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How to Approach Amino Acid Balancing

By Richard Ware, Ph. D., Beef Division Manager, Vi-COR

Nutritionists are constantly looking for strategies to help cows perform more efficiently and increase profitability. One documented strategy that can result in big dividends to the dairy is balancing for amino acids, particularly lysine and methionine. While many have tried to make use of this progressive strategy, surprising few have seen a benefit like those published…and in fact, many have seen feed costs rise without the expected production to offset it. Why, if the science supports amino acid technology, don't more nutritionists experience positive results? The truth is, in order to realize a significant benefit, there are several challenges to amino acid balancing that must first be addressed.

Challenge #1 – Management

It is tempting to think that a new feed supplement should be able to "plug" right in to the current diet and have an immediate impact…but such is not always the case. Today's dairy ration is carefully formulated to contain certain nutrients and energy content, and requires intimate knowledge of the feed ingredients being used and how they will be utilized by the animal. Keeping up-to-date with ingredient analyses, especially of those ingredients that have greater variability (silages, forages, wet feeds, etc.) is extremely important.

Additionally, other areas of the dairy can present bottlenecks that prevent the cows from performing at their best. For example, the way feeds are managed can have a huge impact. Both a mixer wagon with dull knives, and a silage pile that is not defaced properly can alter the characteristics of the diet in the feed lane to such a degree that it is no longer the diet that was presented on paper. Proper training of milkers, time between milkings, and how the animals are brought into the parlor can also remove hurdles to production – up to 4+ lbs/hd, depending on the severity of the problem. Periodic feed management and parlor audits can be great tools to keep a dairy running smoothly and eliminate bottlenecks.

Table 1. A comparison of the essential amino acid composition of body lean tissue, milk, and ruminal bacteria with that of some common feeds.

ITEM	Lys	Met	His
	---------- (% of CP) ----------		
Lean tissue	6.4	2.0	2.5
Milk	7.6	2.7	2.7
Bacteria	7.9	2.6	2.0
Alfalfa silage	4..4	1.4	1.7
Corn			
Corn silage	2.5	1.5	1.8
Grass silage	3.3	1.2	1.7
Barley	3.6	1.7	2.3
Corn	2.8	2.1	3.1
Oats	4.2	2.9	2.4
Wheat	2.8	1.6	2.4
Canola meal	5.6	1.9	2.8
Corn DDG w/sol	2.2	1.8	2.5
Corn gluten meal	1.7	2.4	2.1
Cottonseed meal	4.1	1.6	2.8
Soybean meal	6.3	1.4	2.8
Sunflower meal	3.6	2.3	2.6
Blood meal	9.0	1.2	6.4
Feather meal	2.6	0.8	1.2
Fish meal	7.7	2.8	2.8
Meat meal	5.4	1.4	2.1

Adapted from Schwab, C. et al. *Amino Acid Balancing in the Context of MP and RUP Requirements*. 2004. Florida Ruminant Nutrition Conference.

Challenge #2 – Nutritional Status

Once all of the management practices have been addressed, the next challenge is determining the current nutritional status of the herd. This requires an assessment of lean body tissue (muscle mass) as well as body fat covering (body condition scoring). If prior diets have not provided adequate amino acids to meet the needs of high-producing cows, then as with body fat, lean tissue will be mobilized to meet the amino acid requirements for production. Depending on how deficient her body reserves are, it could take up to 12 weeks of methionine supplementation to replenish those body stores. During this time, she will gradually employ more of the supplemented amino acid toward production.

Challenge #3 – Estimating the Starting Point

Finally, an accurate determination of how much lysine and methionine actually reach the duodenum is very important before supplementation begins. Overestimating this starting point can result in under-supplying needed levels and result in little to no benefit; while underestimating the starting point can lead to adding more than is necessary, thus inflating the feed costs.

There are two main sources of these amino acids that can affect your starting point, microbial crude protein (MCP) and rumen undigestible protein (RUP). Microbial protein consists of organisms that pass from the rumen to be digested in the small intestine. The methionine and lysine content of this protein is very high (see Table 1) and as such, is an excellent supply. Any nutritional strategy that increases the amount of MCP is extremely beneficial and cost effective. RUP is that fraction of feed protein, made up of amino acids, that passes out of the rumen to be broken down and absorbed in the small intestine. The common theoretical models (NRC, CPM, CNCPS/AMTS) being used to generate and evaluate

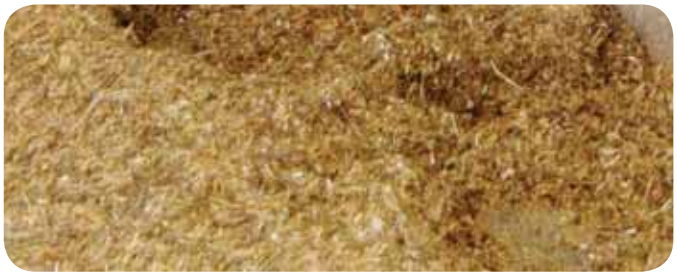

Table 2. Estimates of MCP and RUP passage to duodenum from various software models using the same diet.

ITEM	CPM	CNCPS/AMTS	NRC
MCP yield, g	1,584	1,340	1,328
MP from ration RUP, g	1,404	1,738	1,319
MP Supported Milk, lbs	99.7	109.9	91.6

the dairy ration generate a different estimate for both MCP yield and RUP in feeds. This can present a challenge unless the nutritionist understands the limitations of the model and adjusts accordingly. For example, inputting the same "Western" style diet into all three models generated three different estimates for MP (see Table 2) from microbial yield and RUP. These differences in predicted amino acid flows resulted in three different milk yield estimates with a range from 91.6 lbs of supported milk, up to 109.9 lbs – a difference of 18.3 lbs!

One way to establish a baseline for the model is to use it to predict flows from a study where MCP and/or amino acid flows to the duodenum were measured. It is this author's experience that NRC model's validated estimates come closest to being accurate in predicting both MCP yield and ration RUP flows.

Regardless, the bottom line is that amino acid balancing (as well as any other supplementation) should be verified with the only expert that matters…the cow!

The author, Richard Ware, graduated with a doctorate in ruminant nutrition from UABC in Mexico. After working as a technical support consultant to feed additive companies in the Beef industry, Dr. Ware joined an independent dairy consulting firm, Central Valley Nutritional Associates, LLC (CVNA). During that time, CVNA began applying amino acid balancing to dairy rations throughout central and southern California. In a joint effort with Dr. Charles Schwab at UNH, CVNA developed an amino acid calculator/optimizer that extends the capabilities and amino acid requirements for lactating dairy cattle in the NRC 2001 dairy model. Dr. Ware joined Vi-COR in December 2011 as the Beef Division Manager, and focuses on bringing research and product solutions to meet the challenges of the animal production industry. He and his wife have four children and currently reside in central California.