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Metabolism and Nutrition I: Amino Acids

19 Dietary protein composition influences expression of intestinal peptide transporter, PepT1, mRNA in two lines of broilers.

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The intestinal peptide transporter, PepT1, is known to be regulated by a variety of dietary factors, including protein quantity, protein quality, and feed intake. The objective of this experiment was to determine the effect of dietary protein composition on mRNA abundance of chicken PepT1. From day of hatch to day 8, chicks from 2 genetic lines (A and B, selected under different dietary conditions) were given ad-libitum access to a commercial corn-soy diet. From day 8 to day 15, birds were fed 1 of 3 diets (24% CP) that differed only in protein source. Protein sources included whey protein concentrate (Whey), a partial whey hydrolysate (Hydro) consisting of mainly small peptides, or a mixture of free amino acids (AA) identical to the composition of the whey protein. Intake of all diets was restricted to the group that consumed the least (Line B, AA diet). Intestinal samples were collected at day 8 (before random assignment to dietary treatment), and days 9, 11, 13, and 15. Abundance of PepT1 mRNA was assayed by real time PCR. Quantities of PepT1 mRNA were greater ($P = 0.0001$) in Line B chicks as compared with Line A chicks. Abundance of PepT1 mRNA was greater in chicks that consumed the Hydro diet as compared with chicks that consumed the Whey ($P = 0.06$) or AA diet ($P = 0.008$). There was a line \times diet interaction where PepT1 mRNA showed the greatest ($P = 0.005$) induction in Line B birds consuming the Hydro diet. Line B birds were heavier ($P = 0.03$) than Line A birds, but BW did not differ among treatments. These data demonstrate that dietary protein composition influences expression of the intestinal peptide transporter, PepT1. In particular, the Hydro diet accentuated the difference in gene expression between genetic lines.

Key Words: hydrolysate, PepT1, whey

20 An economic analysis of L-threonine in a broiler grower diet, using a least-cost model, based upon digestible amino acids and ideal digestible amino acid ratios. N. Sriperum*², P. B. Tillman¹, G. M. Pesti², and M. E. Wetzstein³, ¹Ajinomoto Heartland LLC, Chicago, IL, ²Department of Poultry Science, University of Georgia, Athens, ³Department of Agricultural Economics, University of Georgia, Athens.

During the past 2 years in the United States, corn, soybean meal (SBM), and feed-grade fat prices have shown increases in both their levels and volatility. This is largely driven by the negative impact to animal agriculture from the ethanol-fuel tax credit. During this same period, the price for synthetic amino acids available for supplementation into broiler feeds has remained relatively flat and stable. These relative price shifts in poultry feed ingredients indicates a modification is required in least-cost feed formulation. An analysis of L-threonine (L-THR) in a broiler grower diet was made on a least-cost basis using essential digestible amino acids targeted as minimum ratios relative to digestible lysine.

Synthetic sources of DL-MET, L-LYS, and L-THR were offered so as to meet the first 3 limiting amino acids. A crude protein minimum was not set, but it was held up to a reasonable level based upon the targeted minimum digestible lysine level along with the ratio of the fourth limiting amino acid. The inclusion rate and economic sensitivity of L-THR was evaluated across a wide range of corn, SBM, and poultry fat prices. A $7 \times 7 \times 7$ factorial design in diets (with and without L-THR) was used, so as to generate a total of 686 separate formulas. Prices of corn, SBM, and fat, per ton, were varied from \$50 to \$200, \$150 to \$450, and \$300 to \$600, respectively. Per ton price increments for SBM and fat were \$50 and were \$25 for corn, providing a spread between the price of SBM and that of corn of \$-50.00 to \$450.00. An economic evaluation of the L-THR opportunity cost (shadow cost) for each diet was analyzed. The generated prediction equation for L-THR opportunity cost = $-1,023.63 + 2.511034(\text{Corn}\$) + 29.42683(\text{SBM}\$) + 14.21324(\text{Fat}\$) + 0.029324(\text{Corn}\$)^2 + 0.078644(\text{SBM}\$)^2 - 0.2457(\text{Corn}\$) (\text{SBM}\$) - 0.12039(\text{Corn}\$) (\text{Fat}\$) + 0.00032(\text{Corn}\$) (\text{SBM}\$) (\text{FAT}\$)$. The opportunity cost of L-THR increased when either the SBM-corn spread or the fat price increased. Across this group of formulas, the inclusion of L-threonine saved on average \$4.85 per ton over diets formulated without L-threonine.

