

Nonruminant Nutrition: Amino Acids

M204 Response surface model for broiler chickens performance fed diets varying in digestible protein and amino acids. H. Ahmadi and A. Golian*, *Ferdowsi University of Mashhad, Mashhad, Khorasan Razavi, Iran.*

Response surface methodology (RSM) and 5-level-4-factor central composite design (CCD) were used to evaluate the response of broilers (BWG and FCR) to dietary digestible protein (dP), lysine (dLys), methionine+cysteine (dTSAAs), and threonine (dThr). Eighty 4 cages of 5 birds each were assigned to feed diets contained 5 levels of dP (18, 19, 20, 21 and 22%), dLys (1.06, 1.12, 1.18, 1.24 and 1.30%), dTSAAs (0.81 to 0.86, 0.91, 0.96 and 1.01%), and dThr (0.66, 0.71, 0.76, 0.81 and 0.86%) from 11 to 17 d of age. Diets were prepared using corn, soybean meal (45.2% CP), and corn gluten meal (48.6% CP). Protein and amino acid analyses were performed for these ingredients. All diets were formulated to have 3050 kcal/kg. The experimental results of CCD were fitted with the second-order polynomial equation. A ridge analysis was utilized to compute the optimum response for maximizing BWG and minimizing FCR. The fitted second-order polynomial equations for BWG and FCR are produced as follows: BWG (g/bird/d) = 1222.2 - 76.7 dP - 2.4 dP² - 1468.0 dLys - 260.0 dLys² + 675.2 dTSAAs - 522.0 dTSAAs² + 404.0 dThr - 793.5 dThr² + 77.6 dP*dLys + 41.6 dP*dTSAAs + 51.5 dP*dThr + 145.8 dLys*dTSAAs + 556.5 dLys*dThr - 958.3 dTSAAs*dThr; R² = 0.70; Root MS error = 4.97. FCR = -124.3 + 12.8 dP + 0.2 dP² + 70.8 dLys + 44.7 dLys² - 86.5 dTSAAs + 60.8 dTSAAs² - 18.6 dThr + 64.3 dThr² - 9.7 dP*dLys - 4.5 dP*dTSAAs - 4.0 dP*dThr + 34.3 dLys*dTSAAs - 24.8 dLys*dThr + 34.3 dTSAAs*dThr; R² = 0.71; Root MS error = 0.53. The ridge max analysis on BWG and ridge min analysis on FCR models revealed that the maximum BWG may be obtained with dP 18.5%, dLys 1.10, dTSAAs 0.89, and dThr 0.73 and minimum FCR may be obtained with dP 19.44%, dLys 1.18, dTSAAs 0.90, and dThr 0.75. At the optimum point, the predicted BWG and FCR were 40.2 g/bird/d and 1.09, respectively. The combination of CCD and RSM techniques consider simultaneously all investigating factors and their possible interactions. Thus, it appears that the platform may be used to describe relationship between dietary concentration of nutrients and broiler performance to achieve optimal target.

Key Words: response surface model, digestible protein and amino acid, broiler chicken

M205 Partitioning of lysine stable isotopes in broiler breeders during the transition into sexual maturity. R. D. Ekmay*, C. Salas, J. England, and C. N. Coon, *University of Arkansas, Fayetteville.*

A study was conducted to determine how lysine is partitioned during the transition into sexual maturity in broiler breeder hens. At 21 wk, 15 Cobb 500 hens were individually housed and fed a 100g meal. Twelve of these hens were, in addition, administered a 15mg oral dose of ¹⁵N-lysine daily beginning at wk 22; 3 hens did not receive any ¹⁵N-lysine to serve as controls. At first egg, administration of ¹⁵N-lysine ceased and a daily 15mg oral dose of ¹³C-lysine began. When the second egg was laid, 6 hens (Group 1) were slaughtered and the left *Pectoralis major* was excised and snap frozen in liquid nitrogen. The egg contents were also frozen. The remaining 6 hens (Group 2) were slaughtered after the third egg and sampled as described. Molar percent excess (MPE) was determined in the egg and breast samples by GC-MS. The 159 and 160 m/z fragments were utilized for determination of ¹³C enrichment. The 130 and 131 m/z fragments were utilized for determination of ¹⁵N enrichment. MPE was calculated using the Rosenblatt (1992) approach.

Statements of significance are based on testing at $P < 0.05$. No differences in breast weight or the number of days of enrichment between groups were determined. The ¹³C-lysine enrichment in breast muscle was not significantly higher than in control hens, however ¹⁵N-lysine enrichment was higher in groups 1 and 2 compared with the control. The ¹⁵N-lysine enrichment of the egg increased significantly by the 3rd egg (Group 2). The ¹³C-lysine enrichment of the egg did not differ from the control eggs. In summary, skeletal tissue appears to play an increasingly important role in supplying amino acids for egg formation during hen maturation.

Key Words: broiler breeders, amino acids, nutrient partitioning

M206 Varying levels of dietary methionine inclusion on the hematology and serum biochemistry of broilers. G. O. Adeyemo* and A. D. Ologhobo, *University of Ibadan, Ibadan, Oyo, Nigeria.*

The influences on hematology and serum biochemistry of graded levels of methionine inclusion in the diets of broilers were researched. One hundred and fifty broiler chicks were divided into 5 treatments consisting of 6 replicates of 5 chicks each. The chicks were kept in floor pens. The study lasted for 56 d at the teaching and research farm of the university of Ibadan Nigeria. No significant differences ($P > 0.05$) were observed in the packed cell volumes (PCV), red blood cells (RBC) and white blood cells (WBC) values of broilers fed the different levels of methionine inclusion, at the finisher phase, but at starter phase significant differences ($P < 0.05$) were observed, with the WBC values increasing as the inclusion rate of methionine increased. Total protein value of 4.80 g/dl and 4.48 g/dl were obtained for treatments 4 and 5 respectively which were not significantly ($P > 0.05$) different from each other. There were wide variations in the glucose concentration of the birds. The highest glucose concentration was observed from birds on diet 2 (220.90 g/dl) while the least was observed for birds fed the control diet though significant differences ($P < 0.05$) were observed, it did not follow a particular order.

Key Words: broilers, methionine, serum biochemistry

M207 Separate response to lysine and methionine in broiler starter diets. C. Lu¹, C. A. Coto¹, A. Karimi², J. H. Park¹, Y. Min¹, and P. W. Waldroup¹, ¹University of Arkansas, Fayetteville, ²University of Kurdistan, Kurdistan, Iran.

A study was conducted to evaluate the separate response to Lysine (Lys) and to Methionine (Met) in diets on live performance of young broiler chickens from 0 to 18 d of age. Corn and soybean meal of known protein and moisture content were used to formulate basal diets to provide 0.90 to 1.40% digestible Lys in increments of 0.10%. The mean of suggested amino acid ratios to Lys suggested by literature values was used in formulation according to the ideal protein concept. All amino acids other than Met and TSAAs were calculated to meet or exceed the expected ratio to Lys. Diets were calculated to be isocaloric with 3086 kcal/kg ME and were supplemented with inorganic trace mineral premix to avoid any source of Met from this premix. Experimental diets were prepared by addition of variable amounts of MHA (84% of Met) and cornstarch to the Lys basal diets to provide increments of 0.04% up to 0.28% supplemental Met activity for each level of digestible Lys, with a 6 × 8 factorial arrangement of 6 levels of Lys and 8 levels of supplemental Met resulting in a total of 48 treatments. Each of the 48 experimental diets was fed to 6 replicate pens of 6 male chicks (Cobb

500). Body weights by pen were obtained at 1 and 18 d of age with feed consumption determined during the test period. The ANOVA considered levels of Lys and Met and their interaction. There was significant ($P < 0.05$) effect of the dietary Lys level on feed intake, body weight gain and feed conversion ratio, with optimal level close to 1.2% of digestible Lys for both body weight gain and feed conversion ratio. There was no significant ($P < 0.05$) effect of the added Met level on feed intake, body weight and feed conversion ratio, indicating that the Met level in the basal diet of this study might be sufficient to support body weight and feed conversion ratio. No significant interactions were observed between Lys and Met for these 3 parameters. Results of this study suggest that the response to variation in Lys is a response to itself but not to Met in broiler starter diets.

Key Words: broilers, lysine, methionine

M208 Effect of crude protein and essential:nonessential amino acids ratio on nitrogen balance in broiler. C. C. Goulart¹, F. G. P. Costa^{*1}, E. T. Nogueira², M. Kutschenko², H. S. Rostagno³, C. F. S. Oliveira¹, R. C. L. Neto¹, and V. P. Rodrigues¹, ¹Federal University of Paraíba, Areia, PB, Brazil, ²Ajinomoto Animal Nutrition, Sao Paulo, SP, Brazil, ³Federal University of Viçosa, MG, Brazil.

