

## Metabolism and Nutrition: Nutrition II

**397 Determination of nutritional profile and metabolizable energy value of *Tenebrio molitor* meal for broiler chickens.** Marcos Nascimento Filho\*, Raquel Pereira, Alvaro Burin Junior, Ana Beatriz Oliveira, Diana Suckeveris, Caio Alexandre Paes Soares, and José Fernando Machado Menten, *University of São Paulo, Piracicaba, São Paulo, Brazil.*

Determination of the nutrient composition and metabolizable energy of new ingredients are essential for their use in feed formulation. Insects are considered promising sources of animal origin ingredients for poultry diets. The objectives of this study were to determine the nutrient composition and the apparent metabolizable energy corrected for nitrogen (AMEn) of tenebrio (*Tenebrio molitor*) meal (TM) for broiler chickens. Forty-eight 21-d-old male broilers of commercial strain were weighted and placed over 12 metabolic cages (0.70 × 0.66 m) equipped with one galvanized trough feeder at the front and a linear drinker at the back in a completely randomized design. Each treatment was composed of 6 replicates (cages) of 4 birds assigned into 2 assay diets: a control diet, based on corn and soybean meal to meet nutritional requirements, and an experimental diet subsequently formulated by replacing 300g/kg (wt/wt) of the control diet with TM. The adaptation period lasted 7 d. Feed and water were available *ad libitum*. Total excreta samples were collected from d 28 to d 32, twice a day (morning and afternoon) on metal trays covered with plastic material, weighted and stored at -20°C for further analysis. Feed intake was measured per cage and 1% ferric oxide was added to the diets on the first and last day of the collection to identify precisely excreta from the test period. TM was analyzed for dry matter (DM), crude protein (CP), gross energy (GE), ether extract (EE), crude fiber (CF), calcium, phosphorus, and fatty acids. Samples of the diets, and excreta were analyzed for DM, nitrogen (N), and GE. The apparent total-tract digestibility coefficient (ATTDC) of nutrients and AMEn were calculated based on the analytical results. TM used in this study contains 50.0% CP, 6,366 kcal/kg GE, 29.7% EE, 3.8% CF, 0.07% calcium, and 0.54% phosphorus, as fed basis. Regarding fatty acids profile, TM is a rich source of oleic 45.4%, linoleic 26.2%, and palmitic acid 15.4%, showing also good content of stearic 2.3%, palmitoleic 1.9%, and linolenic acid 1.1%. The ATTDC of DM, N, and GE of TM were 70.2%, 37.3%, 79.6%, respectively. Calculated AMEn was 5,004 kcal/kg DM, indicating that TM has higher metabolizable energy value compared with common animal and vegetable food origin sources as other insect larvae meals already published in literature. The values of nutritional composition and AMEn of TM determined in this study might be applied as a guide for poultry feed formulation using this ingredient. Acknowledgment: FAPESP for the research grant (No 2017/05423-8) and MS scholarship (No 2017/19751-7).

**Key Words:** insect meal, *Tenebrio molitor*, metabolizability, energy, broilers

**398 Effect of pre-peak feeding strategy on performance, egg quality, and tibiae mineralization of brown-egg laying hens from 27 to 62 week of age.** J. García<sup>1,2</sup>, Lewis Aguirre<sup>1</sup>, G. Fondévila<sup>1</sup>, R. Scappaticcio<sup>2</sup>, N. L. Corrales<sup>1</sup>, and Gonzalo Mateos<sup>\*1</sup>, <sup>1</sup>UPM, Madrid, Madrid, Spain, <sup>2</sup>Camar Agroalimentaria S.L., Toledo, Spain.