Key Words: threonine, broiler, economics

21 The effect of selection for body weight along at 16 weeks on the lysine and TSAA requirement of turkeys. O. C. Aimuwu* and M. S. Lilburn, *The Ohio State University/OARDC, Wooster.*

In 1971, the NRC lysine and TSAA requirements for turkeys from 0 to 4 weeks was 1.5 and 0.87%, respectively. These requirement estimates increased to 1.6 and 1.05% by 1984 (NRC, 1984) and remained there in the last NRC published (1994). A randombred control line of turkeys was developed at the Ohio Agricultural Research and Development Center (OARDC) from a composite of commercial lines available in the mid 1960s (R2) and from this randombred line a growth line was developed with the sole selection criteria being body weight at 16 wk (F line; Nestor, 1977). The F line has currently undergone over 35 years of selection. Experiments were conducted with the R2 and F line to compare their response to diets varying in lysine and TSAA. From 17 to 31 d, poults from each line were individually penned and fed diets containing 1.60 or 1.75% lysine and 0.85, 1.0, or 1.15% TSAA. Body weight at 31 d was approximately double in the F line (1.60 vs. 0.81 kg) and feed intake was also twice as great in the F line. There were no significant line by lysine or line by TSAA effects on carcass weight, pectoralis major muscle weight, or carcass nitrogen. Selection for body weight alone has resulted in a significant increase in body weight at a given age in the F line and proportional increases in breast muscle weight but no changes in carcass protein. Selection for BW alone, therefore, may not alter the percentage dietary amino acid requirement.

Key Words: selection, turkeys, carcass

22 Strain and immune status affect body protein metabolism and lysine requirements in broilers. R. D. Kirschenman*, S. Moehn, and D. R. Korver, *University of Alberta, Edmonton, AB, Canada.*

Selection for growth rate has affected the immune system in broilers; limited research has been conducted in this area. The acute phase (AP) inflammatory response redirects amino acids (AA) from growth to hepatic AP protein synthesis, thus affecting protein kinetics. Differences in AA requirements and protein kinetics following an AP response may exist between chickens selected or not selected for rapid growth. Body weight (BW) gain, plasma AA and protein kinetics, and lysine requirements (using the indicator AA oxidation method) during recovery from an AP response were measured in random-bred (R) and modern commercial (C; Ross 308) broilers. At 10 d of age, birds were placed in metabolic chambers and adapted to 1 of 7 diets containing 6.07, 7.18, 8.38, 9.38, 10.49, 12.14, or 13.24 g/kg of lysine. At 13 or 14 d of age, birds were either injected with bacterial lipopolysaccharide (LPS; I) or not injected (U) 12 h prior to each 4-h AA oxidation study ($n = 4$ per strain \times LPS \times diet treatment). Plasma AA levels and kinetics, and BW were analyzed by ANOVA (GLM procedure; SAS) with significance set at $P \leq 0.05$. Lysine requirements were analyzed using a linear plateau model in the nonlinear procedure of SAS. C birds had higher BW than R birds throughout; LPS injection had no effect on BW gain. I birds had higher plasma phenylalanine than U birds, likely due to breakdown of phenylalanine-rich AP proteins. Plasma lysine increased with dietary lysine levels. C birds had higher whole-body protein synthesis, breakdown, flux, and retention than R birds. I birds had greater whole body protein breakdown ($P = 0.05$), synthesis ($P = 0.06$), and flux ($P = 0.06$) than U birds. Lysine requirements were higher in CU birds than I birds (10.48 ± 0.25 vs. 7.45 ± 0.17 g/kg diet), and in RU birds than RI birds (8.28 ± 0.13 vs. 7.18 ± 0.11 g/kg diet), and greater for C birds than R birds. Therefore, the innate immune system of broiler chicks, as measured by lysine requirements and protein kinetics, has been changed by genetic selection for growth potential.