This study aimed to evaluate the effect of crude protein (CP) and for essential amino acids:nonessential amino acids (EAA:NEAA) diet on nitrogen balance in broiler chickens from 18 to 21 d. A total of 480 Cobb broiler chicks, males, distributed in a completely randomized design with 4 treatments and 6 replicates of 20 birds. Was formulated a diet with 18% CP supplemented with lysine, methionine, threonine, arginine, valine, isoleucine, glycine and tryptophan, to meet the requirements of amino acids (AA) digestible. After the formulation, there was the delivery of EAA in total AA (TAA). Added to the total amount of EAA was calculated and compared with the level of dietary protein, considering this value as AAT. Were considered EAA: lysine, methionine + cystine, threonine, arginine, valine, tryptophan, isoleucine, leucine, phenylalanine, histidine and glycine. The other treatments were formed from glutamate supplementation to achieve levels of 19, 20 and 21% CP. Starch, oil and gravel were used in animal feed to make them isocaloric. Relations EAA:NEAA diets with 18, 19, 20 and 21% CP were 55:45, 52:48, 49:51 and 47:53, respectively. In the period of 18 to 21 d were collecting excreta and feed intake was measured for the determination of consumption, excretion and retention of N. It was observed linear increase in the consumption and excretion of N with increasing levels of dietary CP. No significant levels of CP level on N retention by the birds, however, the retention efficiency of N responded quadratically with increasing CP, being higher in the diet with 19% CP ($y = -403.77 + 49.414x - 1.3025x^2$; $r^2 = 0.98$). Diet with 19% CP and EAA:NEAA ratio of 52:48 is recommended in diets for broilers from 8 to 21 d.

Key Words: ideal protein, N excretion, N retention

M209 True ileal amino acid digestibility and protein utilization in broilers fed various levels of canola meal and phytase. C. Kong^{*} and O. Adeola, *Purdue University, West Lafayette, IN.*

A total of 384 broiler chicks were used in a 14-d trial to examine the effect of levels of canola meal (CM, 387.5 g/kg CP) and microbial phytase on ileal amino acid (AA) digestibility and protein utilization of broilers. Experimental treatments consisted of 2 factors including phytase at 2 levels (0 or 1500 FTU/kg) and CM at 3 levels (125, 250, or 375 g/kg). The birds received standard starter diet from d 1 to 7 and the assay diet from d 8 to 22. On d 8, birds were allocated to 6 dietary treatments in a randomized complete block design and excreta were collected

for both body weight gain and feed conversion ratio. There was no significant ($P < 0.05$) effect of the added Met level on feed intake, body weight and feed conversion ratio. Regressions of CM-associated digestible AA intake against AA intake without or with phytase were used for determination of true ileal AA digestibility of CM. There was a significant phytase effect ($P < 0.05$) for true ileal digestibility of all indispensable AA except for histidine. On d 15 and 22, there was a linear increase ($P < 0.05$) in N retention as CM increased from 0 to 375 g/kg, whereas there was a linear decrease ($P < 0.05$) in P retention, regardless of phytase addition. Weight gain (WG), feed intake, protein gain (PG), and protein intake (PI) linearly increased ($P < 0.01$) with increasing CM level regardless of phytase supplementation and experimental period. There were phytase effects ($P < 0.05$) on WG and protein efficiency ratio (PER) on d 15, whereas there were phytase effects ($P < 0.05$) on WG and PG on d 22. On d 15, there was a linear increase ($P < 0.01$) in net protein utilization (NPU) of the diets with phytase, whereas on d 22, there was a linear increase ($P < 0.05$) in NPU regardless of phytase supplementation. In conclusion, the result of this study indicated that phytase supplementation improves the true ileal digestibility of indispensable AA and WG, whereas PER was only improved on d 15 by addition of phytase.

Key Words: phytase, true ileal digestibility, protein utilization

M210 Separate response to lysine and methionine in broiler grower diets. C. Lu^{*1}, C. A. Coto¹, A. Karimi², J. H. Park¹, Y. Min¹, and P. W. Waldroup¹, ¹University of Arkansas, Fayetteville, ²University of Kurdistan, Kurdistan, Iran.

A study was conducted to evaluate the separate response to Lysine (Lys) and to Methionine (Met) in diets on live performance of young broiler chickens during the grower period of 14–35 d. Corn and soybean meal were used to formulate basal diets to provide 0.80 to 1.30% digestible Lys in increments of 0.10%. The mean of suggested amino acid ratios to Lys suggested by literature values was used in formulation according to the ideal protein concept. All amino acids other than Met and TSAA were calculated to meet or exceed the expected ratio to Lys. Experimental diets were prepared by addition of variable amounts of MHA (84% of Met) and cornstarch to the Lys basal diets to provide increments of 0.03% up to 0.21% supplemental Met activity for each level of digestible Lys. Two consecutive trials using the same experimental diets were conducted with identical design. Each of the 48 test diets was fed to 2 replicate pens of each trial at 14 d. Body weights by pen were obtained at 14, 28 and 35 d of age with feed consumption determined during the test period. During the period of 14 to 28 d, there were significant effects of the dietary Lys and added Met levels on BWG and FCR, with optimal digestible Lys level $\geq 0.90\%$ for BWG and $\geq 1.30\%$ for FCR. The optimal level of added Met during this period is $\geq 0.09\%$ (total Met ≥ 0.33) and $\geq 0.12\%$ (total Met ≥ 0.43) for BWG and FCR, respectively. During the period of 28 to 35 d, there were significant effects of the dietary Lys and added Met levels on BWG and FCR, with optimal digestible Lys level $\geq 1.00\%$ for BWG and $\geq 1.30\%$ for FCR. The optimal level of added Met during this period is $\geq 0.18\%$ for both BWG (total Met ≥ 0.38) and FCR (total Met ≥ 0.49). No significant interactions between Lys and Met were observed based on BWG and FCR during each of the 2 periods. Results of this study suggest that the response to variation in Lys is a response to itself but not to Met in broiler grower diets.

Key Words: broilers, lysine, methionine

M211 Digestible arginine:lysine ratios for broilers during the starter and finisher periods. A. Campos¹, E. T. Nogueira², L. F. Albino¹, and H. S. Rostagno*¹, ¹Federal University of Viçosa, Viçosa, MG, Brazil, ²Ajinomoto of Brazil/Ajinomoto Animal Nutrition, Sao Paulo, SP, Brazil.

The ideal protein concept requires all amino acids to be present in exact levels to provide for maintenance and protein deposition. Arginine (Arg) is an essential amino acid for poultry and also related to immune functions. Little information has been reported on digestible Arg:Lys ratios for starter and finisher broilers. Two experiments were carried out to evaluate digestible Arg:Lys ratios for male Cobb 500 broilers in 2 periods: 7 – 21 (starter) and 28 – 40 (finisher) days of age. A total of 1000 starter and 800 finisher broilers were distributed in a completely randomized experimental design with 5 digestible Arg:Lys ratios and 8 replicates of 25 and 20 birds per experimental unit (pen) in the starter and finisher period, respectively. Diets were formulated to meet or exceed the nutritional requirements in both periods, except for digestible Lys (1.08% and 0.98% for the starter and finisher periods, respectively). Digestible Arg:Lys ratios of 95 (1,026% dig Arg), 100, 105, 110, and 115% were used in the starter period, whereas ratios of 91 (0.892% dig Arg), 98, 105, 112, and 119% were used in the finisher period. Statistical analysis using different models (quadratic, 95% of the quadratic peak, broken line and quadratic and plateau) were applied to the performance data. In the starter period, weight gain and feed conversion presented a quadratic response ($P < 0.05$) to Arg:Lys ratios, as described by the equations $Y = -1530.57 + 39.174 \text{ Arg} - 0.1742 \text{ Arg}^2$ ($R^2 = 0.96$) and $Y = 5.047 - 0.0649 \text{ Arg} + 0.00029 \text{ Arg}^2$ ($R^2 = 0.98$), respectively. In the finisher period, there was a quadratic effect ($P < 0.05$) on weight gain ($Y = -926.96 + 38.09 \text{ Arg} - 0.172 \text{ Arg}^2$; $R^2 = 0.94$) and feed conversion ($Y = 4.323 - 0.0468 \text{ Arg} + 0.000205 \text{ Arg}^2$; $R^2 = 0.95$). These results suggest that a dietary Arg:Lys ratio of 108% is adequate for optimal performance of broiler chickens during the starter and finisher periods.

Key Words: arginine, lysine, performance

M212 Effect of a mono component protease on true amino acid digestibility of a corn and soybean meal diet for chicks. R. K. G. Messias¹, L. F. T. Albino¹, J. O. B. Sorbara², and H. S. Rostagno*¹, ¹Universidade Federal de Viçosa, Viçosa, MG, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

Today the utilization of feed additives that improve performance and reduce the impact of pollution generated by intensive broiler chicken production is a concern of every poultry nutritionist. A digestibility trial was conducted to determine the effect of a mono component protease on true ileal amino acid digestibility (TAAD) of a corn and soybean meal diet. The trial was conducted with 168 male chickens placed on 28 wire cages from 12 to 22 d of age, in a complete randomized experimental design with 4 treatments (a corn soy diet and a protein free diet with and without protease supplementation) with 6 replicates of 7 birds each. The mono component protease used was RONOZYME ProAct with 75000 Prot Units/g product (dose of 200 ppm). Acid insoluble ash (Celite) was added to all diets as inert marker. Feed and water were provided ad libitum. At 22 d of age all birds were sacrificed and ileum content collected. Digesta samples were freeze-dried at -40°C for 72 h. The protease improved ($P < 0.05$) TAAD by 4%, 2%, 6%, 11%, 11%, 10%, 6%, 6%, 1%, 5%, 17%, 9%, 6%, 6% and 9% for Lys, Met, M+C, Thr, Val, His, Arg, Ile, Phe, Gly+Ser, Asp, Glu, Ala, Pro and Tyr, respectively. The essential TAAD of the corn soybean basal diet was increased on average 6% by the enzyme supplementation.

