

Metabolism and Nutrition: Amino Acids

102 Possibility of reducing protein level in the broiler finisher diets effects on growth performance, carcass yield and nitrogen excretion. Y. A. Attia,* *Department of Animal and Poultry Production, Faculty of Agriculture, Damanhour University, Damanhour, Behria, Egypt.*

The effect of amino acid (AA) supplementations on improving utilization of low protein diet and decreasing nitrogen excretion was studied with Hubbard broilers during d 28–49 of age (Trial 1) and 30–45 of age (Trial 2). In trial 1 and 2, the positive control (PC) diet contained 18% CP while the negative control (NC) diet contained 15% CP supplemented with methionine plus lysine as those of the PC. In trial 1, the NC diet was formulated based either on corn-soybean meal without (vegetable protein) or with fish and meat meals (animal protein supplements) and supplemented or not with arginine (Arg), and valine (Val). Therefore, there were 3 experimental groups within each 15% CP source in addition to the PC. In trial 2, the NC diet was supplemented or not with either Arg, Val or Ile. In addition all of these amino acids without or with glycine as a source of amino acid nitrogen and urea as a nitrogen source were supplemented to the negative control diet to equalize nitrogen percentage between the NC and the PC diet. Thus, there were 6 experimental groups within the NC diet. Amino acids were supplemented to meet the NRC (1994) AA requirements for broiler chicks during 3–6 weeks of age. There were no differences ($P \geq 0.05$) in growth and feed conversion ratio (FCR) among the experimental groups fed high or low-protein amino acid-supplemented diet. Intact protein utilization was improved ($P \leq 0.05$) by feeding low protein AA-supplemented diet as compared with the high protein level. Feeding low crude protein diet supplemented with Met plus Lys had no effect ($P \geq 0.05$) on carcass yield and protein, either extract and moisture percentage of the breast meat. Nitrogen excretion was decreased ($P \geq 0.05$) by about 20% when low protein AA-supplemented diets were fed compared with the high protein diet. In conclusion, it is possible to reduce protein levels to 15% in broiler finisher diets during d 28–49 of age when supplemented with methionine plus lysine while reducing nitrogen pollution.

Key Words: amino acids, broilers, protein utilization, growth performance, nitrogen excretion

103 Correlation between ileal digestibility of amino acids and chemical composition of the soybean meals in 21-d-old broilers. M. Frikha¹, M. P. Serrano¹, D. G. Valencia¹, P. G. Rebollar¹, J. Fickler², and G. G. Mateos*¹, ¹*Departamento de Produccion Animal, Universidad Politecnica de Madrid, Ciudad Universitaria, Madrid, Spain,* ²*Evonik, Hanau-Wolfgang, Germany.*

The correlations between the in vivo standardized ileal digestibility (SID) of crude protein (CP) and amino acids (AA) and the chemical composition of 22 soybean meal (SBM) samples originated from USA (n = 8), Brazil (BRA; n = 7) and Argentine (ARG; n = 7) were determined in broilers at 21 d of age. Birds were fed a commercial corn-SBM diet from d 1 to d 17 followed for 3 d by the experimental diets in which the SBM tested was the only source of protein (20.5% CP). Independent of origin, the SID values varied from 86.4 to 91.9 for CP, 89.1 to 94.0 for Lys, 93.1 to 97.0 for Met, and 78.6 to 85.5 for Cys. The trypsin inhibitor activity (TIA) was positively correlated with the protein dispersibility index (PDI; $r = 0.419$; $P < 0.05$) and KOH

solubility values ($r = 0.732$; $P < 0.001$). The SID of CP, Lys, and Cys were positively correlated with CP content ($r = 0.514$, $P < 0.05$; $r = 0.370$, $P < 0.10$; $r = 0.423$, $P < 0.05$), KOH solubility ($r = 0.696$, $P < 0.001$; $r = 0.619$, $P < 0.01$; $r = 0.589$, $P < 0.01$) and TIA ($r = 0.541$, $P < 0.01$; $r = 0.416$, $P < 0.10$; $r = 0.449$, $P < 0.05$) of the SBM. The correlations between SID of CP and AA and the NDF content were not significant. The SID of CP and AA were better related with KOH sol. values than with PDI values. The SID of CP and Lys were positively correlated with reactive Lys ($r = 0.563$; $P < 0.01$ and $r = 0.486$; $P < 0.05$, respectively). Ileal digestibility of most limiting AA was higher for the USA and the BRA meals than for the ARG meals. For example, the SID were 92.1, 91.9, and 90.8 ($P < 0.05$) for Lys and 82.8, 83.3, and 80.0 ($P < 0.01$) for Cys for USA, BRA, and ARG meals, respectively. It is concluded that the ileal digestibility of CP and Lys of the SBM increased with CP content, KOH solubility, TIA, and reactive Lys values. The SID of most indispensable AA, including Lys and Cys, were higher for USA and BRA meals than for ARG meals. Nutritionists should be aware of differences in AA digestibility among commercial samples of SBM for feed formulation.

