

Nutritionist's guide to amino acid balancing

New breakthroughs in amino acid balancing have raised interest in the practice and the challenge of putting it to work in clients' herds. There are great opportunities for nutritionists willing to invest time in the practice.

By **ELLIOT BLOCK***

THE direct and defined benefits of feeding limiting amino acids at optimal levels and ratios have been proven across multiple dairy cattle feeding trials.

While the science has identified multiple benefits — increased milk and component production, reduced dietary protein needs, more efficient nutrient utilization and an increased income over feed cost (IOFC) — the practice of balancing the diet for amino acids is still regarded as a challenge.

Nutritionists have the task of not just understanding the concept but are responsible for turning the idea of amino acid balancing into a reality in clients' herd nutrition programs. The following discussion will help translate knowledge into practical application on a dairy operation.

Building blocks

Amino acids are the building blocks of protein, which is one of the most important nutrients in dairy cow diets as the cows depend on protein for all bodily functions — from immune system regulation to growth and reproduction to milk and component production.

Supplying cows with the right levels of amino acids directly influences their ability to stay healthy, grow properly and reach peak performance.

Limiting amino acids get their name because they limit protein synthesis when unavailable. Lysine and methionine are the two most-limiting amino acids; these amino acids cannot be synthesized in the cow's body from other amino acids or precursors, which means they must be supplemented through the diet.

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When the diet delivers optimal levels of these two limiting amino acids — 7.5% lysine and 2.5% methionine as a percentage of metabolizable protein (CPM-Dairy version 3.0.1.0) — the cow can then use more of the dietary protein for all necessary functions.

The result is more productivity and better health and/or the ability to reduce total dietary protein because of the resulting efficiency boost.

Solutions, challenges

Until recently, the ability to balance amino acids has revolved around delivering commodity protein sources rich in amino acids — such as blood meal — to the diet. While blood meal is still used in rations for this purpose, research continues to show that the variability in blood meal quality can cost the dairy more than the initial price tag.

Research completed at The Ohio State

University, and quoted by Boucher (2009), showed that blood meal variability is very real.

In the study, 265 blood meal samples were collected to represent a variety of blood meals from different species, origins and regions of the country. These samples were each tested for percent crude protein, rumen unavailable protein (RUP), percent of RUP digestibility, percent lysine as a percentage of crude protein and lysine digestibility.

Table 1 lists the research findings, which showed extreme variability, as evidenced by the ranges between the fifth and the 95th percentiles. While the average blood meal quality was arguably acceptable — although of a lower digestibility than feed tables such as those of the National Research Council show — the range showed marked inconsistency.

For nutritionists, the range in blood meal quality is especially alarming because cows depend on consistent levels of lysine to maintain high production levels. From a diet formulation perspective, if the amino acids provided by blood meal are different every day or in every load delivered, it's nearly impossible to be confident that cows are actually receiving the formulated diet.

The volatile prices and staggering

1. Composition and variability of blood meal samples (n = 265)

	Average	Fifth percentile	95th percentile	Standard deviation
Crude protein, % of dry matter	90.1	84.4	96.0	3.68
RUP, % of crude protein	76.8	50.4	96.6	14.80
RUP digestibility, % of RUP	64.6	19.9	97.6	23.06
Lysine, % of crude protein	9.12	7.44	10.31	0.79

Source: **Boucher (2009).**

2. Example comparison of producer income using different component levels but similar production levels

	Herd 1	Herd 2
Milk production, lb.	85	85
Milk fat, %	3.2	3.6
Milk protein, %	2.9	3.1
Fat, lb.	2.72	3.06
Value of fat (\$1.58/lb. x 2.72 lb.), \$/cow/day	4.30	4.84
Protein, lb.	2.47	2.64
Value of protein (\$2.15/lb. x 2.47 lb.), \$/cow/day	5.31	5.68
Additional milk income for herd 2, \$/cow/day	—	0.91

inconsistency are a liability from both a ration cost and cow performance standpoint.

New commercial bypass lysine sources are allowing nutritionists to consistently balance rations for optimal levels of amino acids. Consistent lysine delivery to the cow's small intestine improves milking string performance, nutrient utilization and, ultimately, IOFC.

Let's take a look at how this new technology can be used.

New look

Balancing diets for amino acids means a new way of thinking for nutritionists when it comes to ration protein. Rather than looking at the crude protein percentage — a common way to measure protein levels provided to the cow — balancing for amino acids allows for a more precise approach to supplying the nutrients the cow actually receives and utilizes from protein.