Key Words: lysine, protein metabolism, acute phase response

23 Digestible lysine and threonine requirements of male turkeys from days 8 to 21, and days 29 to 42. L. B. Linares*¹, E. A. Guaiume¹, R. A. Murarolli¹, R. E. Shirley², D. Hoehler³, D. R. Ledoux¹, and J. D. Firman¹, ¹University of Missouri, Columbia, ²Ajinomoto Heartland LLC, Chicago, IL, ³Evonik Degussa Corporation, Kennesaw, GA.

Two experiments were conducted to determine the digestible lysine (dLys) and digestible threonine (dThr) requirement of Nicholas male turkeys from days 8 to 21 (Phase I), and days 29 to 42 days (Phase II). In both phases, birds were randomized to floor pens with 12 treatments and 7 replicates per treatment, plus an additional 2 treatments with 6 replicates. A total of 1,152 birds were used in Phase I (12 birds/pen) and 1,056 birds were used in Phase II (11 birds/pen). In Phase I, a reduced low crude protein (25% CP, and 3,000 kcal/kg ME) corn-soybean meal-peanut meal basal diet supplied 1.14% dLys and 0.56% dThr. To determine the requirement for dThr, the level of dLys was kept at 1.50%, and the 7 dietary dThr treatment levels ranged from 0.56 to 1.04%, in 0.08% increments. For the dLys requirement, the level of dThr was kept at 1.04%, and the 7 dietary dLys treatment levels ranged from 1.14 to 1.50%, in 0.06% increments. The positive control (PC) diet was an industry average diet containing 29% CP. The broken-line analysis of SAS estimated the requirement for dLys in Phase I to be 1.36% for BWG and 1.39% for F:G, and the requirement for dThr to be 0.74% for BWG and 0.81% for F:G. In Phase II, a reduced CP (24% CP, and

3,100 kcal/kg ME) corn-soybean meal-peanut meal basal diet supplied 1.06% dLys and 0.50% dThr. To determine the requirement for dThr, the level of dLys was kept at 1.42%, and the 7 dietary dThr treatment levels ranged from 0.50 to 0.99%, in 0.08% increments. For the dLys requirement, the level of dThr was kept at 0.99%, and the 7 dietary dLys treatment levels ranged from 1.06 to 1.42%, in 0.06% increments. The PC industry average diet had 27.5% CP. The broken-line analysis of SAS estimated the requirements for dLys in Phase II to be 1.27% for BWG and 1.29% for F:G, and the requirement for dThr to be 0.70% for BWG and 0.74% for F:G.

Key Words: turkeys, lysine, threonine

24 The effect of dietary protein level and digestibility on the growth performance of broiler chickens. G. P. Widyaratne* and M. D. Drew, *University of Saskatchewan, Saskatoon, SK, Canada.*

A study was conducted to evaluate the effect of dietary protein level and digestibility on the growth performance of broiler chickens in a 35 d growth experiment. A total of 320 broiler chickens were fed 4 different ideal protein-balanced, isocaloric diets (1.24 and 1.04% ileal digestible Lys and 3,050 and 3,150 kcal/kg on days 1–14 [Starter] and 15–35 [Grower], respectively). The dietary treatments consisted of 2 protein levels (HP: 20 and 18% and LP 18 and 16% ileal digestible crude protein on days 1–14 and 15–35, respectively) and 2 protein digestibility levels (HD: 88% and LD: 82% mean ileal crude protein digestibility). During the starter phase, neither of the main effects significantly affected growth performance. However, the protein level \times digestibility interaction was significant for ADG and the LP:LD fed birds grew significantly slower than the LP:HD fed birds (33.9 vs. 35.7 g/d) while no difference between the HP:LD and HP:HD fed birds ($P < 0.05$). During the grower phase, the main effect of digestibility was significant for FE (1.56 for LD-fed and 1.59 for HD-fed birds). The protein level \times digestibility interaction was significant for ADFI with LP:LD birds consuming significantly less feed than the LP:HD birds while there was no significant difference between the HP:LD and HP:HD fed birds. The final BW of the birds was affected by protein level \times digestibility interaction ($P < 0.05$). Birds fed the LP:LD diets had lower BW than those fed the LP:HD diets (2,480 vs. 2,650 g) while there were no significant differences between the birds fed the HP:LD and HP:HD diets. The main effect of protein level affected the Pectoralis major, P. minor and total breast meat yield ($P < 0.05$). The birds fed HP diets yielded 6.7, 3.6, and 6.2% more P. major, P. minor and total breast meat, respectively, than birds fed LP diets. In contrast, the main effect of protein digestibility affected the yield of abdominal fat ($P < 0.05$) and birds fed HD diets yielded 16.6% more abdominal fat than birds fed LD diets. The results suggest that feeding low protein diets formulated using highly digestible protein sources optimizes overall performance and yield.