Key Words: amino acid, broiler, ileal digestibility, Pearson correlation, soybean meal

104 Comparative amino acid digestibility for broilers and ducks. C. Kong* and O. Adeola, *Purdue University, West Lafayette, IN.*

A total of 304 3-week-old broiler chickens and White Pekin ducks were used in a 7-d trial to compare ileal amino acid (AA) digestibility in soybean meal (SBM) and canola meal (CM) by using regression method. A corn-casein-cornstarch-based diet was mixed to contain 15% CP. Cornstarch was replaced with test ingredient (SBM or CM) to contain 18 or 21% of CP in 4 other diets. Nitrogen free diet (NFD) was used for standardization of apparent digestibility and chromic oxide as an indigestible marker. Birds received a standard starter diet from d 0 to 14, the 6 experimental diets for 7 d in a randomized complete block design. On d 21, birds were asphyxiated with CO₂, digesta from the distal section of ileum was collected. The partial digestibility of AA from the test ingredients was assessed by multiple linear regression analysis using data on daily digestible (apparent or standardized) and total AA intakes. There was no significant interaction between species and ingredients for all AA digestibility regardless of standardization. For digestibility by regression of apparent digestible AA intake against AA intake, there was a higher ($P < 0.05$) digestibility for N, Lys, Thr, Val, Asp, and Pro in SBM than those in CM. Ducks had a higher digestibility of Cys and Pro ($P < 0.05$) than broilers. Within species, digestibility was not different between SBM and CM except for Lys of ducks and Pro of broilers ($P < 0.01$). After standardization, ducks had a higher digestibility ($P < 0.05$) of N, Arg, Leu, Phe, Trp, Val, Ala, Cys, Pro, Ser and Tyr than broilers. Main effect of ingredient resulted in differences for N, Lys, Thr, Val, and Pro with higher digestibility ($P < 0.05$) for SBM. There was significant different between ingredients for digestibility of Lys in ducks and Pro in broilers. In conclusion, the result of this study indicated that AA digestibility for broilers should not be used for diet formulation for ducks.

Key Words: amino acid, regression, ileal digestibility, broilers, White Pekin ducks

105 Relationship between in vitro assays and standardized ileal amino acid digestibility of animal protein meals in broilers. S. J. Rochell,* D. L. Kuhlers, and W. A. Dozier III, *Auburn University, Auburn, AL.*

Animal protein meals (APM) are known to be variable in digestible amino acid (AA) contents. Two identical trials were conducted to determine the relationship of a novel digestive enzyme assay, Poultry Complete IDEA (PC IDEA), and the pepsin digestibility assay with standardized ileal amino acid digestibility (SIAAD) of 20 animal protein meals (APM) fed to broilers from 25 to 30 d of age. Animal protein meals included 10 meat and bone meals (MBM) consisting of bovine, porcine, or mixed bovine and porcine raw materials, and 10 animal protein blends. Treatments consisted of 20 semi-purified diets containing 1 APM as the sole source of dietary AA, and 1 N-free diet to determine endogenous ileal AA flow. With the exception of the N-free diet, diets were formulated to contain 20% CP. In each trial, 756 Ross × Ross 708 broilers were housed in battery cages and randomly assigned to 21 dietary treatments on d 25 (12 birds per cage; 3 replicate cages), and ileal digesta were collected on d 30. Pepsin digestibility and PC IDEA were determined for APM samples from each experimental diet (3 replicate per trial; 6 total replicates). Pepsin digestibility and PC IDEA were both correlated ($P < 0.001$) with SIAAD for each AA. Multiple linear regression of PC IDEA and pepsin digestibility on SIAAD resulted in the following equations: % Lys SIAAD = $[-9.65 + (0.38 \times \% \text{ PC IDEA predicted Lys digestibility}) + (0.69 \times \% \text{ pepsin digestibility})]$, % Met SIAAD = $[-35.95 + (0.62 \times \% \text{ PC IDEA predicted Met digestibility}) + (0.75 \times \% \text{ pepsin digestibility})]$, % Thr SIAAD = $[-77.5 + (0.39 \times \% \text{ PC IDEA predicted Thr digestibility}) + (1.37 \times \% \text{ pepsin digestibility})]$. Values of R^2 were 0.46, 0.47, and 0.55 for Lys, Met, and Thr, respectively. These data indicated that PC IDEA and the pepsin digestibility assay can be used to predict SIAAD of APM. The relatively low R^2 values may have been due to the limited range in SIAAD observed for the 20 APM, and additional data on APM varying in SIAAD are needed.