Key Words: enzyme, broiler, digestibility

M213 Performance of white commercial layers fed with different of threonine: lysine ratio. F. G. P. Costa*¹, M. R. Lima¹, E. T. Nogueira², L. Sá², J. H. V. Silva¹, H. S. Rostagno³, C. C. Goulart¹, R. B. Souza¹, S. A. N. Morais¹, and G. S. Lima¹, ¹Federal University of Paraíba, Areia, PB, Brazil, ²Ajinomoto Animal Nutrition, Sao Paulo, SP, Brazil, ³Federal University of Viçosa, MG, Brazil.

The reduction of the crude protein levels of the diets of the commercial layers causes damages to the productive performance, therefore it can make with that other amino acids if become considerably with limits of performance, as the threonine and the tryptophan, for example, thus compelling a supplementation with industrial sources of these amino acids. On the basis of this, this study intended to evaluate the nutritional requirements in digestible threonine for white layer in initial phase of production, being used itself diets with different relations threonine digestible: digestible lysine on the basis of the parameters of productive performance of white commercial layers. A total of 288 chickens with 29 weeks, distributed in delineation randomized, with 6 treatments, 6 repetitions, with 8 birds for experimental unit. The diets had consisted of a basal diet, where the evaluated levels had been 0.446, 0.486, 0.526, 0.565, 0.605 and 0.645% of digestible threonine, generating the threonine digestible: digestible lysine ratios 56, 61, 66, 71, 76 and 81%. With a quadratic behavior, the egg production improved until relation 76%, in accordance with the regression ($\hat{Y} = -0.0112x^2 + 1.6896x + 30.352$; $r^2 = 95$), the maximum point, that is, the best digestible threonine: digestible lysine was 75.43%. For the egg weight (EW), egg mass (EM) and egg mass conversion (EMC), the behavior was similar to the one of the egg production, where its regressions (EW: $\hat{Y} = -0.006x^2 + 0.8728x + 33.256$; $r^2 = 86$; EM: $\hat{Y} = -0.0149x^2 + 2.1964x - 19.562$; $r^2 = 80$; EMC: $\hat{Y} = 0.0005x^2 - 0.0728x + 4.5332$; $r^2 = 96$), had esteem the best relations in 72.73, 73.70 and 72.80%, respectively. These results corroborate with research that evidences the importance of the threonine in the metabolism of the chickens and that its daily necessities of this amino acid had grown with passing of the years and this, conclude that the excellent digestible threonine: digestible lysine ratio for white commercial layers in initial phase of production is of 75%.

Key Words: amino acid, ideal protein, performance

M214 Digestible valine:lysine and isoleucine:lysine ratios for brown egg laying hens. G. Lelis¹, E. T. Nogueira², L. F. Albino¹, and H. Rostagno*¹, ¹Federal University of Viçosa, Viçosa, MG, Brazil, ²Ajinomoto of Brazil/ Ajinomoto Animal Nutrition, São Paulo, SP, Brazil.

When formulating minimum cost diets for laying hens it is essential to supply enough valine (Val) and isoleucine (Iso) to allow the hens to express their maximum genetic potential. Val or Iso deficiency may decrease the efficiency of the utilization of methionine + cystine and lysine (Lys), which are the first and second limiting amino acids in layer diets. Two experiments were carried out simultaneously to evaluate 3 digestible Val:Lys and Iso:Lys ratios for brown egg laying hens. In each trial a total of 180 Dekalb Brown layers (25– to 37–wk–old) were evaluated during 3 periods of 28 d with 3 treatments and 10 replicates of 6 birds per experimental unit. The following digestible Val:Lys ratios were tested: 84 (0.554% dig Val), 90 and 96%. The Iso:Lys ratios evaluated were 67 (0.442%), 75 and 83%. To prevent excess, digestible Lys level (0,660%) was calculated to supply 93% of the Brazilian Tables (Rostagno et al., 2005) recommendation. A positive control treatment (60 layers; 0.706% dig Lys; 0.633% dig Val and 0.548% dig Iso) was included to show that Lys was the second limiting amino acid in both experiments. Layers fed the positive control diet presented the best performance when compared with those fed the Val:Lys and Iso:Lys diets. During the period of 25 to 37 weeks, there was a linear response

to the dietary Val:Lys ratios as to egg production ($P < 0.002$) (%/bird/day $Y = 31.445 + 62.135 \text{ Val}$; $R^2 = 0.99$) and egg mass ($P < 0.001$) (g egg/bird/day $Y = 12.056 + 41.562 \text{ Val}$, $R^2 = 0.93$). Laying hens fed diets containing different Iso:Lys ratios presented quadratic response ($P < 0.05$) for the following parameters: egg production (%/bird/day) and egg mass (g egg/bird/day). Based on the evaluated parameters, the digestible Val:Lys and Iso:Lys ratios recommended for brown egg laying hens are 96% and 79%, respectively.

Key Words: valine, isoleucine, brown egg hens

M215 Influence of diet formulation technique on requirements of sulfur amino acids and lysine to brown egg laying hens. J. H. V. Da Silva^{*1,2}, P. B. Lacerda¹, D. V. Gonçalves Vieira², C. T. Silva², J. J. Filho¹, M. L. G. Ribeiro¹, J. M. B. De Souza¹, J. A. De Araújo¹, E. L. Da Silva¹, and F. G. Perazzo Costa², ¹CCHSA-Universidade Federal da Paraíba, Bananeiras, Paraíba, Brazil, ²CCA-Universidade Federal da Paraíba, Areia, Paraíba, Brazil.

Three trials were carried out to evaluate the influence of 2 techniques of diet formulation on the requirements of amino acids and the relationship Met+Cys: Lys utilizing brown egg laying hens as biologic model. The first technique consisted of simultaneous supplementation of a reference diet (RD) deficient in Met+Cys and Lys with industrials sources of these amino acids, maintaining a constant relationship between these amino acids in 0,85 and the second technique consisted of RD deficient in one amino acid. Each trial was developed in a completely randomized design and involved 180 birds with 18 weeks of age and initial live weight of 1.64 kg. In trial one a RD deficient in Met+Cys and Lys was supplemented to provide levels of these amino acids of 0.55 and 0.64%; 0.62 and 0.72%; 0.69 and 0.81%; 0.76 and 0.88%; and 0.83 and 0.96%. In trial 2 the RD deficient only in Met+Cys was supplemented to provide 0.55; 0.62; 0.69; 0.76 and 0.83% Met+Cys, and in trial 3, the RD deficient only in Lys was supplemented to provide 0.64; 0.68; 0.72; 0.76; 0.80; 0.84 and 0.88 of Lys. All trials were divided into 6 periods of 28 d. In trial one the requirements of Met+Cys were 0.67% and Lys 0.79%. In trial 2 the requirement of Met+Cys was 0.65% and in trial 3 Lys was 0.76%. According the results Met+Cys and Lys requirements increased when the relationships between amino acids was maintained at 0.85. However, the relationship Met+Cys: Lys remained unchanged considering the estimates values from trials 2 and 3. These results suggest that the technique of formulating diets influences the amino acid requirements of birds but not the Met+Cys: Lys relationship.

Key Words: egg production, experimental method, nutritional interrelation

M216 Amino acid digestibility in corn, soybean meal, field peas, and corn co-products fed to weanling pigs. G. I. Petersen^{*} and H. H. Stein, *University of Illinois, Urbana.*

Several alternative feedstuffs are available for use in weanling pig diets, but the standardized ileal digestibility (SID) of AA in most ingredients have not been measured in weanling pigs. The objective of the present experiment, therefore, was to measure the SID of AA in corn, soybean meal, corn gluten meal, high protein distillers dried grains, and field peas fed to weanling pigs. Twelve weanling barrows (initial BW: 10.3 ± 0.9 kg) were prepared with a cannula in the distal ileum and randomly allotted to a replicated 6×6 Latin square design with 6 diets and 6 periods in each square. Five diets were formulated using corn, soybean meal, corn gluten meal, high protein distillers dried grains, or field peas as the sole source of protein and AA. An N-free diet that was used to calculate basal endogenous losses of AA and protein was also

formulated. Chromic oxide was included in all diets as an indigestible marker. All pigs were fed each diet for 7 d and ileal digesta were collected during the last 2 d of each period. Samples were lyophilized and analyzed for CP and AA and the SID of all AA were calculated according to standardized procedures (Table 1). It is concluded that the SID of all AA in corn gluten meal is similar to that in soybean meal, but high protein distillers dried grains have SID values for AA that are less than in both corn and soybean meal.

Table 1. Standardized ileal digestibility of AA in corn, soybean meal, corn gluten meal, high protein distillers dried grains, and field peas

	Corn	Soybean meal	Corn gluten meal	High protein distillers dried grains	Field peas
Ile	81.6 ^b	87.0 ^{ab}	88.2 ^a	72.0 ^c	82.2 ^b
Lys	75.9 ^b	86.6 ^a	84.5 ^{ab}	56.0 ^c	85.1 ^a
Met	86.4 ^a	88.2 ^a	90.4 ^a	80.9 ^b	79.7 ^b
Thr	75.7 ^b	83.7 ^{ab}	86.5 ^a	64.9 ^c	79.0 ^{ab}
Trp	85.0 ^{ab}	88.1 ^a	88.9 ^a	75.6 ^c	78.9 ^{bc}
Val	81.4 ^b	86.3 ^{ab}	88.0 ^a	70.8 ^c	81.2 ^b

^{abc}Means lacking common superscript in same row are different ($P < 0.05$).

