

# Managing variability for MBM discussed

**T**HE second annual roundtable on the use of digestible amino acid value in feed formulation was held in May 2005 prior to the Multistate Poultry Nutrition conference.

This roundtable meeting was organized and chaired by Dr. Todd Applegate of Purdue University. The objective of the roundtable was to provide a forum for discussing the of the current status of digestible amino acid values for feed ingredients and the use of digestible amino acid values in commercial feed formulations.

Formal presentations were made by: P. Dorr of Pilgrim's Pride, Field Perspectives on Corn/Soybean Meal Nutrient Variability; D. Kirstein of National By-Products LLC, Supplier's Perspective on Meat & Bone Meal Quality & Variability; C. Parsons of the University of Illinois, Variability in Amino Acid Digestibility Among Ingredients; G. Engleke of Cargill Animal Nutrition, Field Perspectives on How to Practically Manage Ingredient & Digestibility Variability, and M. Lilburn of The Ohio State University, Formulation Opportunities on a Digestible Amino Acid Basis.

## MBM quality, variability

D. Kirstein's discussion on meat and bone meal (MBM) quality and variability reported that about 2.5 million tons of MBM are used in animal feeds in the U.S. each year. Historically, the large domestic users of MBM have been poultry (1.1 million tons, 43%) and pet foods (593,000 tons, about 23%). Approximately 500,000 tons were exported each year.

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## Bottom Line

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When bovine spongiform encephalopathy was discovered in the U.S. in late 2003, exports dropped precipitously to about 140,000 tons in 2004. With the aid of a temporary price adjustment, the poultry and particularly the swine industries quickly absorbed the additional MBM tonnage that became available. The use of MBM in animal feeds is typically the result of coordination between the nutritionist and the buyer.

The nutritionist wants to use a product that contains the level of nutrients that are most important and a product that is always the same, or at least low in variability. The buyer is most concerned about price and service.

In order to evaluate variability, National By-Products conducted a survey of 11 of its plants in 2003. One hundred seventy-four samples (16 samples per plant) were collected and analyzed for crude protein and other nutrients. The average protein level was calculated for each of the 11 plants.

MBM is frequently referred to as a 50% crude protein product. The actual average protein content analyzed varied from a low of 43.6% 12 *Feedstuffs*, June 5, 2006 Bottom Line of Nutrition: Poultry Managing variability to a high of 61.8%. Only one of the plants actually produced a product that was 50% crude protein (50.3%).

The coefficient of variation (CV) was 11.2% for the 174 samples. However, when analyzed as individual plants, CV ranged from 2.8 to 5.0%. The point is that while CV is relatively high when calculated for all samples across all plants, CV for individual plants is much lower.

Each MBM plant has a unique set of raw materials it receives from the local area. The raw materials a plant

receives tend to be relatively uniform from week to week. Comparisons among plants may indicate that MBM is highly variable, while product from individual plants will be relatively consistent. In the 11-plant survey, no significant seasonal components were noted.

Kirstein pointed out that an important strategy for managing the variability of MBM is to use sampling and analysis to identify individual MBM plants that produce product that contains the level of nutrients (i.e., protein) you want. Then, purchase MBM from those selected plants.

## Blending

An even more advanced approach to managing variation is the use of MBM products that have been blended to a target nutrient — but at a cost. These are not “analog” products that may contain other feed ingredients that are not MBM. Blending material from several MBM plants to achieve a targeted nutrient content produces blended MBM. The target nutrient may be protein, individual amino acids and phosphorous or other nutrients.

National By-Products conducted a study where it compared the protein level CV for selected MBM plants and MBMs that were formulated based on a protein target.

The CV for MBM from five plants, selected because the plants produced similar protein levels, was 4.3%. Blended product produced by formulating to a target protein level based on analysis resulted in a CV of about 2.0%, about half the CV observed for the selected plant material. The CV for the blended product compared favorably with the results of other studies that observed CVs of 1.7 and 1.6% for the protein content of soybean meal.

Targeting amino acids can also be effective in reducing the variation associated with amino acid content. When protein level was the formulation target, CVs were 2.0, 7.5 and 7.4%, respectively, for protein, lysine and methionine. When lysine

was the targeted nutrient, CVs were 1.4, 1.1 and 1.9%, respectively, for protein, lysine and methionine content.

For comparison, CVs were 4.3, 9.3 and 10.7% for protein, lysine and methionine among the selected MGM products and 11.2, 17.5 and 18.64% for protein, lysine and methionine, respectively, for all MBM products tested.

These results show that blending MBM to a targeted nutrient can dramatically reduce variation. The blending process requires more equipment and more handling and, therefore, comes at a cost. There must be a value associated with this decrease in variation, and the customer must be willing to pay the additional cost of the more uniform product.