Key Words: standardized ileal digestibility, amino acid, meat and bone meal, broiler

106 Does formulation on a digestible basis for amino acid make productive sense for laying hens? S. A. Adedokun,* L. Xu, and T. J. Applegate, *Department of Animal Sciences, Purdue University, West Lafayette, IN.*

The objective of this study was to determine the effects of amino acid (AA) concentration and diet formulation method (total, TOT and digestible, DIG AA basis) on egg production (EP), feed conversion to EP, and egg quality parameters in laying hens. Hyline W36 hens (768) were used in this study. The study was conducted as a 2×4 factorial experimental arrangement in a completely randomized design study from 30 to 46 w of age. Diets were formulated on a TOT or DIG AA basis as well as by AA density (low, medium, medium-high, and high). All diets contained 10% dried distillers' grains plus solubles and 6% meat and bone meal and maintained the ratio of AA to Lys ratio. Forty-eight cages of hens (2 hens per cage, 542 cm²/bird) were fed each diet. Feed intake was determined monthly from 4 cage blocks (12 blocks per diet). Data were analyzed as a 2 (formulation methods) \times 4 (amino acid densities) factorial. In addition to EP measures (egg number, egg weight, egg component and solids yield), feed-to-egg conversion (number and mass) was also determined for each treatment (diet). Hens on the lowest AA intake lost the most ($P < 0.05$) BW during this 16 wk laying period (8.1%). For egg production

(number and mass), the AA density largely affected production with birds on low AA (TOT and DIG) producing fewer ($P < 0.05$) eggs (4.6 eggs/bird) relative to birds on high AA density diet. Hen fed medium-high and high AA density had lower ($P < 0.05$) feed conversion (feed:egg number) relative to birds on low AA density diet. Formulation method (TOT vs. DIG) did not drastically impact number or mass of egg produced. There was a trend ($P < 0.08$) toward formulation on a DIG basis having improved production for birds fed the 'Medium' level versus those fed on a TOT AA basis (3.3 eggs or 428 g more over a 16 wk lay). Based on the results from this study, there is the need for further investigation using different types and levels of alternative feed ingredients on production parameters.

Key Words: amino acid, digestible amino acid, laying hen, egg, total amino acid

107 Increasing protein intake for the post-hatch broiler concurrent with yolk sac depletion and subsequent live performance and fillet characteristics. E. T. Moran*¹ and E. E. M. Pierson², ¹*Auburn University, Auburn, AL*, ²*Pierson Consulting LLC, University City, MO.*

Dietary protein after emergence progressively replaces embryonic reserves through the first 7 d when fillet development is extensive. Additional feed protein was examined as a means to improve yield. Male chicks (41 g) from a 38 week old breeder flock (Ross × Ross 708) were placed on used litter floors (32 pens, 40 chicks, 13.7 m³ area). Alternate pens received either a standard corn-soybean meal crumbled starting feed (22.5% CP, 3.15 Kcal ME/g, 1.35% Lys) or the same feed substituting 5% poultry fat for soybean meal (24.0%, 2.85 kcal/g, 1.45% Lys) for the first 7 d. Additional protein led to increased body weight (185 vs 175g, P

Key Words: breast meat, growth, post hatch nutrition, broiler, protein requirement