Key Words: corn co-products, pigs, standardized ileal amino acid digestibility

M217 Pyrolic infusion of arginine increases portal vein blood flow in growing pigs. S. W. Kim^{*1}, M. I. Perret-Gentil², M. W. Hart³, and R. D. Mateo⁴, ¹North Carolina State University, Raleigh, ²The University of Texas at San Antonio, ³Georgia State University, Atlanta, ⁴Texas Tech University, Lubbock.

This study was conducted to test if dietary arginine would affect portal vein blood flow (PVBF) in growing pigs. Two pigs (26.3 ± 0.6 kg BW), surgically fitted with catheters into the carotid artery (CA), portal vein (PV), mesenteric vein (MV), and pyloric region of the stomach (PL), were allotted to 2×2 Latin square design with 2 treatments: Injection of arginine-HCl (ARG); and injection of L-alanine (CON) through the PL catheter and with 2 periods (72-h intervals). Alanine was used as a non-specific nitrogen source in CON matching the contribution of nitrogen from arginine in ARG. Each period was composed of 48-h feeding ($0.09 \text{ kg} \times \text{BW}^{0.75}$), 19.5-h fasting, and 4.5-h infusion. A corn-soybean meal based diet with 18.2% CP and 3.35 Mcal ME/kg but without supplemental arginine was fed to pigs for 48 h before fasting. Para-aminohippuric acid (PAH) was infused (3.2 mg/min) into MV for a 4.5 h period. L-arginine-HCl (19 g) and L-alanine (32 g) was mixed with 100 mL distilled water and injected into the lumen of PL catheter 60 min after beginning the PAH infusion period. Blood samples (3 mL) were collected simultaneously from CA and PV catheters at -60, -30, 0, 15, 30, 45, 60, 90, 120, 150, and 210 min relative to injection to measure PAH concentration in the plasma. The PVBF rate (L/min) was calculated by $\text{PAH infusion rate (mg/min)} / ([\text{PAH}]_{\text{PV}} - [\text{PAH}]_{\text{CA}})$ (mg/L). Blood flow before the injection was averaged 1.85 ± 0.23 L/min. After injection, average increase in PVBF of ARG (1.66) tended to be greater ($P = 0.09$) than PVBF of CON (-0.14) during the entire 210 min. Increase in PVBF of ARG was greater ($P < 0.05$) than PVBF of CON at 60 (6.05 vs. -0.20) and 90 (3.40 vs. -0.77) min after the injection. Increase in PVBF occurred ($P < 0.05$) at 60 min and maintained until 90 min after injection of arginine whereas injection of alanine did not increase PVBF during the 210 min period. This study suggests that

one time dose of arginine can have a short-term increase in PVBF in growing pigs.

Key Words: arginine, blood flow, pigs

M218 Apparent and standardized ileal digestibilities of amino acids for pigs fed corn-soybean meal-based diets at varying crude protein levels. H. Zhai* and L. Adeola, *Purdue University, West Lafayette, IN.*

A study was conducted to determine the effect of CP level on apparent (AID) and standardized ileal digestibility (SID) of AA. Six pigs (initial BW 47.1 ± 0.97 kg) fitted with T-cannula at distal ileum were fed 6 diets for 6 periods in a 6×6 Latin square design. The 6 diets consisted of a nitrogen-free diet and 5 corn-soybean meal-based diets that contained 5 CP levels at 6.8, 10.5, 14.1, 17.7, and 21.4%. Each period consisted of a 5 d of adjustment period and 2 of ileal digesta collection for 10 h on each of d 6 and d 7. The ratio of corn:soybean meal was fixed at 3 to 2 by weight and cornstarch was added to dilute the CP concentration. Chromic oxide was included at 0.5% as an indigestible marker. The results showed basal endogenous loss ranged from 65 mg/kg DMI for Met to 3,104 mg/kg DMI for Pro. Proline and Gly (1,053 mg/kg DMI) were the 2 most abundant endogenous AA in endogenous flow and together accounted for approximately 43% of the total endogenous AA flow. The AID were 80.9 to 84.7%, 85.1 to 87.4%, 72.9 to 79.5%, and 86.5 to 87.9% for Lys, Met, Thr, and Trp individually with corresponding SID being 86.6 to 88.6%, 87.5 to 90.3%, 82.7 to 86.8%, and 90.2 to 93.6% as dietary CP increased from 6.8 to 21.4%. There were linear increases in AID of N, Arg, Ile, Val, Thr, Gly and Tyr ($P < 0.05$) as CP increased and linear decreases in SID of Leu, Trp, Asp, Cys, and Glu ($P < 0.05$). Both linear and quadratic effects were observed in AID and SID for Pro ($P < 0.05$). In conclusion, the protein levels in corn-soybean meal diets evaluated in the current study affected SID of the indispensable AA Leu, Phe, and Thr and the dispensable AA Gly, Pro, and Tyr.

Key Words: amino acid, apparent ileal digestibility, standardized ileal digestibility

M219 Influence of total lysine level provided during the finishing period on carcass, meat and fat characteristics of heavy barrows and gilts. M. A. Latorre*¹, J. A. Rodríguez-Sánchez², M. Blanco², M. A. Sanz², and M. Joy², ¹Universidad de Zaragoza, Spain, ²CITA de Aragón, Zaragoza, Spain.

A total of 120 Duroc \times (Landrace \times Large White) pigs were used to study the influence of gender and lysine content during the finishing period on carcass, meat and fat characteristics. The experimental diets were based on corn, barley, wheat, and soybean meal diets, contained 2,280 Kcal NE/kg and 13.5% CP and were provided from 100 to 130 kg BW. There were 6 treatments with 2 genders (barrows and gilts) and 3 total lysine levels (0.70, 0.65 and 0.60%). Each treatment was replicated 4 times and the experimental unit was the pen constituted by 5 pigs allocated together. No significant interaction between gender and dietary treatment was detected. Carcasses from barrows had similar ($P > 0.05$) carcass yield but were ($P < 0.001$) heavier and fatter at the level of *gluteus medius* muscle (GM) than carcasses from gilts. The total weight of trimmed lean cuts (shoulder+ham+loin+sirloin) were heavier ($P < 0.01$) in barrows than in gilts but the yield was similar ($P > 0.05$). Meat from barrows had higher ($P < 0.05$) intramuscular fat content but lower ($P < 0.05$) protein content than meat from gilts. Subcutaneous fat from barrows had higher ($P < 0.05$) content in saturated fatty acids and lower ($P < 0.01$) in unsaturated fatty acids than that from gilts. The reduction in total lysine content in diet did not modify ($P > 0.05$) the

weight and yield of carcass and main lean cuts but fat thickness at the GM muscle tended to increase ($P < 0.10$). Meat characteristics were not affected by dietary treatment but saturated fatty acids tended ($P < 0.10$) to increase and monounsaturated fatty acids tended ($P < 0.10$) to reduce as lysine content reduced. It is concluded that any effect of dietary treatment was independent of gender. The effect of reducing total lysine content provided during the finishing diet on carcass, meat and fat quality of pigs were scarce. However, a decrease of lysine levels from 0.70 to 0.60% could be interesting in the case of pigs intended for dry-cured products when a minimum carcass fat thickness is a criterion to choose the carcasses.

Key Words: lysine, carcass and meat quality, pigs

M220 Comparison of amino acid digestibility of corn, corn distillers dried grains with solubles (DDGS), meat and bone meal (MBM), and poultry-by-product meal (PBPM) determined with the precision-fed cecectomized rooster assay and the standardized ileal amino acid digestibility chick assay. E. J. Kim*¹, P. L. Utterback¹, T. J. Applegate², and C. M. Parsons¹, ¹University of Illinois at Urbana-Champaign, Urbana, ²Purdue University, West Lafayette, IN.

The objective of this study was to evaluate and compare the standardized amino acid digestibility (SAAD) of several feedstuffs using 2 commonly accepted methods; the precision-fed cecectomized rooster assay (PFR) and the standardized ileal amino acid chick assay (SID). To carry out these objectives, 17 different feedstuffs were obtained. These samples included 6 corn, 6 corn distillers dried grains with or without solubles (DDGS/DDG), 2 meat and bone meal (MBM) and a poultry-by-product meal. The SAAD varied among the feed ingredients and among samples of the same ingredient. For corn, there were generally no differences in SAAD between the 2 bio-assay methods. When differences did occur, there was no consistent pattern among the individual amino acids due to bio-assay methods. The SAAD was not different between the 2 methods for the 4 DDGS samples; however, the PFR did yield greater SAAD for a high protein DDG and a conventionally processed DDGS. The PFR yielded greater SAAD values than the SID for several amino acids in one MBM and the poultry-by-product meal, but it yielded lower SAAD values for the other MBM. Overall, there were no consistent differences between methods for SAAD values.

Key Words: amino acid digestibility methods, roosters, chicks

M221 Feeding a diet containing specific excess amino acids minimizes the reduction in performance and carcass traits associated with an inflammatory response. A. Diaz¹, M. Raymond¹, R. Angel², and B. D. Humphrey*¹, ¹California Polytechnic State University, San Luis Obispo, ²University of Maryland, College Park.

