204 Additivity of amino acid digestibility in corn and soybean meal for broiler chickens and White Pekin ducks. C. Kong* and O. Adeola, Purdue University, West Lafayette, IN.

A total of 256 broiler chickens and 208 White Pekin ducks were used in a 5-d trial to test additivity of the apparent and standardized ileal digestibility (AID, SID) of AA in corn and SBM. A nitrogen free diet was used for standardization of apparent digestibility. Two diets contained corn or SBM as the sole source of CP and AA. Another diet was prepared by mixing corn and SBM. Chromic oxide was included as an indigestible marker. The calculated CP levels were 0, 79, 200 or 200 g/kg for NFD, corn-, SBM-based diet, or mixed diet, respectively. Birds received a standard starter diet from d 1 to 21 and thereafter the 4 experimental diets for 5 d in a randomized complete block design. On d 26, birds were asphyxiated with CO2, digesta from the distal section of ileum was collected. To test additivity of digestibility values, the difference between measured values in mixed diet and predicted values calculated with measured values in individual ingredients was examined. The estimated basal endogenous losses of N and AA were higher in ducks compared with broilers (P < 0.05). The estimated basal endogenous losses of indispensable AA for broilers ranged from 87 (Trp) to 582 (Thr) mg/kg DMI. Corresponding range for ducks was from 278 (Trp) to 2350 (Leu) mg/kg DMI. Regardless of species, the calculated proportion of basal endogenous losses of CP and AA in calculating SID was higher (P < 0.01) in corn than in that in SBM. The measured AID of His, Leu, Lys, Met, Phe, Glu, Pro, and Tyr in mixed diets for broilers were higher than predicted values (P < 0.05) whereas measured and predicted SID did not differ except for Cys. For ducks, the differences between the measured and predicted AID were significant (P < 0.05) for CP and all AA except for 8 AA (Arg, Ile, Thr, Val, Asp, Gly, Pro, and Tyr). Similar to the result from broiler study, there was no difference between the predicted and measured SID of CP and all AA except for Cys. The results showed that AID of some AA for corn and SBM were not additive in the mixed diet but SID values were additive irrespective of the ingredients and species used.

Key Words: amino acid, additivity, broiler chicken, duck, ileal amino acid digestibility


Various amino acid recommendations exist for formulating broiler diets. The innovative approach, proposed by Geraert et al. (2002) who developed factorial models predicting amino acid requirements (g/d) according to weight gain (in g/d) for growing animals, was used to update the amino acid recommendations for broilers optimized on weight gain, FCR or breast meat yield of the Rhodimet Nutrition Guide (RNG). The aim of this study was to compare the performance of broilers and the economical return when diets were formulated to meet the digestible amino acid recommendations either from Ross 308 breeder (2012) or from the new RNG (2013) optimized on FCR. A total of 256 male Ross 308 birds were allocated in a randomized complete block design to 2 treatments with 8 replicates of 16 birds each. The experimental diets were formulated using corn and soybean meal to contain 22.0% CP, 3025 kcal ME/kg, 1.27% or 1.15% digestible Lys, 0.94% or 0.96% digestible TSAA and 0.83% or 0.75% digestible Thr for the pre-starter phase (0 to 12 d of age), 20.0% CP, 3150 kcal ME/kg, 1.10% or 1.16% digestible Lys, 0.84% or 0.90% digestible TSAA and 0.73% or 0.72% digestible Thr for the starter phase (12 to 22 d of age), 18.0% CP, 3200 kcal ME/kg, 0.97% or 0.98% digestible Lys, 0.76% or 0.75% digestible TSAA and 0.65% or 0.61% digestible Thr for the grower phase (22 to 35 d of age) and 17.0% CP, 3200 kcal ME/kg, 0.97% or 0.83% digestible Lys, 0.76% or 0.63% digestible TSAA and 0.65% or 0.58% digestible Thr for the finisher phase (35 to 42 d of age). Experimental data were analyzed by ANOVA and Tukey test was applied when necessary. Final body weight, body weight gain, feed intake and FCR were not affected by treatments over the entire 42 d period. Feed cost per gain was not significantly affected by treatments; however, formulating broiler diets based on the amino acid recommendations of the RNG (2013) allowed a decrease in feed cost per gain of 1.9% over the entire 42 d period. Formulating diets based on the amino acid recommendations of the RNG (2013) can be of an economic interest.