108 Digestible valine to lysine ratio of male broilers from twenty-six to forty-two days of age. K. J. Meloche*¹, P. B. Tillman², R. B. Shirley³, and W. A. Dozier III¹, ¹*Auburn University, Auburn, AL*, ²*Poultry Technical Nutrition Services LLC, Buford, GA*, ³*Ajinomoto Heartland Inc., Chicago, IL.*

Valine is the fourth limiting amino acid for broilers fed corn-soybean meal based diets. This study examined growth and meat yield responses of broilers provided experimental diets varying in digestible (dig) Val from 26 to 42 d of age. Three-thousand one hundred and 20 Ross × Ross 708 male chicks were randomly distributed into floor pens at 1 d of age and were fed a common starter diet until 25 d of age. At 26 d of age, all pens were equalized with 25 birds (0.09 m²/bird) and fed the experimental diets until 42 d of age. Two diets (dilution and summit) consisting of corn and soybean meal were formulated to be adequate in all other amino acids with the exception of Val and Lys. The dilution and summit diets were blended to create 7 intermediate diets, for a total of 9 titration diets resulting in dig Val ranging from 0.57 to 89% (calculated). A control diet containing adequate dig Val (0.74%) was used for comparison with the titration diets. All diets were formulated to contain 0.95% dig Lys, which is slightly below the dig Lys requirement for male broilers from 28 to 42 d of age. Each treatment was represented by 12 replicate pens. True Val digestibility, BW gain, feed intake, dig Val intake, dig Val intake/BW gain, feed conversion, mortality, and carcass

characteristics were assessed during experimentation. True Val digestibility of the dilution diet was determined to be 0.60%. Digestible Val to Lys ratios were estimated using broken-line methodology. Broilers fed progressive additions of dig Val resulted in linear improvements ($P \leq 0.05$) in BW gain, feed conversion, carcass weight, and total breast meat weight. Digestible Val to Lys ratios for Ross \times Ross 708 male broilers ranged from 76 to 78 for BW gain, feed conversion, and total breast meat weight. These data support a minimum dig Val ratio of 76 for male broilers from 28 to 42 d of age, which concurs with our previous research.

Key Words: amino acid, broiler, valine

109 Dietary tryptophan supplementation lowers plasma corticosterone levels in broiler breeder hens. D. A. Neves^{*1}, R. B. Shirley², M. E. Freeman¹, J. L. Usry², and A. J. Davis¹, ¹University of Georgia, Athens, ²Ajinomoto Heartland, Chicago, IL.

Limited previous research in chickens indicates that providing dietary tryptophan above the requirement for maintenance and growth or production may alleviate behavioral stress. It was hypothesized that the elevated intake of tryptophan increased the production of serotonin which positively modulated behavior. Broiler breeder hens are feed restricted during rearing and breeding which may cause stress. In the current research, broiler breeder hens were fed a diet supplemented with 0.05% crystalline tryptophan (TRP) to determine if it would enhance reproductive performance and reduce stress as indicated by plasma corticosterone (CORT) levels. At 29 weeks of age, 96 birds were selected from 600 Cobb 500 fast feathering pullets, split into 2 equal groups and placed into individual cages. The body weight profile of the 48 hens in each group was equivalent and reflected the body weight profile of the entire cohort of pullets from which they were selected. At 35 weeks of age, after allowing acclimation to the cages and ensuring that the original groups were still equal in weight profile and production parameter, one group of hens was maintained on a broiler breeder diet containing 0.20% TRP while the other group was fed this diet supplemented with 0.05% TRP. All birds were fed individually the same amount of total feed once per day until 62 weeks of age. Hens were artificially inseminated. Body weight and egg production, weight, specific gravity, fertility and hatchability were monitored. Blood samples were taken at 39, 48 and 58 weeks of age for plasma corticosterone assessment by EIA. While the TRP supplement had no overall effect on any reproductive parameters, plasma corticosterone was significantly ($P < 0.05$) decreased by TRP supplementation at each time point examined. The results indicate that TRP supplementation may alleviate stress associated with restrictive feeding boiler breeder hens which might have a more profound effect on reproductive performance in an industry setting.

