in situ, and in vivo methods have been used to arrive at estimates of the metabolizable amino acid contribution of lysine and methionine from rumen-protected products. In vitro methods lack the influence of pre-feeding effects (mixing

and handling) and animal effects like chewing and rumination. Accurate estimates of metabolizable amino acid contribution cannot be obtained.

The in situ method with rumen and duodenally cannulated cows has been used, but it has several limitations. These include the absence of chewing and rumination effects, disappearance from rumen bags in the rumen is taken to mean degradation, ruminal passage rates (seldom measured) are needed to estimate ruminal escape, disappearance from mobile bags in the small intestine is taken to mean absorption, products not fully degraded in the rumen or digested and absorbed in the small intestine are subjected to hindgut fermentation where further loss can occur, and the procedure cannot be used with fine or soluble products. In addition, how the residue-containing bags are handled from the time they are removed from the rumen to their eventual placement in the duodenum can have a large influence on product loss from the mobile bags. This step can lead to high and false values for intestinal digestibility.

In vivo methods have been used too. The first of three such methods is the Area Under The Curve (AUC). This method involves quantifying the change in blood plasma concentrations of the amino acids after a large rumen spot-dose of the RP-AA is provided. While the method has been shown to differentiate products with varying degrees of efficacy, the approach should not be relied on to provide accurate estimates of metabolizable amino acid contribution because of the absence of pre-feeding effects and because animals receive large doses of the amino acids not otherwise encountered.

Another in vivo method, the Milk Protein Dose Response Method, is an indirect method. Its two most obvious shortcomings are the need to maintain a deficiency of the amino acid that is being evaluated over the range of dosages used- which cannot be determined or guaranteed in advance - and that increases in milk protein are “indirect” or downstream effects of increased adequacy of the limiting amino acid. As a result of these two shortcomings, the method lacks a measure of precision in arriving at estimates of metabolizable amino acid contribution as compared to estimates calculated from changes in blood plasma concentrations of the amino acid. At best, this method can only give a precision of +/- 30 % in estimating the metabolizable AA contribution of a product.

[Feedinfo] So, in your view what ought to be the “Gold Standard” you referred to previously?

[Chuck Schwab] A third in vivo method: The Blood-Plasma Free-Amino-Acid Dose Response Method. It is receiving acceptance as the gold standard, and it has no obvious shortcomings.

Research comparing the Milk Protein Dose Response Method with the Blood-Plasma Free-Amino-Acid Dose Response Method was conducted by Ordway et al. (2013) and showed the superiority of the Blood-Plasma Free-Amino-Acid Dose Response Method. Changes in amino acid level in blood plasma is the more direct indicator of increased amino acid absorption.

A critical and comprehensive review of the dose response method for evaluating rumen-protected lysine supplements was published by Whitehouse et al. (2017). To date, more than 20 experiments have been conducted at the University of New Hampshire by Whitehouse using this technique and more than 100 lactating, ruminally cannulated multiparous Holstein cows.

The metabolizable lysine contribution values determined with the dose response method

have ranged from values of 5% to slightly greater than 80% for commercial products. A value of 87% was obtained on a non-commercial product of known high-lysine metabolizable amino acid contribution in the same experiment where a value of less than 15% was obtained on a commercial product. With this singular experiment, the legitimacy of the method was confirmed. The dose response method gives accurate values with a precision of at least +/- 5 percentage points, irrespective of the technology evaluated.

[Feedinfo] What are the next steps for Adisseo? How do you think the industry will react to your 'Gold Standard'? Can companies adapt easily?

[Brian Sloan] As a long-term market leader, Adisseo consistently works to ensure that both the feed industry and dairy farmers receive what they are paying for and expect. We set the example. In accordance with this, we adhere to the gold standard methodology to demonstrate the quality of our SmartLine™ of amino acid products for ruminants. The Gold Standard advances industry interests. It allows suppliers to confidently and accurately represent their rumen-protected products to their customers. As its use becomes the norm, the methodology will become a routine practice, one that is expected by the industry with new product development.

The Gold Standard is easily adopted by companies. It can be used for all products (methionine, lysine, other amino acids, and analogues) and technologies irrespective of physical and chemical characteristics. The methodology is calibrated through the number and timing of feedings and the four-day adaptation period prior to the start of sampling. During these four days, steady state is achieved for the blood plasma concentration of the amino acid being tested. The robustness necessary for sampling to produce accurate and precise results is thus realized.

The gold standard methodology can be used for any rumen-protected amino acid or amino acid analogue. To demonstrate the precision of the Gold Standard, it has been used to evaluate the metabolizable methionine contribution of our own MetaSmart®. Evaluating MetaSmart® is inherently challenging. As a liquid, it cannot be tested in sacco. It also does not bypass the rumen. Instead it is absorbed across the rumen wall into the blood stream. Nevertheless, the gold standard is still applicable. In 2021, the publication of the research leading to this Gold Standard method for rumen-protected methionine products will be published in the Journal of Dairy Science (JDS).

[Feedinfo] What is your take-home message?

[Brian Sloan] The dairy industry needs an animal bioassay for use in determining reliable estimates of the metabolizable amino acid contribution from rumen-protected products. Differences among products should be as evident as differences in the protein content of protein supplements. The Blood-Plasma Free-Amino-Acid Dose Response Method seems the right solution. It also provides an important advantage: adaptability to be used under different feed management systems, e.g., dry vs. wet diets and the individual feeding of concentrate feeds vs. total mixed rations. The resulting estimates of metabolizable amino acid contribution, therefore, are consistent with how the product is fed.

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