



by Steve Martin

From protein to carbohydrates and back again

IN THE 33 years I have been involved in dairy nutrition, I have noticed a bit of a cyclical pattern on the hot topics of feeding dairy cows. In the 1990s, I remember that concepts of bypass protein dominated the conversation. In grad school and early in my career, the very general term of bypass protein was refined into metabolizable protein and amino acids. It was a new thought that supplementation of various amino acids would be necessary to reach maximum production levels.

As we moved into the early 2000s, we talked more about detailing carbohydrates. Instead of thinking about highly digestible carbohydrates as simply something that was not counted as fiber, we started detailing sugar and starch. All of this came alongside an ever-improving cow with genetics to keep making more and more milk. The nutrient supply needed to keep up!

The corn driver

The emphasis on carbohydrates and starch came alongside the trend to higher feed rates of corn silage on larger dairies. The trend for Western dairies to be strong alfalfa feeders gave way to the economics and predictability of corn silage. Dair-

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ies further east already knew of the corn silage advantage. As a result, fine-ground corn or flaked corn was partially replaced by corn grain in corn silage. Concurrently, micron size, bushel weight, and kernel processing scores began to have an influence on how cows were fed and an even bigger influence on how the cows responded.

These physical characteristics of corn processing and starch availability were further enhanced by a better understanding of corn genetics and phenotypic expression. The saying "corn is not corn" became common, and we learned terms like floury and flinty and gained a better understanding of prolamin. Long story short, we were doing a much better job supplying energy to lactating cows.

As we were feeding more and more available starch, we were also learning about the milkfat synthesis risks from 18:2 fatty acids. Getting those under control allowed for a nice milk response from the more digestible starch with less butterfat risk.

Coming full circle

I recounted history to make the point that, like many things in life, the dairy nutrition focus seems to go in circles. I think we are headed back to focus once again on the protein side of the diet.

The way we are returning to the protein conversation is very exciting. In fact, some parts of the new approach are things that I "hoped" were true as long as I have been feeding cows. To put it simply, the

lysine and methionine focused approach we have been using as the primary effort for balancing for amino acids sells the cows short in their ability to be more flexible in amino acid requirements.

An amazing give and take

When I look at the variety of wild ruminants that seem to raise a newborn each year, lactate, then gestate, and do it all over again the next year on a wide variety of available nutrition, this should not surprise us. The list of important amino acids goes from two to five.

In addition to lysine and methionine, we add histidine, isoleucine, and leucine. These are referred to as essential amino acids, and the amazing thing is that the cow has a bit of a give and take at the metabolic level to produce the same milk with different supplies of these five amino acids.

A bit complicated

As we enter this new era, we need to learn some new terms like branch-chained amino acids and a protein complex called mTOR (mammalian target of rapamycin). If you Google branched-chain amino acids and mTOR, you will see hits in topics from cancer to body building.

To be sure, this is complicated science that we will start using. However, it truly helps the cow adjust to our often not-perfect ration formulation.

The finer details of this will certainly go over most of our heads, but the awesome fact is that we can

already start thinking about some of these general principles as we formulate dairy rations. We cannot only feed for more milk support, but we can hopefully reduce some feed input costs as we think more about the metabolic flexibility of our beloved dairy cows.

When we get all of this figured out, we can circle back to find ways to supply better energetics to cows. For now, we should figure out the formulation opportunities afforded by the focus on these five core amino acids. I am sure there are top researchers pushing forward in both areas concurrently.

In reality, it is difficult to think of one without the other. We need both carbohydrate and amino acid building blocks to make milk. The next step will be implementing these principles on the farm. With that in mind, questions abound.

Will this require more frequent feed analysis? Are there rumen modifiers that can have an impact on this new science? What are the rich sources of these additional amino acids? How does microbial protein fill the need?

Sustainability enters picture

Since we are truly talking about nitrogen efficiency, there is also a sustainability angle. With the use of a strong linear program in a ration formulation model, we can find the optimum blend of proteins to best match the carbohydrates in use. The result will likely be more milk support, better immunity, and, hopefully, reduced feed cost. So, stay tuned. 🐄

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