Key Words: broiler breeder, production, stress

110 Dietary lysine requirements of female Japanese quails base on performance and immunity variables from twenty-one to forty-two days of age with different requirement determination methods. M. Shivazad,* I. Hajkhodadadi, H. Moravej, and A. Zare-Shahneh, *University of Tehran, Karaj, Iran.*

The present research was conducted to estimate the dietary lysine (Lys) requirement of growing female quail base on performance, carcass constituents and immunity parameters at 24 to 42 d of age. A dose-response

diet mainly based on corn, corn gluten and soybean meal was used. Lys content was minimized in dose-response diet (1.00%) while assuring the minimum levels of all other essential amino acids in a manner that would meet or exceed NRC (1994) recommendation. This experiment was carried out in a complete randomized design arrangement with 6 dietary Lys level; 1.00, 1.15, 1.30 (NRC 1994), 1.45, 1.60, and 1.75%, from 21 to 42 d of age. Each treatment was consisted of 5 floor pens as replicate with 50 quail chicks. With increasing dietary Lys level, body weight, body weight gain and feed conversion ratio improved significantly ($P < 0.05$). Feed intake, carcass weight, breast weight and yield, thigh weight, and packed cell volume, were significantly ($P < 0.05$) affected by dietary Lys. The thigh yield, response to SRBC (sheep red blood cell), white blood cell count, lymphocyte, heterophil and Monocyte percentage, not influenced significantly ($P > 0.05$) by dietary Lys at 42 d of age. Our results suggested Lys requirement can be estimated to be as 1.35, 1.47% when feed conversion, BW gain, and breast and thigh meat properties are considered and may be at least 1.38, 1.55% when immunity variables are taken into account in female Japanese quails at 21–42 d of age for second order polynomial and quadratic broken-line models respectively. These results indicated that the NRC (1994) Lys requirement 1.30% is not adequate for female Japanese quails from 21 to 42 d of age. Future research, however, should determine lysine needs for immune system functions of quails reared in conventional environments or during an infectious challenge.

Key Words: quail, lysine, performance, broken-line, second order polynomial

111 Protein expression in pectoral skeletal muscle of chickens as influenced by dietary methionine. W. Zhai^{*1}, L. F. Araujo¹, S. C. Burgess¹, A. M. Cooksey¹, K. Pendarvis¹, Y. Mercier², and A. Corzo¹, ¹Mississippi State University, Mississippi State, ²Adisseo France, S.A.S. Commentry, France.

This study evaluated the effect of dietary methionine (Met) on Pectoralis muscle development, and the impact that Met as a nutritional substrate has on gene and protein expression of skeletal muscle cells of Pectoralis muscle of chickens. Broiler chickens received a common pre-test diet up to 21 d of age, and were subsequently fed either a low (LM) or high Met (HM) diet (0.41 vs. 0.51% of diet) from 21 to 42 d of age. Dietary deficiency was shown in vivo judging by the depression in breast meat weight ($P = 0.002$) and yield ($P < 0.001$) when broilers were fed the LM diet. Global protein expression was analyzed by quantitative high-performance liquid chromatography nanospray ionization tandem mass spectrometry. Up- and downregulated proteins were analyzed via Ingenuity Pathways Analysis to identify the genetic pathways affected. Six canonical pathways were identified as differentially regulated between LM and HM fed chickens: citrate cycle, calcium signaling, actin cytoskeleton signaling, clathrin-mediated endocytosis signaling, germ cell-sertoli cell junction signaling and cellular effects of sildenafil. More nutrients may have been absorbed into the muscle cells for muscle protein deposition. Even though the supplementation of Met has increased breast muscle growth, the contraction fiber concentration in the muscle decreased and associated with lower calcium transportation rate and sensitivity, as well as lower energy supply to the contraction. The increase of muscle protein deposition induced by Met supplementation might have been caused by sarcoplasm rather than myofibrillar hypertrophy.