Key Words: amino acid, broiler, requirement, growth, economy


The objective of this experiment was to determine the effects of DL-met (DLM) and 2-hydroxy-4-(methylthio) butanoic acid (HMTBA) on muscle protein synthesis and flesh texture in broiler chickens. One hundred and five male Ross broiler chickens (1 d, 49 g) were randomly divided into 7 groups (15 birds per group), with 3 replicate pens per treatment and 5 birds per pen. All broilers were offered the same basal diet with added DLM and HMTBA at levels of 0 (control group), 0.1% and 0.3% (starter phase, 0–21 d), 0.08% and 0.24% (finishing phases, 21–46 d). All broiler chickens had free access to feed and drinking water throughout the 46-d test. Results: As compared with the control and DLM groups, leg weight and leg muscle rate were significantly higher in 0.08% HMTBA group and 0.24% HMTBA group (P < 0.05). The measured AID of His, Leu, Lys, Met, Phe, Glu, Pro, and Tyr in mixed diets for broilers were higher than predicted values (P < 0.05) whereas measured and predicted SID did not differ except for Cys. For ducks, the differences between the measured and predicted AID were significant (P < 0.05) for CP and all AA except for 8 AA (Arg, Ile, Thr, Val, Asp, Gly, Pro, and Tyr). Similar to the result from broiler study, there was no difference between the predicted and measured SID of CP and all AA except for Cys. The results showed that AID of some AA for corn and SBM were not additive in the mixed diet but SID values were additive irrespective of the ingredients and species used.

Key Words: amino acid, additivity, broiler chicken, duck, ileal amino acid digestibility
The effects of dietary amino acid (AA) density and metabolizable energy (AME) responses on summer-reared Cobb × Cobb 700 broilers (CCB-700) were evaluated. The CCB-700 chicks were fed diets with low or high AA density in combination with a low or high AME through a starter (0 to 14 d, in crumbles), grower (14 to 28 d, in pellets), finisher (28 to 35 d, in pellets), and withdrawal (35 to 54 d, in pellets) phase program. The CCB-500 birds were fed a low AA density diet that had either a low or high AME level, and served as a reference. Feed ingredients were analyzed for AA concentration to formulate the experimental diets. A randomized complete block design (6 treatments × 14 replicate pens × 14 chicks/replicate) was used in the current study.

Live performance, carcass traits, meat yield, and feed cost efficiency were evaluated. Mortality was not affected by treatment, however, as compared with birds fed other diets, feeding CCB-700 a low AME and high AA density diet decreased feed intake and BW on d 35, 42, and 54 (P < 0.0001), and decreased carcass (P = 0.02), breast (P = 0.01), wing (P = 0.02), front half (P = 0.01), and back half (P = 0.04) weights on d 55. The higher AME increased feed intake and BW on d 42 (P = 0.009, P = 0.0002) and 54 (P < 0.0001, P = 0.0001), and improved FCR on d 42 (P = 0.0006), and the higher AA decreased feed intake and BW on d 42 (P = 0.0008, P = 0.0009) and 54 (P < 0.0001, P = 0.0005). At 55 d of age, carcass weight and wing yield were observed to be higher in CCB-700 than CCB-500 when high AME and low AA diets were fed (P < 0.0001). In addition, carcass (P = 0.04), breast (P = 0.004), and front half yields (P = 0.02) were higher in CCB-700 than in CCB-500 when low AME and low AA diets were fed. In conclusion, without affecting feed costs, broiler performance and carcass yield was affected by diet in both strains. More specifically, a higher AME diet increased the yield of all cut-up parts, whereas a higher AA density decreased the yield of most parts in summer-reared CCB-700 chicks.

Key Words: amino acid, broiler, metabolizable energy, growth performance, meat yield


The effects of amino acid (AA) supplementation on growth performance and immunity of broilers during an acute coccidiosis challenge were evaluated. Ross 308 male broiler chicks (420 total) were housed in battery cages (10 chicks/cage) from d 1 to 28 post-hatch. Chicks were provided 1 of 3 dietary treatments that included: 1) a corn-soybean meal basal diet fed from d 1 to 28 d post-hatch (CON), 2) the basal diet plus Ser, Tyr, Trp, and Phe supplemented to 150% of NRC (1994) recommendations from d 1 to 28 d post-hatch (AA1–28), or 3) the CON basal diet fed d 2 to d 6 post-hatch and the AA-supplemented diet from d 7 to 28 d post-hatch (AA7–28). At 7 d post-hatch, chicks were inoculated with 0.5 mL sterile water (sham control) or 1 × 10⁸ sporulated *E. acervulina* oocysts. There were 7 replicate cages for each of the 6 experimental treatments (3 dietary treatments × 2 infection treatments). Chick weights and feed intake were recorded weekly and at d 10 post-hatch. Blood was collected from 2 birds per pen at 10, 14, and 28 d post-hatch to evaluate immune cell profiles and plasma α-1-acid glycoprotein (AGP) concentrations. *Eimeria acervulina* inoculation decreased (P < 0.01) growth performance of birds from 7 to 21 d post-hatch. By 21 d post-hatch, average daily gain of infected birds fed AA1–28 or AA7–28 was similar (P > 0.05) to uninfected birds. In infected birds, feeding AA1–28 and AA7–28 increased (P < 0.01) final body weights 23 and 17%, respectively, over birds fed CON. At 14 d post-hatch, both infection and AA supplementation increased (P < 0.05) the percentage of CD4⁺ cells, and the macrophage/monocyte ratio was increased (P < 0.05) in birds fed AA1–28 regardless of infection status. Plasma AGP concentrations varied inconsistently among treatments and time periods. These results indicate that dietary concentrations of Ser, Tyr, Trp, and Phe fed above requirements for growth may enhance the capacity for compensatory gain in broilers recovering from an acute coccidiosis challenge.