We studied the influence of the nutritive value (AMEn, SID Lys, and Ca) of diets fed to pullets from 15 to 26 wk of age, on productive performance, egg quality, and tibia mineral content of brown egg-laying hens from 27 to 62 wk of age. Five feeding strategies were used. Three

of them differed in the nutrient content of the diet fed from 15 to 18 wk of age: A) a pullet diet (2,700 kcal AMEn/kg, 0.61% SID Lys, and 1.0% Ca), B) a pre-lay diet (2,750 kcal AMEn/kg, 0.78% SID Lys, and 2.5% Ca), and C) a layer diet (2,750 kcal AMEn/kg, 0.78% SID Lys, and 3.8% Ca), respectively. The other 2 feed strategies (D and E) consisted in feeding the hens from 15 to 26 wk of age a diet low in energy (2,615 kcal AMEn/kg) and high in SID Lys (0.82%) diet with a medium or a high level of Ca (2.5 vs. 3.8%, respectively). After 18 wk (diets A, B, and C) or 27 wk (diets D and E) of age all the hens received the C layer diet to 62 wk of age. Each treatment was replicated 18 times and the experimental unit was an enriched cage with 10 hens for all traits. The experiment lasted for 12 periods of 4 wk each. Hen performance (egg production, egg mass, FCR, BW gain, and mortality) was controlled by replicate by period and cumulatively. Percentage of shell-less, broken, and dirty eggs were determined in all eggs produced. Egg quality, including Haugh units, shell thickness, shell strength, and shell weights in absolute (g) and in relative (%) terms, were determined by replicate in 8 eggs chosen at random for the last 2 d of each of the 12 periods. At 62 wk of age, one hen from 8 of the replicates per treatment was selected at random and sacrificed. The ash, Ca, and P content of these tibiae were determined. Data were analyzed as a completely randomized design with feeding strategy as main effect using the MIXED procedure of SAS. The Tukey test was used to make pairwise comparisons to separate treatment means. Feeding strategy did not affect any of the productive performance traits studied, except egg weight that tended ( $P = 0.079$ ) to be greater in hens that were fed the high energy diets during the pre-peak period. Cumulatively, all shell quality variables studied were better ( $P < 0.05$ ) in hens fed the 3.8% Ca diets during the experimental period than in hens fed 2.5% Ca or less, but Haugh units were not affected. At 62 wk of age the pre-peak feeding strategy did not affect the ash, Ca, or P content of the tibia. In summary, the use of a layer diet with 3.8% Ca from 15 wk of age onward, might improve shell quality traits during the entire egg cycle, without showing any negative effect on egg production.

**Key Words:** calcium level, external egg quality, laying hens, pre-peak feeding

**399 Effects of the source and level of digestible phosphorus in the diet on performance and egg quality of brown laying hens from 64 to 76 weeks of age.** P. Hernández<sup>1</sup>, A. F. de Juan<sup>1</sup>, G. Fondévila<sup>\*1</sup>, J. Ben Mabrouk<sup>1</sup>, J. García<sup>2</sup>, R. Scappaticcio<sup>2</sup>, and Gonzalo Mateos<sup>1</sup>, <sup>1</sup>UPM, Madrid, Madrid, Spain, <sup>2</sup>Camar Agroalimentaria S.L., Toledo, Spain.

We studied the influence of the source and level of digestible phosphorus (dP) in the diet on performance and egg quality traits of brown hens from 64 to 76 wk of age. The diets were based on corn and soybean meal and all contained 4.0% Ca. The design was completely randomized with 8 treatments arranged as a 2x4 factorial with 2 sources of P [monocalcium phosphate (MCP) and calcined bone phosphate (CBP)] and 4 levels of dP (0.27, 0.31, 0.35, and 0.39%) as main effects. Each treatment was replicated 14 times and the experimental unit was an enriched cage with 6 hens. The experiment lasted for 12 wk (3 periods of 4 wk each). Egg production and hen mortality were recorded daily. Feed intake (FI) and BW of the hens were determined by period and cumulatively. Egg weight was estimated by period by weighing all the eggs produced the last day of each week on trial. From these data, ADFI, egg mass, feed conversion ratio (FCR), and BW gain (BWG) were calculated by period