Key Words: protein, digestibility, broilers

25 Lysine and threonine responses in Ross TP16 broilers. D. L. Everett*¹, A. Corzo¹, B. J. Kerr², W. A. Dozier III³, and M. T. Kidd¹, ¹Mississippi State University, Mississippi State, ²USDA-ARS, Ames, IA, ³USDA-ARS, Mississippi State, MS.

The efficiency of utilization of the nutrient Lys has been shown to be dependent upon the adequacy of the nutrient Thr. This order of limitation

response strengthens formulation expression of ratios “ideal protein” to Lys. Although interactions between Lys and Thr have been shown to occur in birds and further add to the validity of the former formulation practice, these responses in Ross TP16 broilers have not been investigated to the authors’ knowledge.

Five hundred and seventy-six male Ross TP16 broilers were allocated to 48 floor pens (12 birds/pen) and were fed on common feeds to d 28. Pens contained built-up pine shavings as litter, one water line with nipple drinkers, and one hanging pan feeder. At d 28, birds were provided a 2 × 4 factorial arrangement of treatments (digestible Lys of 1.00 or 1.05% of diet in combination with digestible Thr of 0.56, 0.60, 0.64, or 0.68% of diet) that were replicated 6 times. At 42 d of age, birds and feed were weighed by pen and 6 birds per pen were processed. BW on d 28 was used as the covariate during ANOVA.

Lys and Thr interacted ($P = 0.026$) for 28 to 42 BW gain. Birds fed 1.00% Lys and 0.64 and 0.68% Thr had similar BW gain to birds fed 1.05% Lys and 0.60, 0.64, and 0.68% Thr, indicating the sensitivity of the Thr to Lys ratio when broilers are fed diets containing marginal Lys. Regarding main effects, increasing dietary Lys improved BW gain ($P = 0.002$), feed conversion ($P = 0.058$), and breast meat tender muscle yield ($P = 0.057$). Birds that consumed diets containing 0.68% Thr had improved BW gain ($P = 0.009$) and feed conversion ($P = 0.014$) over birds consuming diets that contained 0.60% Thr with the 0.64% dietary level yielding an intermediate response. Results point to the importance of Lys and Thr, and their interaction in TP16 male broilers.

Key Words: lysine, threonine, broiler

26 The effect of genotype, choice-feeding and season on organically reared broilers fed diets devoid of synthetic methionine. A. L. Rack*, K. G. S. Lilly, K. R. Beaman, C. K. Gehring, and J. S. Moritz, *West Virginia University, Morgantown.*

In light of the impending ban on synthetic methionine in organic poultry diets, researchers have focused on finding alternative strategies to supply this amino acid. The objectives of this study were threefold: 1) to assess performance and carcass characteristics of a slow-growing and fast-growing broiler genotype fed diets devoid of synthetic methionine, 2) to determine performance and carcass quality effect of choice-feeding, and 3) to assess the effect of seasonal variation and pasture access on performance and processing variables. Inclusion of fish meal and high percentages of soybean meal enabled the specific genotype methionine requirement to be met. All diets were certified organic. Slow-growing broilers (Gourmet Black) were raised from 1–84 days, and fast-growing broilers (Cobb 500) were raised from 1–56 days. The experiment was run during the grower and finisher phases in 4 different seasons: late fall, spring, summer, and early fall. Broilers were located on the West Virginia University certified organic farm, given access to pasture for at least 8 hours daily, and exposed to natural fluctuations of environmental conditions. Replicate treatments were held at the Animal Sciences farm, and allowed no access to pasture. No Choice (single diet) or Choice (corn offered in a separate feeder from rest of diet) feeding strategies were implemented. Birds on no choice management showed higher average daily gain (ADG; $P < 0.05$) compared to choice managed birds. Slow-growing broilers had higher FCR and lower breast yields ($P < 0.05$) than the fast-growing genotype. Fast-growing no choice birds had higher breast yield than the choice birds of the same genotype ($P < 0.05$). Fast-growing genotypes were superior in performance and carcass characteristics compared to slow-growing genotypes, and choice-feeding management did not improve performance or carcass

characteristics. Performance was decreased in late fall, likely due to cold ambient temperatures.