Key Words: broiler, methionine, pectoral skeletal muscle, protein expression

112 Growth performance and arginine metabolism of broiler chicks as affected by dietary arginine and methionine. B. Zhang,* P. Jiao, J. Yuan, and Y. Guo, *China Agricultural University, Haidian District, Beijing, P.R.China.*

An experiment was conducted to determine the effects of different levels of arginine (Arg) and methionine (Met) on growth performance and carcass composition in chicks, and to determine Arg requirement of male broilers feeding diets containing different levels of Met. The study with 8 treatments arranged as 4 × 2 factorial. The 4 dietary levels of Arg were 80%, 100%, 120%, and 140% of NRC (1994) recommendation and those of Met were 100% and 120% of NRC (1994) recommendation. Four hundred and 80 one-day-old male Arbor Acres broiler chicks were obtained from a local hatchery and randomly allocated into 8 groups with 5 replicates of 12 chicks each. The experimental period lasted 42 d. On d 42, one chick per replicate was randomly selected to measure breast and leg muscle and abdominal fat weight, breast muscle fiber diameter and creatine analysis, and kidney arginase activity. The broken-line linear model was used to estimate the Arg requirements of the chicks. The result showed that Arg supplementation could increase (PL < 0.05, PQ < 0.05) body weight gain (BWG) but decrease (PL < 0.05) feed conversion ratio (FCR) for 1 to 3 wk and 1 to 6 wk of age. However, Met level had no effect on growth performance. An interaction on FCR for 1 to 6 wk was observed between Arg and Met levels. Increased Arg level increased breast muscle yield (PL < 0.05, PQ < 0.05), fiber diameter (PL < 0.05, PQ < 0.05), leg muscle yield (PL < 0.05, PQ < 0.05) and linearly decreased abdominal fat yield (PL < 0.05). Arginase activity was highest in 120% of NRC (1994) Arg group. Arg supplementation significantly increased muscle creatine content ($P < 0.05$). The regression model suggested that the highest BWG and lowest FCR were obtained when Arg was supplemented at 117.3% and 119.3% of NRC (1994) recommendation for 0 to 3 wk when Met was supplemented at NRC (1994) recommendation. The data indicate that moderate Arg supplementation improves growth performance of broiler chicks and might lead the partitioning of nutrients away from adipose tissue deposition toward muscle growth through enhancement of Arg metabolism.

Key Words: arginine, methionine, growth, requirement

113 Establishing the bioavailability of lysine in corn DDGS for D3-42 Cobb 500 male broilers. K. G. S. Wamsley*¹, R. E. Loar II², K. Karges², and J. S. Moritz¹, ¹West Virginia University, Morgantown, ²POET LLC, Sioux Falls, SD.

The objective of the current study was to evaluate the bioavailability of lysine in corn distillers dried grains with solubles (DDGS) as DDGS inclusion in diets increased to evaluate if established digestible lysine (Dig Lys) values (0.70% Dig Lys) needed altering due to advances in DDGS production and broiler genotypes. A 5x3 factorial analysis was utilized with variations in diet formulations for Dig Lys (70, 80, 90, 100, or 110% of agristat recommendations) and DDGS Level (No, Low, or High). Starter diets contained either 0% DDGS or a low inclusion of 4% DDGS. Grower diets (D11–22) contained 0, 5, or 10% DDGS and Finisher diets (D23–42) contained 0, 10 or 20% DDGS. All diets were manufactured at West Virginia University's pilot feed mill and descriptive manufacture data was obtained. Increasing DDGS inclusion lowered relative electrical energy use of the pellet mill. Diets containing Low DDGS had similar pellet qualities compared with diets containing No

DDGS across Dig Lys. All diets were ground to eliminate feed form before feeding. Treatments were randomly assigned to one of 90 pens containing 22, 3-d-old Cobb 500 chicks. The experimental period was D3–42 with measured variables including: average bird weight (BW), average live weight gain (LWG), pen feed intake (FI) and feed conversion ratio (FCR). On D43, 2 birds/pen ± 0.1kg of pen mean were chosen for carcass characteristics (CC). Average FCR, ending BW and CC improved with increasing levels of Dig Lys and DDGS ($P = 0.0001$). Improvements were most dramatic across Dig Lys levels in diets containing Low DDGS. Quadratic equations were derived for each performance metric across Dig Lys levels and solved 2 ways: 1) using the observed metric resulting from each DDGS inclusion at the lowest Dig Lys level in the equation derived from No DDGS inclusion and 2) selecting a common performance metric and comparing Dig Lys predictions across DDGS inclusions. These data demonstrate that the current Dig Lys coefficient for DDGS is justified, but may be underestimated by 0.08 percentage points.