The objective of this experiment was to determine the effect of feeding specific amino acids in excess of their growth requirement on performance and carcass traits during an inflammatory response. Male Cobb 500 hatchlings were raised in pens ($n = 15$ chicks/pen) for 14 d and were fed a diet that met NRC requirements. On d 14, birds were fed 1 of 2 diets ($n = 20$ /diet) that contained either adequate (A) or excess (E) amino acid levels. A and E diets were similar, except the E diet contained excess Phe (+0.43%), Trp (+0.14%), Thr (+0.30%) and Arg (+0.35%). On d 21 (0 h), half of the pens per dietary treatment ($n = 10$) were not injected or injected with 1 mg/kg BW of *E. coli* lipopolysaccharide (LPS). At 0, 3, 6, 9, 12, 15, 18, 21, 24, 48, 72, 96, 120, 144 and 168 h pen and feeder weights were measured and one bird per pen was sampled for determination of organ and carcass traits. LPS-injected chicks fed the E diet consumed 6.3% more feed from 0 to 168 h compared with chicks fed

the A diet ($P < 0.05$). LPS-injected chicks fed the E diet had 28% higher gain from 0 to 168 h compared with LPS-injected chicks fed the A diet ($P < 0.05$). LPS-injected chicks fed the E diet had lower feed conversion from 0 to 164 h compared with A chicks ($P < 0.05$). LPS-injected chicks fed the E diet had 7.4% higher body weights at 168 h compared with LPS-injected chicks fed the A diet ($P < 0.05$). Relative visceral weight was 12.2% higher in LPS-injected chicks fed the E diet compared with LPS-injected chicks fed the A diet ($P < 0.05$). At 168 h, absolute and relative pectoralis weight were higher in LPS-injected chicks fed the E diet compared with LPS-injected chicks fed the A diet ($P < 0.05$). These data indicate that feeding specific amino acids in excess of the growth requirement may help to mitigate the reductions in performance and carcass traits associated with an inflammatory response.

Key Words: amino acid, inflammation, pectoralis

M222 Amino acid digestibility of various feedstuffs of plant and animal origin using three different methods. E. J. Kim*, C. M. Jacobs, P. L. Utterback, and C. M. Parsons, *University of Illinois at Urbana-Champaign, Urbana*.

The objective of this study was to determine and compare amino acid (AA) digestibility of 3 distillers dried grains with soluble (DDGS), a corn gluten meal (CGM), canola meal, and a fish meal samples using the precision-fed cecectomized rooster assay (PFR), the standardized ileal assay (SID), and a newly developed precision-fed chick assay (PFC). For the PFR, after a 24 h feed withdrawal period, cecectomized roosters were precision-fed approximately 30 g of feed sample and excreta were collected for 48 h post-feeding. For the SID, 16 d-old broiler chicks were fed a semi-purified diet containing the feed samples from 17 to 21 d, with ileal digesta collected at 21 d. For the PFC, after a period overnight feed withdrawal, 22 d-old chicks were precision-fed 10 g of sample mixed with chromic oxide and ileal digesta were collected at 4 h post-feeding. Digestibility coefficients were standardized using a nitrogen-free diet (NFD) for the SID and PFC and using fasted roosters for the PFR. When 3 DDGS samples were evaluated, the PFR produced higher digestibilities than the PFC for all 3 DDGS samples for most of the amino acids. When comparing the PFR and the SID, the PFR yielded higher values than the SID for one DDGS, whereas there was no significant difference between the 2 methods for the other 2 DDGS samples. For the CGM, the PFR yielded significantly higher amino acid digestibilities than the SID and PFC for the majority of the amino acids. For canola meal, the PFR generally yielded greater amino acid digestibilities than the PFC with the SID yielding intermediary values. Differences did occur among methods for amino acid digestibility in fish meal; however, these differences were not consistent among methods or amino acids. The results of this study indicated there were differences among standardized amino acid digestibility values for the PFR, SID, and PFC in some instances but that the differences were not consistent among methods.

Key Words: amino acid digestibility methods, ileal digestibility, roosters and chicks

M223 Effect of the use of L-valine and metabolizable energy levels of diet on nitrogen intake, retention and apparent excretion in broilers. F. G. P. Costa*¹, C. C. Goulart¹, E. T. Nogueira², M. Kutschenko², J. H. V. Silva¹, V. P. Rodrigues¹, G. B. V. Lobato¹, and R. C. L. Neto¹, ¹*Federal University of Paraiba, Areia, PB, Brazil*, ²*Ajinomoto Animal Nutrition, Sao Paulo, SP, Brazil*.

The experiment was conducted at the Agrarian Sciences Center of UFPB, Brazil. The aim was to evaluate the effect of the use of L-valine

(VAL) and metabolizable energy (ME) levels of diet on nitrogen (N) intake, retention and apparent excretion in broilers from 1 to 42 d. Seven hundred and 20 male broiler chicks were distributed in completely randomized design, in factorial scheme 2×3 (without or with VAL \times 3 ME levels). To the treatments 1, 2 and 3, only L-lysine, DL-methionine and L-threonine were added, which allowed CP to attend digestible amino acids ratio, and the ME varied -50 , 0 and $+50$ kcal/kg, respectively, according to the requirements for each stage of creation. In treatments 4, 5 and 6 was also added VAL, resulting in a CP reduction, and ME was similar to that in the previous treatments. N retention was determined by the difference in body N content of the birds at 42 d (2 birds per pen, ground whole, with feathers) and an additional group with 15 chicks 1 d old, used to determine the initial N content. The apparent N excretion was determined by the difference between N intake (N content of diet \times feed intake) and N retention. The N retention was always higher in birds fed diet with VAL (79.6 vs 75.2 g/bird). Assessing the levels of ME within each diet, it was found that for birds fed diets without VAL, the diet with -50 kcal/kg reduced N retention. However, when the VAL was used the greater N retention was observed with the highest ME level. The apparent N excretion was lower with the diet with VAL, for any ME levels evaluated (46.3 vs. 56.7 g/bird). For the VAL-free diet, the lowest N excretion was observed at the intermediate ME level and for the diet with VAL, the lowest N excretion was observed with the diet with $+50$ kcal. It is concluded that the use of VAL and increase of 50 kcal of ME/kg in diet improves N retention and reduces N excretion to the environment.

Key Words: amino acids, body protein, ideal protein

M224 Effect of the use of L-valine and metabolizable energy levels of diet on body composition of broilers. F. G. P. Costa*¹, C. C. Goulart¹, E. T. Nogueira², M. Kutschenko², J. H. V. Silva¹, V. P. Rodrigues¹, and R. C. L. Neto¹, ¹*Federal University of Paraiba, Areia, PB, Brazil*, ²*Ajinomoto Animal Nutrition, Sao Paulo, SP, Brazil*.

The experiment was conducted at the Agrarian Sciences Center of UFPB, Brazil. The aim was to evaluate the effect of the use of L-valine (VAL) and metabolizable energy (ME) levels of diet on body composition of broilers at 42 d old. Seven hundred and 20 male broiler chicks were distributed in completely randomized design, in factorial scheme 2×3 (without or with VAL \times 3 ME levels). To the treatments 1, 2 and 3, only L-Lysine, DL-Methionine and L-Threonine were added, which allowed CP to attend digestible amino acids ratio, and the ME varied -50 , 0 and $+50$ kcal/kg, respectively, according to the requirements for each stage of creation. In treatments 4, 5 and 6 was also added VAL, resulting in a CP reduction, and ME was similar to that in the previous treatments. At 42 d 2 birds per pen were selected, killed by cervical dislocation after fasting for 24 h and ground whole (with feathers) to body composition analysis. There was an interaction between the use of VAL and ME levels for percentages of protein (%CP), fat (%EE) and water body, while the percentage of ash was not influenced by treatments (expressed in % as-fed). In diets without VAL the largest body %CP (17.1%) was found with the intermediate ME level and lower %CP (15.9%) with the lowest ME level. At the lowest ME level the body %CP was higher in birds fed diets with VAL in relation to those fed diets without VAL (17.5 vs. 15.9%), with no differences between the higher ME levels. This shows that in birds fed diets with VAL, the lowest level of CP and consequent reduction of excess amino acids to be excreted, resulting in less need of ME than diets without VAL. At the intermediate ME level, body %EE was higher when using a diet with VAL (12.8 vs. 10.3%). Using diets without VAL the lowest %EE (10.3%) was observed in intermediate ME level. It is concluded that

VAL can be used in diets with a reduction of 50 kcal in ME without harming the body composition of broiler chickens.

Key Words: body fat, body protein, ideal protein

M225 Different protein and conjugated linolenic acid levels on broilers diets. T. Previero¹, C. J. C. Castillo², N. B. Petroli¹, R. Albuquerque³, C. S. S. Araujo^{*4}, and L. F. Araujo¹, ¹University of Sao Paulo, Pirassununga, SP, Brazil, ²University of Sao Paulo, Piracicaba, SP, Brazil, ³University of Sao Paulo, Sao Paulo, SP, Brazil, ⁴Poultry Nutritionist, Pirassununga, SP, Brazil.

The objective of this research was to study the effects of the conjugated linoleic acid, known as CLA, associated with reduction of crude protein (CP) level in broiler diets. An experiment was conducted from 21 to 41 d, using 1440 male broilers Ross, with the same weight initial, which were allocated according to a completely randomized design, with factorial model 3x3, corresponding in 3 CLA inclusions levels (0%, 0.5% and 1.0%) and 3 CP levels (19%, 17%, 15%). Data were statistically evaluated by GLM. Weight gain reduction and increased feed conversion were only related to decrease of CP level. Carcass and breast meat yields decreased due to the reduction of CP addition in diets ($P < 0.05$). The interaction between CLA and CP factors modified liver size, and both elevated the abdominal fat ($P < 0.05$). In relation to parameters analyzed in breast samples, the pH elevated proportionally to CP inclusion, the redness and yellowness were modified by CP or CLA addition and interaction of both were detected to luminosity parameter ($P < 0.05$). About fatty acid composition, the addition of CP only elevated the stearic acid and CLA inclusion improved the saturated fatty acid levels and reduced the monounsaturated fatty acid levels ($P < 0.05$). An improvement on incorporation of CLA isomers was verified due to more inclusion of this product in 19% or 17% CP diets ($P < 0.05$). In the case of 15% CP diets, the incorporation of CLA isomers had a maximum limit. Reduction on CP can affect negatively and CLA can improve carcass parameters and carcass quality, respectively.