If the nutritionist discounts the nutritional value of a product based on the observed variation in the product's nutrient level, there is a clear value to reducing the nutrient variation.

Kirstein formulated a series of six broiler starter diets. The price of all feed ingredients remained the same in all six diets. The cost of 48% soybean meal was set at \$204 per ton. When MBM was not offered (a corn/soy diet), the cost of the diet was \$138.30 per ton. When MBM was offered to the diet at \$210 per ton with no reduction in nutrient content associated with variation, the computer selected 8.7% of the MBM, and the diet cost was \$135.61 per ton, a reduction of \$2.69 per ton.

The importance of nutrient variation was illustrated in four diets, where the nutrient content of the MBM was reduced by one-half of the standard deviation (SD) associated with the nutrient content of the MBM. When the computer was offered an MBM formulated based on a lysine target (lysine SD = 0.03), 8.3% MBM was selected with a resulting diet cost of \$135.76 per ton, a reduction of \$2.54 per ton from the corn/soy diet.

When the computer was offered an MBM formulated based on a protein target (lysine SD = 0.25), it selected 5.0% at a diet cost of \$136.14 per ton, a reduction of \$2.16 per ton from the corn/soy diet.

For the diet formulated using MBM from the five selected rendering plants (lysine SD = 0.28), the computer selected 5.0% MBM at a diet cost of \$136.17 per ton, a

reduction of \$2.13 per ton from the corn/soy diet.

Finally, when the computer was offered MBM based on all 11 MBM plants (lysine SD = 0.49), the inclusion level was 5.0% with a diet cost of \$136.35 per ton — a reduction in cost of only \$1.95 per ton compared with the corn/soy diet.

The additional savings associated with the MBM blended to a lysine target was 59 cents per ton of diet (2.54 - 1.95 = 0.59). This is equivalent to nearly \$12 per ton of additional value for the blended MBM when the nutrient values are reduced based on the SD associated with the nutrients.

It probably is not practical to routinely analyze MBM for amino acid content by classical methods. A good, quick method of analysis is critical for the benefit of both the blender and the nutritionist.

Kirstein said amino acid levels can be predicted based on regression analysis of protein and ash content. Studies to evaluate the use of nearinfrared

spectrometry to predict amino acid levels and amino acid digestibility are underway. In vitro assays to predict amino acid digestibility may be important.

Two strategies effective in reducing the nutrient variation of MBM are (1) selecting MBM plants that produce similar products and (2) purchasing MBM that has been blended to a nutrient target.

Kirstein stressed that nutritionists should use the diet formulation process to compare MBM sources that have different levels of nutrient variation. Compare diet costs and shadow prices to establish the relative value of MBM that has differing levels of nutrient variability. Work closely with the purchasing department so it will appreciate the economic benefit of reducing nutrient variation. There is a cost associated with reducing variation, and that cost must have a value.

### The Bottom Line

The nutrient variation of MBM can be significantly reduced by selecting MBM plants that produce the kind of product you want and by purchasing MBM that has been blended to a nutrient target.

### Holo-analysis

Dr. G. Rosen was invited to prepare a

paper for the Poultry Science journal reviewing methods of analysis of research results and comparing the relative merits of meta-analysis and holo-analysis (Poultry Science 85:957-959).

"Meta-analysis is a vague descriptor used to encompass very diverse methods of data collection analysis, ranging from simple averages to more complex statistical methods. Holo-analysis is a fully comprehensive statistical analysis of all available data and all available variables in a specified topic, with results expressed in a holistic factual empirical model," Rosen wrote.

"The objectives and applications of holo-analysis include software production for prediction of responses with confidence limits, translation of research conditions to praxis (field) circumstances, exposure of key missing variables, discovery of theoretically unpredictable variables and interactions and planning future research.

"Holo-analyses are cited as examples of the effects on broiler feed intake and live weight gain of exogenous phytases, which account for 70% of variation in responses in terms of 20 highly significant chronological, dietary, environmental, genetic, management and nutrient variables. Even better future accountability of variation will be facilitated if and when authors of papers routinely provide key data for currently neglected variables, such as temperatures, complete feed formulations and mortalities," Rosen wrote.

Clearly, holo-analysis can be extremely valuable to elucidate new and additional information and responses when a sufficiently large body of related research is available. All researchers should take care to include more detail about "currently neglected variables" in their research reports. In some papers, it is virtually impossible to detect exactly what was done or exactly what was measured. More careful peer review (read: junior author review) would be a great help.

### The Bottom Line

This paper is interesting and provocative — required reading for researchers.