As a nutritionist, this new way of thinking offers an advantage in the market and provides additional opportunities to a consulting business. Extra profits for the dairy — resulting from higher milk and component production and/or reduced protein needs — demonstrate a vested interest in moving the dairy's business forward.

Improving on-farm efficiency can also help open the door for future opportunities to work with other dairy operations.

Nutritionists have said one roadblock to balancing rations for amino acids is the challenge of ensuring that the right levels and amounts of amino acids are reaching the cow's small intestine. However, ensuring this may not be as challenging as thought.

Utilizing the following three-step process can help properly balance a diet for amino acids:

(1) Pay attention to and balance for rumen degradable protein. Rumen microbes need those soluble peptides, free amino acids and ammonia to optimize their rumen fermentation capacity.

(2) Balance grams of metabolizable protein (MP) methionine for the targeted production level without oversupplying total MP.

(3) Finally, adjust lysine levels to arrive at a proper lysine:methionine balance (approximately a 3:1 ratio depending on the ration balancing software program).

Using this three-step approach will ensure that the rumen is still functioning, protein is not being overfed and delivered MP will be used with as high efficiency as

possible.

Realizing benefits

The opportunities are endless if a nutritionist is willing to invest time getting educated on balancing rations for amino acids. To reap the greatest benefit, it's important to understand and believe that the following concepts can effectively lead to an improved nutrition program and financial state for the dairy operation.

Milk component percentage versus pounds. Looking at percentages of milk components alone can be deceiving when performance improvements are made. Since producers are paid on pounds of fat and protein rather than percentages, it's especially important to take this into consideration when looking at income generated over time.

The example in Table 2 compares two herds with the same milk production but different component levels and the resulting income.

As shown, while milk production per cow did not change, additional income was generated per cow per day in herd 2 when components were raised. Looking at pounds rather than percentages tells the full story of how milk income is generated.

IOFC is a proven financial measurement to economically evaluate if feed ingredients and feeding practices are generating additional income for the dairy operation.

As the largest expense for a dairy operation, having a grasp of feed costs allows clients to make business-minded decisions on which ingredients have a profitable impact.

However, profit is not determined by feed cost alone; feed cost is only half of the profitability equation. IOFC is the determining factor.

The IOFC calculation subtracts the feed costs from the income generated by milk and component production. IOFC is also a proven method to show that some investments, such as amino acid balancing, may increase a producer's initial investment but result in greater returns for the dairy.

Holistic approach to cow health and performance. Amino acids are critical for more than just milk and component production. The delivery of amino acids also affects the cow's growth, immune function, reproduction and body condition.

As amino acids are delivered to the diet, production improvements may not be the first thing seen. Sometimes, amino acids are needed first for greater

growth or to reduce health concerns. As the diet approaches optimal levels of supplementation, improvements will start to show in other areas, such as component levels and milk production.

Summary

A lot of discussion about and new breakthroughs in amino acid balancing have raised interest in the practice and the challenge of putting it to work in clients' herds, creating great opportunities for the nutritionists willing to invest time in the practice.

The following take-away tips suggest the next steps forward with amino acid balancing:

- **Opportunities exist.** Balancing diets for MP and specific amino acids in the MP — rather than crude protein percentage — offer an opportunity to deliver just what the cow needs for peak performance without overfeeding protein. The amino acids cows need to excel in the milking string and beyond are known. The job is about delivering these amino acids in the right balance.

- **It's more than milk and components.** Amino acids have a variety of functions and, therefore, influence more than the milk check alone. Health, reproduction and growth will influence the balance of amino acids needed throughout the cow's lifecycle.

- **Use the three-step process.** Remember that amino acids are nutrients as opposed to another additive. Follow the three-step process to properly balance amino acids in lactating animal diets and ensure that the right levels of the right amino acids are available for use by the cow.

- **It's easier than previously thought.** Nutritionists may have struggled with balancing diets for amino acids in the past, but with the software and resources available today, the amino acids needed to make clients' herds thrive can be easily provided.

- **There's a benefit to the nutritionist.** A nutritionist is continually judged on how well clients' herds perform. Amino acid balancing is a tool that can take a program to the next level and ensure that customers are reaping the greatest benefits.

Reference

Boucher, S.E. 2009. Challenges of predicting metabolizable lysine content of ingredients. In: Proceedings of Cornell Nutrition Conference for Feed Manufacturers. p. 16-27. ■