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Key Words: carcass quality, fatty acids, performance

M226 Effect of dietary arginine, glutamine, and tryptophan on growth performance, gut morphology, and meat quality of broilers. S. J. Park^{*1}, C. Z. Alvarado¹, and S. W. Kim², ¹Texas Tech University, Lubbock, ²North Carolina State University, Raleigh.

This study was conducted to evaluate the supplemental effects of Arg, Gln, and Trp on growth performance, gut morphology, metabolic response, and meat quality of broilers. Newly hatched birds were allotted to 4 dietary treatments (6 replicates per treatment and 6 birds per cage): C (Control); A (a diet with 0.5% L-Arg); G (a diet with 0.5% L-Gln); and T (a diet with 0.5% L-Trp). Corn and soybean meals were the major ingredients in the diets. All diets were isonitrogenous using L-Ala and isocaloric using corn oil. Birds were fed the diets for 6 wk based on a 3 phase feeding program (2 wk each). Body weight and feed intake were measured at the end of each phase. On d 11, 2 birds from each pen were killed to measure gut morphology and serum immunoglobulins (Ig). At 6 wk of age, 2 birds from each pen were killed to measure carcass characteristics. On d 11, serum IgA and IgG were not different among treatments. Heights of villus in jejunum of birds in C (65.9 μ m), A (69.8 μ m), and G (64.4 μ m) were greater ($P < 0.05$) than birds in T (59.3 μ m). Depths of crypts did not differ among treatments. At the end of wk 6, birds in A (2.55 kg), G (2.40 kg), and T (2.53 kg) were heavier ($P < 0.05$) than birds in C (2.14 kg). Feed intake and feed:gain ratio did not

differ among treatments. Hot carcass weights of birds in A (1.89 kg), G (1.75 kg), and T (1.88 kg) were greater ($P < 0.05$) than birds in C (1.56 kg). Cold carcass weights of birds in A (1.97 kg) and T (1.98 kg) were greater ($P < 0.05$) than birds in C (1.64 kg). Weights of breast meat and thigh meat of birds in A (451 and 296 g, respectively), G (427 and 267 g), and T (451 and 277 g) were greater ($P < 0.05$) than birds in C (361 and 263 g). The pH of breast meat of birds in T (6.43) was higher ($P < 0.05$) than birds in C (5.94), G (6.02), and T (5.97). Collectively, dietary supplementation of L-Arg, L-Trp, and L-Gln at 0.5% improves growth and carcass gain of birds when fed for 6 wk period.

Key Words: amino acids, broilers, growth

M227 Dietary supplementation of L-glutamine and L-glutamate or sodium butyrate during early growth of female broilers. Y. Avelaneda^{*1}, J. Hernandez¹, C. Ariza-Nieto², and G. Afanador^{1,2}, ¹Universidad Nacional de Colombia, Bogota, Colombia, ²CORPOICA, Bogota, Colombia.

This study determined the effects of dietary supplementation of a commercial mixture of L-glutamine and L-glutamate (GlnGlu) and sodium butyrate (SB) for female broiler on nutrients digestibility, intestinal morphometry and performance. Three hundred twenty-five 1-d COBB females broiler were randomly allocated to one of the 5 treatments: 0, 0.5, 1.0, 1.5% of GlnGlu and 0.07% of BS. In every treatment there were 5 replicate pens. Body weight and feed intake were recorded at 1, 8, 15 and 25 d of age. Three broilers from each treatment were randomly selected and sacrificed on d 8, 15 and 25 d. Intestinal tissues were collected at the middle part of duodenum, jejunum and ileum to measure crypt depth, villus height and width. During a 4-d balance period (21–24 d), the chicken received a diet with 0.5% chromium oxide and excreta were collected twice a day. Protein digestibility and apparent metabolizable energy (AME) value were calculated. Data were analyzed as a completely randomized design. Dietary protein digestibility was higher ($P < 0.05$) in birds fed 1.5% of GlnGlu (64.2%) compared with control group (58.3%). AME was 3170 Kcal/Kg and 3161 Kcal/Kg for broilers fed with 1.0 and 1.5% Gln+Glu, respectively. These values were higher compared with the control group (2979 Kcal/Kg, $P < 0.05$). Digestibility of organic matter was directly related to EMA values. At d 25, broilers fed 1.5% of GlnGlu showed a villi of the duodenum larger compared with the control group (1347 vs 1080 μ m) and supplemented with GlnGlu (1127 and 1116 μ m, 0.5 and 1.0% of GlnGlu, respectively) ($P < 0.05$). Female broilers fed 1.5% of GlnGlu showed a higher body weight gain compared with both control and BS groups (36, 34.0 g and 32.3 g/d, respectively). BS group presented the lowest feed intake (42.4 g/d) compared with the other treatments (49.7 g/d, on average) ($P < 0.05$). Feed conversion ratio of BS and 1.5% GlnGlu groups were significantly lower compared with the control and 0.5% GlnGlu ($P < 0.05$). It can be concluded that the supplementation with biomolecules as L-glutamine and L-glutamate showed positive effects on female broiler performance.

Key Words: L-glutamine, L-glutamate, sodium butyrate, female broiler

M228 Evaluation of the fixed crude protein conversion factor (6.25) versus ingredient-specific conversion factors. N. Sriperum^{*1}, G. M. Pesti¹, and P. B. Tillman², ¹University of Georgia, Athens, ²Ajinomoto Heartland LLC, Chicago, IL.

This study examines the validity of the historical nitrogen to crude protein conversion factor of 6.25 based upon assay values of commonly used feed ingredients, analyzed during 2009. A calculated protein level

for an ingredient should provide an indication of the amino acid content of that ingredient. Since laboratory methods for determining nitrogen content report both nitrogen from ammonia (NH₃) and from non-amino acid sources (nucleic acids, etc.), the determined crude protein value is typically over-estimated, relative to the nitrogen strictly from amino acids, the true protein. Amino acid values were collected from the Ajinomoto Heartland LLC laboratory analysis database. Ingredients evaluated included ground corn, soybean meal (dehulled, solvent extracted), corn distillers dried grains with solubles, poultry by-product meal and meat & bone meal. Data for ammonia (NH₃) and 18 individual amino acids were included in the determination of ingredient specific conversion factors. Using the nitrogen content for NH₃ and of each amino acid, along with the analyzed content of NH₃ and each amino acid within each ingredient, the average nitrogen content of each ingredient was calculated. Using these values, ingredient specific conversion factors: K_A , K_P and K (average of K_A and K_P) were determined as outlined by Mosse' (1990). It should be noted that the determined ingredient specific conversion factors were not equal to the standard 6.25% factor. Plant protein sources had higher conversion factors than animal based protein sources. An ingredient specific true protein conversion factor is proposed as being more applicable than a standard fixed factor, especially when the determined true protein content is based upon nitrogen from amino acid analysis.

Table 1. Ingredient-specific nitrogen to crude protein conversion factors

Ingredient	n	K_A	K_P	K
Ground corn	75	5.65	5.02	5.33
Soybean meal	230	5.64	5.13	5.38
Corn DDGS	188	5.74	4.98	5.36
Poultry by-product meal	45	5.45	4.81	5.13
Meat and bone meal	156	5.37	4.77	5.07

Key Words: crude protein, amino acid, corn soybean meal

M229 Effect of dietary probiotic and prebiotic on ileal nutrient digestibility of Ross broiler chickens. H. Ziaie*¹, A. Zeinali², M. Bashtani³, M. A. Karimi Torshizi⁴, G. H. Hadarabadi¹, H. Farhangfar³, and A. Nasr Abad¹, ¹Agriculture and Natural Resources Research Center, Birjand, South Khorasan, Iran, ²Ferdowsi University, Mashhad, Iran, ³Birjand University, Birjand, Khorasan, Iran, ⁴Tarbiat Moddares university, Tehran, Iran.

An experiment was conducted using 240 one-day old male Ross broiler chickens to evaluate the effect of dietary probiotic and prebiotic on ileal nutrient digestibility of Ross broiler chickens. Chicks were allocated to a randomized complete block design with 4 replicate pens (15 birds per pen). The experimental treatments were: T1 = control, T2 = control + 15 ppm of Virginiamycin, T3 = control + 100 mg probiotic (Protexin) per kg diet and T4 = control diet + 100 mg prebiotic (Immunuwall) per kg diet. At age 21 and 42 d, ileal digestibility of nutrients was measured by Titanium oxide marker. Data was statistically analyzed using the GLM models of SAS. Duncan's multiple range test was used for pair-wise comparisons of treatment means. The results showed that supplemental diets significantly ($P < 0.05$) improved bioavailability of energy and ileal digestibility of protein. At 21 d of age, broiler fed with treatments 3 and 4 had lower bioavailability of energy and ileal digestibility of protein as compared with treatment 2, but their differences were not significant at 42 d of age. The experimental diets had no effect on ileal digestibility of fat. In conclusion, using probiotic and prebiotic in broiler diets could improve nutrient digestibility indicating that these compounds may be an alternative to antibiotics.