Key Words: methionine, broiler, organic

27 Effects of supplemental lysine sources on egg-production and economic parameters for laying hens. S. Roberts*¹, S. Gardner¹, S. Mottet¹, B. Kerr², D. Hoehler³, R. Payne³, and K. Bregendahl¹, ¹*Iowa State University, Ames*, ²*USDA/ARS, Ames, IA*, ³*Evonik Degussa, Kenesaw, GA.*

An experiment was conducted to determine effects of supplemental Lys source on egg production and economics in laying hens. Two diets were formulated on a least-cost basis (November 2006 prices) using corn, soybean meal, meat-and-bone meal, corn distillers dried grains with solubles (fixed at 10%), vegetable oil, and DL-Met to contain 2,875 kcal/kg AME_n, 0.78% true digestible TSAA, 0.88% true digestible Lys, 4.25% Ca, and 0.47% nonphytate P. Supplemental Lys was added as L Lys·SO₄²⁻ (Biolys) or L-Lys·HCl with their AME_n, P, and amino acid contributions considered. Cages of 2 hens each were assigned to a diet according to a completely randomized design with 128 cages per treatment. Egg production was recorded daily and feed intake was determined weekly during the 8-wk experiment (hens 58 to 66 wk of age). Eggs collected over a 48-h period every week were weighed and egg mass calculated as egg production × egg weight; feed utilization was calculated as grams of egg mass per kilogram of feed intake. Feed cost was calculated from records of feed intake and diet cost (\$137.34 and \$137.63 per 907 kg for Biolys and L-Lys-HCl, respectively); egg income was calculated from egg mass and November 2006 breaking-stock price (\$0.43/dozen); and return over feed cost was calculated by difference. Data were analyzed by one-way ANOVA and shown as means ± pooled SEM. There were no differences in egg production (82.1 vs. 83.0 ± 0.8%; $P = 0.41$), egg weight (63.3 vs. 63.3 ± 0.2 g; $P = 0.95$), egg mass (51.9 vs. 52.5 ± 0.5 g/hen per day; $P = 0.39$), feed intake (97.2 vs. 98.3 ± 0.5 g/d; $P = 0.13$), or feed utilization (534 vs. 534 ± 4 g/kg; $P = 0.97$) between hens fed the Biolys or L Lys-HCl diets, respectively. Feed cost was lower for Biolys-fed hens (1.47 vs. 1.49 ± 0.01¢/d; $P = 0.07$), but egg income (3.10 vs. 3.14 ± 0.03¢/d; $P = 0.69$) and return over feed cost (1.63 vs. 1.64 ± 0.03¢/d; $P = 0.68$) were not different. The results show that using Biolys lowered diet cost by \$0.29 per 907 kg and that the 2 Lys sources were used equally well for egg production. Therefore, the choice of Lys source should be made based on economics and product availability.

Key Words: Biolys, laying hens, L-lysine-HCl

28 The effects of varying levels of digestible lysine on growth and carcass development in commercial turkey toms from 12 to 16 and 17 to 20 weeks. O. C. Aimiwu* and M. S. Lilburn, *The Ohio State University, Wooster.*

Two studies were conducted to determine the digestible lysine requirement for growth and carcass development in commercial toms from approximately 12 to 16 and 17 to 20 weeks of age. Total dietary lysine level recommended by NRC (1994) for 12- to 16-week-old turkeys is 1.00% and in Study 1, levels used were 0.85, 1.00, 1.15, and 1.30%. NRC (1994) recommended level for 16- to 20-week-old turkeys is 0.80% and in Study 2, levels used were 0.60, 0.75, 0.90, and 1.05%. Digestible

