FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

FRED D. BISPLINGHOFF, D.V.M.
Director Technical Services

7150 ESTERO BLVD. • APT. 906
FT. MYERS BEACH, FL 33931
AREA CODE 813 — 463-4744

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CONSIDERATIONS FOR THE USE OF ANIMAL BY-PRODUCTS IN POULTRY DIETS

Dr. Mike S. Duncan

Holly Farms Foods, Inc.

Because of the high nutrient density requirements of poultry diets, animal by-products have historically found a place in these feeds. Quality, stabilized animal fats are routinely used to achieve metabolizable energy levels in excess of 1425 kcal/lb. Meat meals often complete with soybean meal in supplying protein and amino acids. Meat meals high in bone content compete with inorganic phosphorus sources.

Although animal by-products always seem to find a place in the feed industry, there is far from a universal love affair between nutritionists and these feed ingredients. Many nutritionists, when faced with the nutrient variability of products such as Meat and Bone Meal (MBM) quickly become disenchanted with the utility of these products.

MBM is being singled out here since it has achieved the notorious reputation of being almost to variable to be considered a quality feed ingredient. The majority of its' bad press has stemmed from the lack of available knowledge on what the nutrient content of MBM really is and how to handle the variability. However, this picture is changing since more reliable information is becoming available concerning the relative nutrient bio-availabilities of feed ingredients. It is now evident that MBM can be treated like any other feed ingredient. When evaluating any feed ingredient as a potential nutrient source, nutritionists must keep certain considerations in mind. They are:

1. Nutrient content.
2. Nutrient availability.
3. Nutrient variability.
4. Production and handling characteristics.

The common use of linear programming methods on high speed computers has greatly simplified the computational tasks of the nutritionist. Not only are diets formulated to exacting nutrient content; they are formulated to the least ingredient cost. But, the least cost diets produced will not be nutritionally least cost unless the nutrient profiles of the selected ingredients are accurate.

Unless one is prepared to conduct extensive nutrient analysis of feed ingredients used, some means of estimating nutrient content is needed in order to maintain some degree of accuracy of ingredient profiles. Sufficient information is becoming available to allow one to reasonably estimate totel nutrient content of common feed ingredients from proximate analysis data. But, formulation using total nutrient contents of feed ingredients presents another problem.

That problem lies in the free substitution of ingredients within a formulation to arrive at the least cost. For example, the lease cost optimization process will indiscriminately substitute a gram of lysine from feather meal for a gram of lysine from soybean meal if doing so will result in a lesser diet cost. Since the bioavailability of lysine in feather meal and soybean meal are approximately 62% and 90% respectively, this type of free substitution might result in a lesser diet cost; but, the diet performance would surely suffer. To avoid this pitfall, the nutritionist must either 1) limit the ingredients in a formula to those of similar nutrient content, or 2) formulate using available rather than total nutrient values.

The first approach severely restricts the nutritionist in the selection of alternative feed ingredients. The second is almost as restrictive in that we are sorely in need of reliable bioavailability data. However, that deficiency may shortly be alleviated. There is currently considerable activity to better define the relative availabilities of a wider range of feed ingredients. In anticipation of that day, Table 1 presents the nutrient profiles that might be used in a simple diet formulation to evaluate MBM as an alternative feed ingredient.

In the simple diet formulation, no restriction was placed on the usage of MBM. At its' quoted price, MBM achieved a level of 7.2% of the diet. The effect of this inclusion rate on the expected nutrient variation of the diet is given in Table 2. MBM completely replaced deflourinated phosphate (DFP) as a source of dietary phosphorus which resulted in MBM supplying 73.5% of the total available phosphorus. Of concern would be that MBM also contributed 98.3% of the expected dietary phosphorus variability. It is interesting to note that although MBM has the reputation of being a highly variable feed ingredient, at normal usage rates it would have less affect on dietary amino acid variation than would corn.

The phosphorus variability created by the high contribution rate of MBM would probably create problems in a normal diet. This can easily be alleviated by limiting the inclusion level of MBM. Or, one could add a safety margin to the formulation specification for available phosphorus. Both assigning arbitrary usage limits and adding safety margins will increase diet cost, all of which must be borne by the feed manufacturer. A more desirable alternative would be to devalue the phosphorus content of MBM by an amount that would offset its' variability. The nutrient devaluation would also reduce the value of MBM in relation to other available ingredients. In this case, the MBM supplier would share the cost of the variability.

An additional consideration for any feed ingredient is its' affect on feed production efficiency. Table 3 gives the results of a pelleting efficiency evaluation of feeds containing increasing amounts of MBM. As MBM content of feed increases, there is a proportional decrease in pelleting efficiency. There is evidence to indicate that this effect is due more to decreasing levels of DFP than to MBM level. When the inclusion of MBM in a formula is at a level that would be expected to reduce pelleting efficiency, the cost savings due to MBM usage must be compared to the increased pelleting costs in order to determine the best cost formula.

After all the ramifications of usage of any feed ingredient have been taken into consideration and all the nutrient adjustments are made, if the ingredient is still priced competitively with other available feed ingredients than it should be considered a viable candidate for inclusion in poultry diets.

Table 1. Nutrient parameters for ingredients in simple diet formulation.

	Corn	SBM	MBM	DFP	AF
Price, $/ton	110	249	273	235	245
Metab. Energy, kcal/lb					
Average	1527	1085	1150		3480
STD	18	29	110		30
Crude Protein, %					
Average	8.6	48.4	49.3		
STD	.76	1.61	3.20		
Avail. Lysine, %					
Average	.25	2.86	2.09		
STD	.04	.12	.29		
Avail. TSAA, %					
Average	.38	1.27	1.00		
STD	.04	.05	.18		
Avail. Phosphorus, %					
Average	.09	.21	4.08	12.6	
STD	.01	.02	.85	.13	

SBM - Soybean Meal; MBM - Meat & Bone Meal; DFP - Deflour. Phosphate AF - Animal Fat; STD - Standard Deviation; TSAA - Total Sulfur Amino Acids

Table 2. Dietary nutrient variation analysis.

Contribution to Diet	Corn	SBM	MBM	AF	Diet STD
Metab. Energy					15.99
% of total	73.18	15.48	5.72	5.62	
% of variation	61.17	14.08	24.57	0.19	
Crude Protein					
% of total	30.34	50.83	18.03		
% of variation	62.95	25.04	12.00		
Avail. Lysine					
% of total	18.29	62.29	15.85		
% of variation	42.32	33.76	23.92		
Avail. TSAA					
% of total	33.01	32.85	9.01		
% of variation	73.73	10.21	16.06		
Avail. Phosphorus					0.06
% of total	15.64	10.86	73.50		
% of variation	1.26	0.45	98.29		

Table 3. Effect of Meat and Bone meal on pelleting efficiency.

MBM, lbs/ton	DFP, lbs/ton	RPE, %
0	31.6	100
26	24.8	99
50	18.0	92
76	11.6	74
118	-	70

RPE - Relative Pelleting Efficiency