Key Words: broiler, antibiotic alternative, nutrient digestibility

M230 Tryptophan, niacin and insulin metabolism in weaned pigs? J. J. Matte*¹, Y. Primot², and N. LeFloc'h³, ¹Agriculture & Agri-Food Canada, Dairy & Swine R & D Centre, Sherbrooke, QC, Canada, ²Ajinomoto-Eurolysine SAS, Paris, France, ³Institut National de la Recherche Agronomique (INRA), UMR-SENAH, St-Gilles, France.

The present experiment aimed to better define the role of an active metabolite of tryptophan (Try) oxidation, niacin (vitamin B₃), on post-meal insulin response in weaning piglets. A group of 24 weaned piglets were distributed, at 4 wks of age, in 4 factorial dietary treatments: 2 additions of Try, 0 (-Try) vs. 0.10% (+Try) for Try/Lys ratios of 0.16 vs. 0.23, respectively, and 2 additions of dietary niacin, 15 mg/kg (LB₃) vs. LB₃ + 45 mg/kg (HB₃). Animals were fed ad libitum up to 10 wks of age and were trained to restricted feeding (1 kg/d) in one morning meal during one wk. At 11 wk of age, repeated blood samples were collected during 6 h following initiation of the meal (0.5 kg) to determine profiles of plasma C-peptide, insulin, glucose, Try, kynurenin (Kyn), an intermediate metabolite of Try oxidation and nicotinamide (Nam), an indicator of niacin status. There was no treatment effect on either the peak or the area under the curve of C-peptide or glucose after the meal ($P > 0.12$). However, for insulin, the postprandial peak was lower in +Try piglets especially within LB₃ piglets (Try effect and interaction Try*niacin, $P < 0.05$); values were 1.3, 1.0, 0.7 and 1.0 nM (SE: 0.1) in -Try LB₃, -Try HB₃, +Try LB₃ and +Try HB₃, respectively. The molar ratio insulin:C-peptide during the 0–90 postprandial period was lower ($P < 0.02$) in +Try vs -Try piglets (0.47 vs 0.57, SE:0.03). The post-meal plasma Try (96.2 vs. 72.3 μM, SE:0.1) and Kyn (1.7 vs. 1.3 μM, SE:0.1) were higher ($P < 0.01$) in +Try vs -Try piglets. Post-meal plasma Nam was higher in +Try vs -Try ($P < 0.01$) and in HB₃ vs LB₃ piglets ($P < 0.01$) with overall values of 1.0, 2.7, 2.7 and 4.0 μM (SE: 0.4) in -Try LB₃, -Try HB₃, +Try LB₃ and +Try HB₃, respectively. The present results on C-peptide, insulin and molar ratio insulin:C-peptide suggest that the Try action is exerted mainly on insulin clearance (catabolism and/or cellular uptake in target tissues) rather than on insulin secretion in piglets. However, the postprandial responses of the different plasma metabolites to dietary treatments suggest that the Try effect on insulinemia in piglets is unlikely modulated by either Nam or Kyn homeostasis after a meal.

Key Words: tryptophan, insulin, piglets

M231 Effect of glutamine and temperature on performance of broiler chickens. S. Cerrate*, R. Ekmay, C. Salas, and C. Coon, University of Arkansas, Fayetteville.

The effect of glutamine and 2 ambient temperatures were evaluated during the finisher period of broiler chickens, from 36 to 50 d of age. A corn-soy control and a corn-soy-glutamine diet (1% inclusion) were fed to broilers housed in one of 2 ambient temperatures: 21 ± 1°C (normal temperature) and 30 ± 0.6°C (heat stress). Data were analyzed as a 2 × 2 factorial design. Ten male birds housed individually were placed for each treatment. Broilers housed at 21°C showed greater BW gain and feed intake than did birds housed in 30°C. There were interactions between dietary treatments and temperature on BW gain ($P = 0.018$) and feed conversion ($P = 0.006$). Birds housed at 21°C showed similar BW gain, feed intake and feed conversion between the control and glutamine diets, whereas broilers fed the glutamine diet housed at 30°C had greater BW gain and a more efficient feed conversion than did birds fed the control diet. These data indicate that glutamine inclusion may be beneficial during heat stress.

Key Words: broiler, glutamine, housing temperature

M232 Effect of dietary protein content on cecal microbial ecosystem and mortality of young rabbits. S. Chamorro¹, R. Carabaño², J. García², I. Badiola³, G. G. Mateos*², and C. de Blas², ¹Instituto del Frío-ICTAN, CSIC, Madrid, Spain, ²Universidad Politécnica de Madrid, Madrid, Spain, ³CRESA (UAB-IRTA), Bellaterra, Spain.

The aim of this work was to study the effect of dietary CP content on cecal microbial ecosystem and mortality of young rabbits weaned at 25 d. Two (HP and LP) isoenergetic (3,200 kcal DE/kg DM) diets differing in the CP content (175 and 159 g/kg DM, respectively), were formulated. Rabbits (240/treatment) weaned at 25 d were fed experimental diets during 10 d, and mortality incidence from 25 to 35 d was recorded. At 35 d-old, 30 5 rabbits per treatment were slaughtered and cecal contents were taken to characterize the microbial population by restriction fragment length polymorphism (RFLP). The biodiversity degree (BD) defined as the number of fragments obtained by RFLP, and frequency of detection (FD) defined as the percentage of animals that had a fragment compatible with the presence of a certain bacteria, were recorded. Data were analyzed as a completely randomized design using type of diet as main effect. Mean comparisons of mortality and FD were made using a chi-squared test. A decrease of dietary CP content tended to reduce the mortality rate from 15 to 10% ($P = 0.09$). Animals fed LP diets showed a lower BD than those fed HP diets (1,905 vs. 2,561, $P = 0.04$). A reduction of dietary CP content led to a lower FD of several potential pathogens as *Helicobacter* spp. (from 80.0 to 57.1%, $P = 0.04$) and *Leptospira* spp. (from 77.1 to 57.1%, $P = 0.07$), and the FD of other intestinal bacteria as *Escherichia* spp. (from 45.7 to 20.0%, $P = 0.02$), and *Butyrivibrio fibrisolvens* (from 57.1 to 22.9%, $P = 0.003$). In conclusion, a reduction in dietary CP from 175 to 159 g/kg DM reduced the mortality rate, the biodiversity degree, the presence of several potential harmful bacteria at cecum, and should be contemplated as a strategy to increase the intestinal health in young rabbits.

Key Words: dietary protein, intestinal microbiota, rabbits

M233 Effect of lysine and leucine levels in wheat-based diets on the expression of two cationic amino acid-transporter proteins in growing pigs. M. A. Barrera, A. Morales*, M. Cervantes, A. B. Araiza, E. Avelar, and D. González, ICA, Universidad Autónoma de Baja California, Mexicali.

Dietary amino acid (AA) content may affect the AA absorption. Lysine is the first limiting AA in wheat for pigs, and leucine is recognized as an activator of mTOR, the protein synthesis regulator in muscle cells. An experiment was conducted to determine if adding lysine and leucine, above the NRC (1998) requirement level, to wheat-based diets affects the expression of b0,+ and CAT1 mRNA in 2 muscles (longissimus-LM and semitendinosus-SM), jejunum (J), and liver (L). Twenty crossbred pigs (Landrace-Ham-Duroc; BW of 16.4 ± 1.7 kg) were used. Treatments (T) were: T1, basal wheat-based diet fortified with crystalline lysine, threonine, and methionine; T2, basal plus 0.35% lysine; T3, basal plus 0.15% leucine; and T4, basal plus 0.35% lysine and 0.15% leucine. All diets were added with vitamins and trace minerals. At the end of a 28-d trial, 16 pigs were sacrificed and samples from LM, SM, L, and J were collected to analyze the expression of b0,+ and CAT1 mRNA. The effects of lysine, leucine, and their interaction were tested. Also, 3 contrasts were constructed to analyze the effect of the single or combined AA addition. The relative expression results (arbitrary units: ratios of b0,+ or CAT1 mRNA molecules:18S rRNA molecules) were: for b0,+; J, 1.84, 2.48, 0.43, 0.12; LM, 1.23, 3.71, 1.89, 1.50; SM, 0.80, 0.45, 0.81, 0.42; L, 1.41, 0.95, 4.26, 0.49; for CAT1; J, 0.10, 0.18, 0.13, 0.21; LM, 0.69, 1.38, 0.68, 1.08; SM, 0.33, 0.10, 0.54, 0.38; L, 0.92, 19.1, 0.36, 3.12, for T1 to T4, respectively. Leucine decreased b0,+ expression in

J and LM ($P < 0.05$). Because of lysine addition the expression of b0,+ in LM increased ($P < 0.05$), but in SM decreased and tended to decrease in L ($P < 0.10$). Leucine increased but lysine decreased CAT1 expression in SM; in L there was an opposite response ($P < 0.05$). These data indicate that dietary AA levels affect the expression of their transporter proteins, and their effects are variable, depending on the AA and the animal tissue studied.

Key Words: swine, amino acids, transporters

M234 Effect of high lysine and leucine levels in wheat-based diets on performance and muscle expression of myosin mRNA in growing pigs. M. A. Barrera¹, M. Cervantes*¹, A. Morales¹, A. Araiza¹, D. Cervantes¹, V. Méndez¹, and H. Bernal¹, ¹ICA, Universidad Autónoma de Baja California, Mexicali, BC, México, ²Universidad Autónoma de Nuevo León, Monterrey, NL, México.