lysine values were determined from total lysine levels by using values obtained from ileal digestibility assay in which chromium oxide was the marker. Average digestibility value of 86 to 108 d toms was 75% while that of the 114 to 140 d toms was 80%. In the first study, diets containing digestible lysine levels of 0.64, 0.75, 0.86, and 0.98% were fed to individual toms. Digestible lysine levels fed to toms in Study 2 were 0.48, 0.60, 0.72, and 0.84%. To avoid the compounding effects, individual toms served as the experimental unit in both studies and each tom was fed a predetermined quantity of feed corresponding to what would be fed in a typical commercial scheduled feeding program. The level of digestible lysine in Study 1 had no significant difference on body weight gain and carcass development. However, feeds that contained the highest level of lysine tended to depress body weight gain and carcass development. It could therefore be inferred that the NRC (1994) recommended total lysine level of 1.0% is adequate for toms that are between 12 to 16 weeks of age. In Study 2, lysine levels had linear significant effects ($P < 0.05$) on weight gain and carcass development. However, there was no significant difference between 0.72 and 0.84% digestible lysine. When the data was broken down into groups based on digestible lysine intake, 132 g of digestible lysine intake resulted in maximal weight gain and muscle growth. It would therefore be inferred from the results that the NRC (1994) recommended total lysine level of 0.8% is inadequate for toms that are between 16 to 20 weeks of age.

Key Words: lysine, turkey toms, carcass

29 Effects of dietary lysine and energy combinations on net energy partitioning for protein and fat deposition in starter chicks.

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The objective of this study was to evaluate the growth performance, nutrient retention, tissue composition and deposition in the body and the energy content in the retained protein and fat in chicks from 3 to 12 days of age fed different levels of digestible lysine (DLys) and ME. One hundred and eighty Ross B308 chicks were allocated in group of 5 per pen in a starter battery. Birds were randomly distributed in 1 of 9 treatments in a factorial arrangement of 3 diets (T1 = 1.20% of DLys and 2,950 kcal of ME/kg; T2 = 1.20% of DLys and 3,050 kcal of ME/kg; and T3 = 1.35% of DLys and 3,050 kcal of ME/kg) and 3 dietary energy densities (D100: the diet was fed as such; D90 and D80, the original diet was diluted with sand to get energy densities at 90 and 80%). The last 2 days, total excreta was collected and in an additional group of chicks the endogenous excretion of nutrients was determined. At the end, birds were killed to evaluate the protein and fat content and retention. Chicks killed at the beginning were used to correct for initial body composition. Results were subjected to variance analysis. The nitrogen and energy retention, TME_n, NE retained in fat, total NE, and the efficiency of conversion of GE to NE were lower ($P < 0.01$) in T3. The retention of dietary nutrients, the NE retention in protein and fat and the efficiency with which GE was converted to TME_n were greater ($P < 0.05$) for D80. The consumption of a diet with a lower digestible lysine content but higher in ME did not affect the use of dietary energy; however, the consumption of a diet with a greater content of digestible lysine diminished the retention of nutrients, the NE retained in protein and fat and the efficiency of NE utilization.

Key Words: digestible lysine, metabolizable energy, net energy

30 Dietary lysine requirement of male broilers from 14 to 28 days of age subjected to different environmental conditions.

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This study examined growth responses of broilers provided experimental diets varying in digestible Lys concentrations from 14 to 28 d of age under different environmental conditions. Two experiments were conducted; bird husbandry and the experimental facility were identical for the 2 experiments. Ross × Ross TP16 male chicks were randomly distributed into floor pens (experiment (Exp.) 1 = 765 birds and Exp. 2 = 816 birds) at 1 d of age and were fed a common starter diet until 13 d of age. At 14 d of age, all pens were equalized with 15 birds (0.09 m²/bird) and fed the experimental diets until 28 d of age. Two diets consisting of corn, soybean meal, poultry by-product meal, and peanut meal were formulated to be adequate in limiting amino acids and contained 0.90 or 1.25% calculated true digestible Lys for Exp. 1 and 0.92 or 1.32% calculated true digestible Lys for Exp. 2. Diet dilution was used with L-Lys HCl to create 6 titration diets from 0.90 to 1.25% digestible Lys in 0.07% increments in Exp. 1 (8 replicate pens) and from 0.92 to 1.32% digestible Lys in 0.08% increments in Exp. 2 (7 replicate pens). A control diet containing surfeit Lys was used to validate the titration diets (Exp. 1 = 3 pens/treatment and Exp. 2 = 6 pens/treatment). In Exp. 1, progressive additions of dietary Lys led to linear trends ($P \leq 0.001$) for BW gain, feed intake, and feed conversion. Dietary digestible Lys requirements for BW gain, feed intake, and feed conversion were estimated as 1.24, 1.22, and 1.21%, respectively, based on linear broken-line analysis. In Exp. 2, gradient increments of dietary Lys led to significant quadratic trends of BW gain ($P \leq 0.001$) and feed conversion ($P \leq 0.017$). Dietary digestible Lys requirements were 1.18 and 1.24%, respectively, for BW gain and feed conversion, based on quadratic broken-line analysis. Digestible Lys intake to optimize feed conversion was 1,206 and 1,404 mg/d in Exp. 1 and 2, respectively. These results suggest the dietary Lys need varied considerably with broilers reared in environmental conditions emulating summer (Exp. 1) vs. winter (Exp. 2) production.