Key Words: coccidiosis, amino acid, immunity, growth, broiler

209 Digestible total sulfur amino acid to lysine ratio of male broilers from forty-two to fifty-six days of age. W. A. Dozier III*, and Y. Mercier1, 1Auburn University, Auburn, AL, 2Adisseo France S.A.S., Commeny, France.

Published research on the TSAA to Lys ratio for modern broilers marketed at BW exceeding 3.0 kg is limited. An experiment was conducted to determine digestible (dig) TSAA to Lys ratio of male Ross × Ross 708 broilers from 42 to 56 d. A total of 3,150 male broilers was randomly distributed into 126 floor pens at 1 d of age and were fed a common starter diet until 41 d of age. At 42 d of age, all pens were equalized with 24 birds (0.09 m²/bird) and fed 9 experimental diets consisting of 8 concentrations of dig TSAA to Lys ranging from 60 to 88 in increments of 4%. Two diets (dilution and summit) consisting of corn, soybean meal, and poultry by-product meal were formulated to be adequate in all other amino acids with the exception of TSAA and Lys. The dilution and summit diets were blended to create 6 intermediate diets, for a total of 8 titration diets resulting in dig TSAA ranging from 0.51 to 0.74% (calculated). A control diet containing adequate dig TSAA (0.67%) was used for comparison with the titration diets. All dose-response diets were formulated to contain 0.84% dig Lys, which is slightly below the dig Lys requirement for male broilers from 42 to 56 d of age. Each treatment was represented by 14 replicate pens. Standardized TSAA digestibility, BW gain, feed intake, dig TSAA intake, dig TSAA intake/BW gain, feed conversion, mortality, and carcass characteristics were assessed during experimentation. A standardized TSAA digestibility assay was conducted with broiler chicks to determine amino acid digestibility of the basal diet. Standardized TSAA digestibility of the basal diet was determined to be 0.53%. Progressive additions of dig TSAA to Lys resulted in a significant linear effect for 42 to 56 d of breast meat weight (P = 0.057) and yield (P = 0.035), but no treatment differences were observed for growth performance. Digestible TSAA to Lys ratios were estimated at 74 and 77 for total breast meat weight and yield. These data indicated that dig TSAA requirements for modern broilers are higher for total breast meat yield than growth performance.

Key Words: amino acid, broiler, TSAA

210 The effect of protein source, level and glutamine supplementation of pre-starter diet on performance, intestinal morphometric variables, amino acid composition of breast and thigh and amino acids digestibility of newly hatched chickens. M. Zaghari*, N. Famil Namroud1, M. Shivazad1, K. Nourijelyani1, O. Madagar3, and M. Ghafari3, 1University of Tehran, Department of Animal Science, Karaj, Tehran, Iran, 2University of Tehran, Department of Pathobiology, Faculty of Veterinary Medicine, Tehran, Tehran, Iran, 3Tehran University of Medical Sciences, Department of Epidemiology and Biostatistics, Tehran, Tehran, Iran.

Two experiments were conducted to examine the effects of dietary protein source and Glutamine supplementation of reduced crude protein diets on newly hatched broiler performance with a special emphasis on digestibility and intestinal morphology. In the first experiment, 225 one-
day-old male chickens were fed diets with 3 sources of relatively high digestible protein including Casein, isolated soy protein and dehulled soybean meal from 0 to 14 d of age. In the second experiment, 6 groups of 10 birds were fed diets containing 240, 220 and 200 g/kg crude protein with 0, 7.5 and 15 g/kg Glutamine in a 3 × 3 factorial arrangement of treatments. Apparent and true ileal digestibility and apparent fecal digestibility of protein and amino acids for the 3 ingredients were determined at 3, 7, 10 and 14 d of age. In this experiment, protein source did not affect amino acid content of breast and thigh muscles significantly. In the second experiment, increasing dietary protein level with the same concentration of essential amino acids during first 7 d of age did not affect performance but lead to reduction of villus height, crypt depth, and villus to crypt ratio in 4, 7, 14 and 33 d of age ($P \leq 0.05$). Glutamine supplementation of 200 g/kg crude protein diet increased villus height, villus to crypt ratio, the number of goblet cells, and villus width especially in ileal segment at 4 and 7 d of age ($P \leq 0.05$), but had no significant influence in higher protein levels. All treatments had no effect on intestinal muscularis thickness or the number of enterocytes cells per length of villus epithelium. Furthermore, crude protein per se and glutamine supplementation did not play a critical role during the first days post hatch, provided that requirement of all essential amino acids were supplied.

Key Words: protein, pre-starter diet, glutamine, digestibility, broiler