Making the case for rumen-protected amino acids

Stephen B. Blezinger for *Progressive Dairyman*

Seldom does a week go by without the dairyman receiving at least one dairy-related magazine covering nutrition, and more specifically, amino acid (AA) nutrition in the dairy cow. Countless articles and papers have been written the last few years discussing research and practice and the evolving understanding that is updated almost daily. Formulating diets to balance AA, particularly lysine (lys) and methionine (met), has become increasingly common. Numerous leading universities, research foundations and farm trials have illustrated the value of AA balancing for lactating herds and more recently in transition groups.

Additionally, a variety of computer models now provide estimates or projections of the production and component benefits of targeted delivery of lys and met (and others). Depending on the platform, in some cases these calculations also factor in fiber and carbohydrate components of the diet and the overall rumen fermentation dynamic in an effort to estimate the contribution of all these nutrients.

Interestingly, the practice of balancing for AAs in the dairy cow diet has not been embraced by everyone. Many nutritionists and dairymen alike still question the effectiveness of the practice and overall value once the cost is considered. Second, defining protein/amino acid supply in ruminants is a challenging task, given feedstuff variety and variability (particularly in forages) as well as the reconfiguring effects on nutrient intake by the rumen microflora. Finally, with recent difficulties in sourcing consistent supplies of lys and met over the last year or so, this has caused many in the industry to ask, "Is the aggravation and cost truly worth it?"

Responses to supplementation with lys or met (where both are protected in some manner from ruminal degradation) have been extensive and well documented. The most basic and commonly accepted benefit is generally thought to be in terms of improvements in milk volume and milk components given that the first limiting AAs are met and lys (in that order). Other documented benefits include improvements in reproduction, embryo survivability, offset of oxidative stress during transition periods and potentially reducing heat stress effects.

Economically, opportunities have been noted to reduce overall crude protein levels in the lactating diet when AAs are properly balanced, thus providing for an opportunity to improve income over feed costs. In general, it is well proven that balancing for the AA component of the typical dairy diet can bring very positive results when diets are balanced in this manner.

As noted above, the answers are not always simple. A factor that complicates the matter has been a question of the source of the bypass AAs. Historically, basic feed ingredients such as blood meal, fish meal and soybean meal (conventional and heat or other process) have provided, to at least some degree, a supplemental level of lys and met to possibly meet the animal's needs depending on the formulation of the diet. Likewise, forages also deliver a certain amount of AA but the variability is generally significant due to the wide variety of forage types, growing and harvesting conditions.

Feed ingredients can be very challenging to manage in terms of consistency and quality. Given this, some of these sources of feed ingredients can be more effective than others in terms of providing concentrations of AAs and subsequently the ingredients' ability to bypass the rumen, providing direct absorption of the AA in the small intestine. This question of what is the availability of AAs supplied by an ingredient to the small intestine is a basic fundamental question nutritionists need answers to. These absorption values serve as a primary driver in ration formulation which determine the true value for a product by its cost per unit of available lys or met.

The advent of "synthetic" or manufactured amino acid sources, which are available to nutritionists today, can help address the needs for specific amino acid nutrition during periods of high production in today's dairy cows. This precision nutrition has simplified ration formulation from a nutritionist perspective.

This addition of improved technologies available today to protect the specific AAs from rumen degradation has resulted in a direct benefit in improving the ability to deliver a larger amount of AAs to the small intestine for absorption. Although some nutritionists question the performance of these products relative to "natural" or conventional feed ingredient sources, a large volume of research illustrates repeatedly that the animal does respond to feeding of rumen-protected amino acids (RPAA).

As with most other nutritional tools, there are numerous products that are sold under the description of RPAA. Additionally, as with other nutrient sources, RPAAs vary in the actual technology used in the manufacturing process. In this case, the variation is found in how each product actually provides rumen protection. In general, this protection is provided by the AA in question being combined, through very specific processes, with compounds resistant to microbial effects in the rumen. These technologies include polymer coatings, fat coatings, fat matrices and so on, with each product and the producing company having a proprietary process in place used for manufacture.

The various coatings and compositions affect how well the AAs avoid ruminal effects as well as how the AAs are released in the small intestine for absorption. The correct combination of components that results in a precise response in the rumen and then the intestine can be difficult to achieve. The products that are believed to work the best are those that:

1. Deliver the AA of choice through the rumen while minimizing its losses to rumen degradation but yet release the highest payload of AA that is needed to be delivered to the small intestine.

2. Achieve these results for the best possible cost (cost per unit of deliverable AA).

Finally, the true measuring stick of the effectiveness of a given product is how the cow actually performs when the AA in question is supplemented in this manner.

One significant problem the industry currently has is that there is no recognized standard test for evaluating AA availability in the cow. A number of tests have been developed to evaluate the changes in AA presence (disappearance) at various points in the cow's digestive system. Other tests measure the net amount of nutrient delivered to the animal and the subsequent effect on circulating blood plasma levels post-absorption. Examination of the procedures and the results seem to indicate that one test or the other may be more sensitive to one type of product composition when compared to another. Additionally, many of these models generally employ very small numbers of animals, resulting in low statistical power, making it challenging to truly interpret results.

At the end of the day, most nutritionists will tell you that the true test is to be found in cow performance and return on investment. All products used in dairy nutrition should be evaluated based on their ability to improve the animal's nutritional or health status and to improve the bottom line through production parameters. Rumen-protected amino acids are no exception. ***PD***

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