Key Words: amino acid, broiler, lysine

31 Threonine-to-lysine ratios for female broilers from 14 to 28 days of age.

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Two studies were simultaneously conducted in the same experimental facility using Ross × Ross TP16 female broilers from the same flock and hatch. The studies were designed to individually but simultaneously determine the true digestible Lys and Thr requirements of female broilers from 14 to 28 d of age. Ross × Ross TP16 d-old female broiler chicks were randomly distributed into 96 floor pens (1,248 chicks). Forty-eight pens corresponding to one-half of the house were used to determine the Lys needs of these birds, while the remaining half of the house was used to determine the Thr needs. All chicks were fed a common starter diet in crumbled form up to 14 d of age, formulated to meet or exceed all dietary nutrient requirements. At 14 d of age, all pens were equalized in bird number (12/pen). Three experimental diets based on corn, soybean meal, peanut meal, and poultry meal were formulated to contain the following calculated true digestible values: D1, deficient in Lys (0.84%)

but adequate in Thr (0.86%); D2, adequate in Lys (1.24%) but deficient in Thr (0.46%); D3, adequate in Lys (1.24%) and Thr (0.86%). Diets 1 or 2 were progressively blended with diet 3 to derive the Lys or Thr dose-response diets, respectively. Incremental levels of Lys or Thr were made at a rate of 0.08%, for a total of 6 levels. A control diet containing surfeit amino acid levels was used to validate the titration diets for each experiment. All experimental diets were fed from 14 to 28 d of age in pellet form. Requirement estimates for the Lys dose-response study ranged from 1.04 to 1.08% when using the linear broken line model, and 1.07 to 1.11% when using the quadratic broken line model. The quadratic polynomial regression model was not significant for the Lys study, but was for the Thr dose response study, yielding a requirement estimate of 0.79% for BW gain. The linear broken line model resulted in Thr requirement estimates between 0.73 and 0.76% Thr. Only the linear broken line model resulted in simultaneous Lys and Thr requirement estimates for the same parameters, yielding Thr-to-Lys ratio values of 68 for BW gain and 70 for FCR.

Key Words: amino acid, lysine, threonine

32 Supplementing L-valine and L-isoleucine in low protein corn-soybean meal all-vegetable diets for broilers. J. Berres, S. L. Vieira*, A. K. Ferreira, R. Barros, P. X. Silva, and F. V. F. Furtado, *UFRRGS, Porto Alegre, RS, Brazil.*

This study evaluated the live performance and meat yields of broilers fed increased Val:Lys and Ile:Lys from 14 to 35 d of age. One thousand eight hundred Cobb 500 male broilers were raised on the same feed and similar housing conditions to 14 d of age. A corn-soybean meal all-vegetable feed with 1.1% digestible Lys was formulated w/o crude protein restriction to the fifth limiting AA. This diet was the negative control (T1 = 18.71% CP) and had the following AA to Lys ratios: SAA = 0.75; Thr = 0.65; Val = 70; Ile = 65. Val and Ile from synthetic sources were graded increased to this diet to generate the following treatments: T2) 0.75 Val and 0.65 Ile; T3) 0.80 Val and 0.65 Ile; T4) 0.70 Val and 0.68 Ile; T5) 0.70 Val and 0.71 Ile; T6) 0.75 Val and 0.68 Ile; T7) 0.80 Val and 0.71 Ile. A Positive Control (T8) with 1.1% digestible Lys formulated with CP = 20.37% minimum was also used. Each treatment had 9 replicates of 25 birds (8.9 birds/m²). Body weight, feed intake and mortality were not different between treatments ($P > 0.05$). Weight gain from 14 to 35 d was positively affected by any level of L-Val and L-Ile, whereas feed conversion was improved only when the both AA were supplemented at the highest levels. No differences were found in terms