Lysine is the first limiting amino acid (AA) in wheat-based diets for pigs; leucine is recognized as an activator of mTOR, which regulates protein synthesis in muscle cells. An experiment was conducted to evaluate the effect of adding lysine and leucine, above the NRC (1998) requirement levels, to wheat-based diets on the performance of growing pigs and the expression of myosin mRNA in the longissimus (LM) and semitendinosus (SM) muscles. Twenty crossbred pigs (Landrace-Ham-Duroc; BW of 16.4 ± 1.7 kg) were used in a Randomized Complete Block design. Treatments (T) were: T1, basal wheat-based diet fortified with crystalline lysine, threonine, and methionine; T2, basal plus 0.35% lysine; T3, basal plus 0.15% leucine; and T4, basal plus 0.35% lysine and 0.15% leucine. All diets were added with vitamins and trace minerals. At the end of the 28-d trial, 16 pigs were sacrificed and samples from LM and SM were collected to analyze the expression of myosin mRNA. The effects of lysine, leucine and their interaction were tested. Also, 3 contrasts were constructed to analyze the effect of the single or combined AA addition. The pig performance results were: weight gain, 0.607, 0.560, 0.492, 0.573 kg/d; feed intake, 1.24, 1.18, 1.11, 1.20 kg/d; feed conversion, 2.05, 2.14, 2.27, 2.11, for T1 to T4, respectively. There was a lysine x leucine interaction for weight gain and feed conversion ($P < 0.05$). Adding leucine alone decreased weight gain and depressed feed conversion ($P < 0.05$). Lysine addition to the leucine added diet tended to restore the daily gain ($P < 0.10$) and feed conversion ($P < 0.05$). The results of myosin mRNA relative expression (arbitrary units: ratios of myosin mRNA molecules:18S rRNA molecules) were: LM, 3.6, 3.3, 1.7, 0.12; SM, 1.46, 1.46, 0.59, 1.15, for T1 to T4, respectively. Leucine alone decreased myosin mRNA in both muscles ($P < 0.01$) and, combined with lysine, leucine further reduced myosin mRNA in LM ($P < 0.01$). These data indicate that excess of leucine negatively affects the expression of myosin mRNA, which was associated with a growth depression in pigs.

Key Words: swine, myosin, amino acids

M235 The effect of different animal and vegetable protein sources on the feed intake and weight gain of piglets. D. Solà-Oriol¹, J. Figueroa¹, E. Borda*², C. Chetrit², and J. F. Pérez¹, ¹Universitat Autònoma de Barcelona, Bellaterra, Spain, ²Bioiberica, Palafròlles, Spain.

Porcine Digestible Peptides (PDP; Palbio 50RD) is a highly digestible and economic protein source for weanling diets. The aim of the present work was to study the effect of PDP (52.8%CP) in the diet as compared with Peruvian fish meal (FM; 68.5%CP), spray dried animal plasma (SDAP; 75.0%CP), potato protein (PP; 79.5%CP) and soybean protein concentrate (SBP; 56.0%CP) on the early performance of weaned piglets. A total of 1540 26-d-old piglets (mixed sexes) were used in 4

consecutive trials conducted in the same commercial facility. Animals were distributed into 20 pens (18–20 piglets/ pen) according to the initial BW. Experimental treatments were formulated to meet or exceed piglet requirements with the same energy, protein, Lys, Met+Cys, Thr and Trp content. Control diet was formulated to contain 5% of PDP; and Test diet was obtained by replacing PDP by celite plus either FM (3.82%), SDAP (3.52%), PP (3.32%) or SBP (4.72%) according to their protein content. Feed was offered ad libitum in mash form. Individual animal weight and feed disappearance were recorded at 0, 7 and 14d post-weaning (PW) to calculate the average daily feed intake (ADFI) and average daily gain (ADG). Feed intake was not different ($P > 0.10$) between PDP, FM, SDAP or PP, but tended to be higher for PDP than SBP from 7 to 14d PW (324.8 vs 297.9 g/d; $P = 0.066$). The ADG of piglets fed on PDP tended to be higher ($P < 0.10$) than those fed FM or PP from 0 to 7d post-weaning, and was higher than those fed FM and SBP from 7 to 14d post-weaning (160.6 vs 128.0 g/d; and 200.0 vs 183.0 g/d; $P < 0.01$). However, no differences were observed on body weight at 14 d PW ($P > 0.10$). Lower feed conversion ratio (FCR) was observed for PDP compared with FM from 7 to 14d PW (1.714 vs 2.044; $P < 0.05$) but, higher compared with SDAP for the same period (2.272 vs 1.909; $P < 0.05$). Moreover, better FCR was also observed for PDP than FM during the entire starter phase (0 to 14dPW). Compared with the common protein sources, PDP may be considered as suitable source of protein for piglet diets improving the economic balance of the post-weaning phase.

Key Words: porcine digestible peptides, protein sources, piglets

M236 Aflatoxins and productive performance of two broiler breeder genotypes. A. Scher*¹, A. P. Rosa¹, J. M. Santurio², A. Londero¹, T. N. N. Vieira¹, and J. A. G. Ferreira Jr.¹, ¹*Poultry Laboratory – Universidade Federal de Santa Maria, RS, Brazil*, ²*Lapemi – Universidade Federal de Santa Maria, RS, Brazil*.

The objective of this study was to determine the effect of aflatoxins (AFL) exposure on productive aspects of 2 broiler breeder genotypes. The experiment was carried out at The Federal University of Santa Maria – Brazil. 660 broiler breeder females and 60 males were submitted to intoxication with AFL (AFB1:86%, AFB2: 8.5%, AFG1:3.8%, AFG2: 1.7%) from the 24th to 64th week. From 65th to 68th week, all birds were fed with AFL free diets to evaluate residual effects. The estimated parameters were egg production and egg weight. The experimental design was in a CRD in factorial arrangement with 3 levels of AFL (0.0, 0.50 and 1.0 mg/kg diet) and 2 breeders' strains (A and B), totaling 6 treatments with 5 replicate pens of 22 females and 2 males each. The laying rate was depreciated by the addition AFL in the diet. The addition of 1.0mg AFL/kg of diet was more harmful than 0.5mg AFL/kg, indicating a dose dependent effect. Breeders fed diets containing 0.0; 0.5 and 1.0mg AFL/kg had average laying rates of 63.93; 61.54 and 58.53% respectively ($P \leq 0.0001$) during the intoxication period. It was observed that strain B breeders had a laying rate of 61.72%, and strain A laying rate that was 60.94% ($P = 0.0018$). There was interaction among the levels of AFL and the strains ($P = 0.0779$). Birds of genotype B, when subjected to 0.5 and 1.0mg AFL/ kg diet, showed eggs productions 3.03 and 8.73% lower than not intoxicated. In strain A, the reduction in egg production was 4.45 and 8.16% when the birds were intoxicated with 0.5 and 1.0mg AFL/kg diet, respectively. There was no recovery in the laying rate of birds intoxicated after withdrawal of the AFL. The eggs weight was not

influenced by levels of AFL; however, strain A breeders produced the heaviest eggs during the study period. The productive performance of broiler breeders was depressed by AFL. Strain A breeders were more susceptible to 0.5 mg AFL/kg diet than those of strain B.

Key Words: egg production, breeders, strains

M237 Progeny of broiler breeders from two genotypes intoxicated with aflatoxins. A. Scher*¹, A. P. Rosa¹, J. M. Santurio², A. Londero¹, G. Farina¹, and J. A. G. Ferreira Jr.¹, ¹*Poultry Science Lab – Universidade Federal de Santa Maria, Santa Maria, RS, Brazil*, ²*Lapemi – Universidade Federal de Santa Maria, Santa Maria, RS, Brazil*.

The objective of this study was to evaluate the performance of the progenies of 2 broiler breeder genotypes intoxicated with aflatoxins (AFL). This study was carried out at Poultry Laboratory at The Federal University of Santa Maria – Brazil. Were performed 3 experiments, from 1 to 21 d, each using 600 chicks. In the first (Experiment 1), were used chicks from eggs produced by hens with 32 wk of age, the second and third evaluations were carried out with chicks produced by breeders with 48 (Exp.2) and 64 wk of age (Exp.3), respectively. The progenies were housed in batteries, located in an environment controlled room. For each experiment was used a CRD factorial arrangement 3x2 (0.0, 0.5 and 1.0mg of AFL/kg in breeders diets and 2 genotypes: A and B), totalizing 6 treatments with 10 repetitions of 10 males each. The feed and water were provided ad libitum. In the Experiment 1, hens fed diets containing AFL produced chicks with lower body weight (BW) ($P \leq 0.0001$). The addition of 0, 0.5 and 1.0mg AFL/kg resulted in chicks with 41.83g, 41.48 and 41.09g of BW, respectively. In Experiments 2 and 3, only the addition of 1.0mg/kg AFL in breeders diets depressed chicks' BW ($P = 0.0704$ and $P = 0.0341$). In all experiments, chicks produced by breeders submitted to diets containing 1mg AFL/kg had lower body weight at 21 d. Progeny from genotype A breeders had higher BW, at 1 and 21d, than genotype B progeny. Studying the interaction among the AFL levels and the genotypes, it was observed that genotype B breeder's exposure to AFL did not affect the progeny's initial weight, however, in genotype A, there was a decreased progeny initial weight from breeders exposed to AFL. The addition of 1 mg AFL/kg in broiler breeder's diets resulted in negative effect on the progenies weights.

Key Words: progeny, breeders, strains