MODELS TO ESTIMATE LYSINE, METHIONINE + CYSTINE AND THREONINE REQUIREMENTS IN POULTRY AND PULLETS

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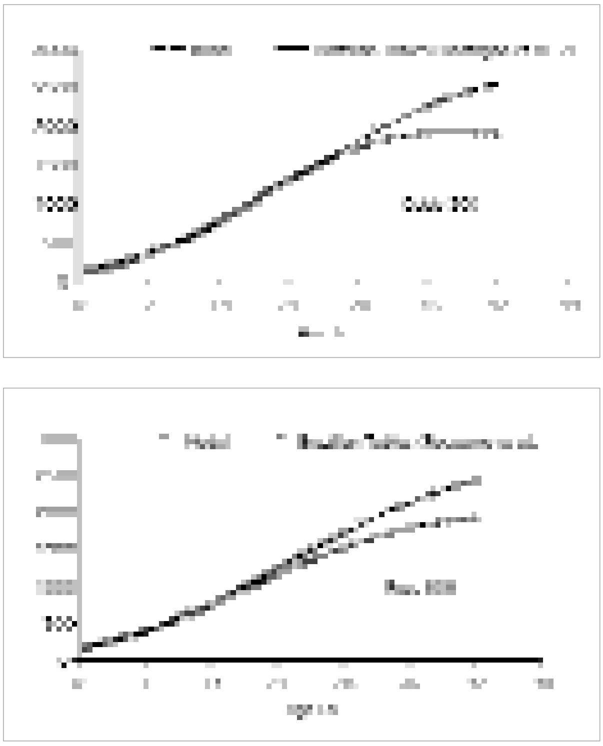

Figure 1. Lysine requirements estimated by the model elaborated in this study as compared to those of Brazilian Tables (Siqueira, J.C. et al.*, unpublished)*

It is essential to supply diets with adequate nutritional requirements in order to allow poultry to express their genetic potential. Amino acids are particularly important as they are closely related to body protein synthesis and accretion. The main methods applied to study nutritional requirements are dose-response and factorial approaches. Dose-response is the most commonly used method and it is based on animal performance response to increasing dietary levels of a limiting amino acid. Nutritional requirement tables, such as the *Nutrient Requirements of Poultry* (1994) and the Brazilian Tables for Poultry and Swine (2000, 2005) are built on the results of such dose-response studies. However, genetics, nutrition, and environment may influence poultry nutritional requirements. The factorial approach is based on the principle that birds require amino acids for the maintenance of vital processes, growth, and/ egg production, fractioning total requirements into ratios for each of these purposes. In order to take into account weight and body composition differences, the factorial method allows building models to predict the nutritional requirements of poultry of different genetic lines and ages raised under various conditions. The models to estimate amino acid requirements provide economically feasible nutritional programs, as well as preventing excessive dietary amino acid supply and environmental pollution. Building these models requires knowledge on amino acid maintenance requirements and efficiencies of utilization. However, methodological variations have led to inconsistencies in their determination. The main objective of the present project is to elaborate prediction models of the amino acid requirements for broilers and layers based on the factorial method. Specific objectives include: (a) standardization of the method to determine amino acid maintenance requirements, (b) to compare poultry response to two diet formulation methods (graded amino acid supplementation and diet dilution), (c) to determine amino acid maintenance requirements, and (d) to determine amino acid utilization efficiencies in broilers and layers.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

In order to standardize the experimental method and to estimate lysine maintenance requirements, metabolism trials were carried out with roosters from different genetic lines (Leghorn, ISA Label e Cobb 500) using nitrogen balance technique. Lysine maintenance requirements obtained were 44.9, 44.4, and 47.1g/kg$^{0.75}$/day for Leghorn, ISA Label, and Cobb, respectively. Considering the three trials, Lys maintenance requirement was estimated 45.1mg/kg$^{0.75}$/day or 151.2mg/$BP_m^{-0.27}$ independently from genetic line. To compare diet formulation methods and to estimate the efficiency of lysine utilization, 4 trials were carried out with broilers in different phases (1 to 8, 8 to 22, 22 to 35, and 35 to 42 days). The results show that the efficiency of lysine utilization is not influenced by diet formulation method, and that it is estimated in 76.9%. Lysine requirement prediction model for broilers was elaborated based on these results and partitioning the requirements for maintenance and growth of body feather-free and feathers, described as:

$$Lys = [(151.2BP_m^{-0.27} * BP_t) + (0.01 * FP_t * 18)] + [(75 * BPD/0.769) + (18 * FPD/0.769)]$$

Lys=digestible lysine requirement (mg/day), BP_m=body protein weight at maturity (kg), BP_t= body protein weight at time (kg), FP_t= protein feather weight at time (g), BPD=body protein deposition (g/day), FPD = protein deposition in feathers (g/day). The lysine content in feather-free body and feathers were considered to be 75 and 18 mg/g, respectively. The lysine requirements for growth of feather-free body and feathers were estimated considering the same k_{Lys} (76.9%).

The *Figure 1* shows lysine requirements estimated by the model as compared to those of Brazilian Tables for Poultry and Swine (2005), for two broiler strains. The proposed model estimated lower requirements than those of Brazilian Tables, after 27 days (*Figure 1*). Considering that during the starter phase, broilers require more amino acids for growth, and that body protein to fat ratio is reduced as bird ages, this model is able to predict requirements as a function of physiological development.

The theory applied to elaborate this model is based on protein growth potential of the body feather-free and feather. Genetic selection of broiler strains has enabled to increase protein deposition, resulting in precocious birds. Therefore, it is expected that the daily protein depositions decline early. In this sense, the proposed model was able to detect these changes accurately compared to Brazilian Tables model.

In addition, in broiler production, approximately 75% of the total feed is consumed after 21 days of age, increasing feeding costs. As the grower-finisher lysine levels estimated by the model were lower than those recommended by the Brazilian Tables, the developed model may contribute to adjust nutritional standards for broilers, thereby promoting poultry production profitability and sustainability.

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