of meat yields, but abdominal fat was reduced with the positive control. It is concluded that supplementing L-Val and L-Ile favored weight gain and feed conversion. It seems, however, that a greater amount of AA when birds are fed diets formulated with a minimum CP provide more consistent benefits in reducing abdominal fat.

Key Words: broiler, valine, isoleucine

33 Digestible lysine requirements and ideal amino acid ratios in diets for young (0–14 d) male broilers formulated to ideal ratios and balanced in amino acids. F. G. P. Costa*², Z. Wang¹, C. Coto¹, S. Cerrate¹, F. Yan¹, and P. W. Waldroup¹, ¹University of Arkansas, Fayetteville, ²Federal University of Paraiba, Areia-PB, Brazil.

For many years, it has been suggested that diets with a “perfect balance” of amino acids with little excess protein will result in optimum performance of broilers. The objective of this study was to evaluate the need for digestible lysine in diets for the young (0-14 d) male broiler while maintaining a ratio of other amino acids to lysine. One series of diets used conventional amino acid supplements (Met, Lys, and Thr) to help meet amino acid needs while a second series of diets used additional amino acid supplements to have as many essential amino acids at the minimum level as possible. The ideal amino acid ratios suggested by Rostagno et al. (2005) were used as the basis for formulation. All diets were formulated to contain 1.14, 1.24, 1.34, 1.45, 1.55, and 1.65% digestible lysine with dietary ME level of 3,030 ME kcal/kg. In the first series of diets, minimum requirements were met for Lys, TSAA, Thr, and Val; in the second series minimum requirements for Gly+Ser, Arg, and Ile were also met. Diets with unconventional amino acid supplements ranged from 0.68 to 2.45% lower in crude protein than diets with conventional supplements. Twelve pens of 5 male chicks (Cobb 500) were fed each diet from 1 to 14 d of age. When diets were formulated using conventional amino acid supplements, increasing the level of digestible lysine while maintaining other amino acids in a fixed ratio resulted in improved growth and feed conversion. When nonconventional amino acids were used to minimize excess levels of essential amino acids, there was little or no response in body weight or improvement in feed conversion as the level of lysine and associated amino acids increased. These results suggest that some of the amino acid to lysine ratios may be underestimated with these amino acids becoming deficient when forced to their minimum suggested levels.

Key Words: broilers, lysine, ideal protein

National Extension Workshop

34 Washington update. R. D. Reynnells*, *USDA/CSREES/PAS, Washington, DC.*

The activities and observations of the National Program Leader, Animal Production Systems, are reported. The 2008 Extension Special Recognition Award is presented to Jesse and Doris Lyons. Jesse provides exceptional leadership at the University of Missouri in youth, environmental protection, and extension programming, while Doris has made extensive contributions to the American Poultry Historical Society, and has several extension duties. Progress is being made in multi-state research committees: Agricultural Bioethics (NC_temp1902)

was moved to the North Central Region; both Applied Animal Behavior and Welfare (NC1029), and Improvement of Poultry Air and Water Quality (S1035) are now full research committees. Portfolio reviews are yearly [Knowledge Area (KA) 306, Environmental Stress in Animals; KA308, Improved Animal Products (Before Harvest); KA315, Animal Welfare]. Project summaries submitted to the Current Research Information System (CRIS) are generally error free. The 2009 Southern Region (Quadrennial) Poultry Extension Workshop will be in Charlotte, NC, and the chair, Ken Anderson, requests ideas and volunteers. The 2008 National Poultry Waste Management Symposium will be in Des Moines, IA. Casey Ritz (GA), coordinator, encourages submission of