Key Words: DDGS, digestible lysine, feed manufacture, broiler performance

114 Modulation of immune-related gene expression by dietary threonine and purified fiber during a coccidiosis challenge. E. L. Wils-Plotz* and R. N. Dilger, *University of Illinois, Urbana.*

Coccidiosis is a major contributor to economic losses in the poultry industry due to its deleterious effects on growth performance and nutrient utilization. We hypothesized the combined effects of supplemental threonine (Thr) and purified dietary fiber would benefit immune-related gene expression and gut morphology of chicks infected with *Eimeria maxima*. A semi-purified, Thr-deficient basal diet (3.2 g of Thr/kg diet) was supplemented with 7% silica sand (control), cellulose, or high-methoxy pectin and one of 2 levels of Thr (0 or 9.6 g/kg diet; 6 diets total). At d 1 post-hatch, 432 male crossbred male chicks were randomly allotted to dietary treatments, and on d 10 post-hatch, an equal number of chicks on each treatment received either 0.5 mL of distilled water or an acute dose of *Eimeria maxima* (1.5×10^3 oocysts) with 6 replicate pens of 6 chicks per each of 12 treatments. Chicks remained on study from hatch to d 15 post-hatch, at which time cecal tonsil and ileal mucosal samples were collected for mRNA expression of mucin (MUC2) and cytokines [interleukin (IL)-1 β , IL-12, IL-8 and interferon-gamma (IFNG)]; expression was relative to the Thr-deficient, control diet. In mucosal scrapings, pectin-fed chicks had decreased ($P < 0.001$) IL-12 and IFNG expression. Infection decreased ($P < 0.01$) MUC2 and increased ($P < 0.01$) IL-12 mRNA expression. There was an interaction ($P < 0.001$) between fiber and infection status for IFNG, and an interaction ($P < 0.05$) between fiber and Thr for MUC2 and IFNG, as well as a 3 way interaction ($P < 0.05$) for IL-12 and IFNG. In cecal tonsils, birds receiving fiber had increased ($P < 0.01$) IL-1 β expression, and the control and cellulose diets increased ($P < 0.01$) IFNG expression compared with pectin. Expression of IFNG was increased ($P < 0.001$) by infection and an interaction ($P < 0.05$) between fiber and infection was observed. Interactive effects ($P < 0.01$) between infection and Thr were observed for IL-1 β and IFNG. These findings suggest that the combined effects of dietary fiber source and Thr may impact immune-related gene expression in growing chicks infected with coccidiosis.

Key Words: *Eimeria maxima*, pectin, cellulose, chick, cytokine

115 Relative bioefficacy of natural methionine compared with synthetic methionine in broiler chicks. Z. Hayat*^{1,2}, M. Akram², A. M. Rana³, S. Mehmood¹, and J. Husain¹, ¹*Department of Animal Sciences, University of Sargodha, Sargodha, Pakistan*, ²*Department of Poultry Production, University of Veterinary & Animal Sciences, Lahore, Pakistan*, ³*HiVet Animal Health, Lahore, Pakistan*.

Methionine is a sulfur containing amino acid which is dietary essential for healthy and productive poultry. It is usually considered as the first limiting amino acid and poultry diets are supplemented with its synthetic form for balanced feed formulation. The objective of the study reported herein was comparison of relative bioefficacies of natural methionine source (Mercometh; MM) and synthetic methionine (dl-methionine; DLM) in broiler chickens. Day old broiler chicks (straight run Cobb500; n = 360) were purchased from a local hatchery. These chicks were randomly allotted to one of 4 experimental diets with 6 replicates of 15 chicks each totaling 90 chicks per treatment. The basal starter and finisher diets were formulated to be deficient in methionine to detect clear differences between the bioefficacies of added methionine sources. Other 3 diets were prepared with addition of MM, DLM or MM+DLM to fulfill dietary methionine requirements of broilers corresponding to age. Experiment was conducted for 6 weeks under completely randomized design. Statistical analysis of data revealed significant ($P < 0.05$) differences between the basal diet (deficient in methionine; negative control) and other experimental treatments with inclusion of different methionine sources with respect to body weight, feed conversion and production efficiency factor. However, feed consumption was independent of dietary treatments ($P > 0.05$). Experimental diets supplemented with different methionine sources did not significantly affect production performance of the birds. Non-significant differences were also observed for slaughter data and serum biochemistry values of chicks fed on different experimental diets. It may be concluded from this preliminary trial that natural methionine has potential to replace synthetic methionine in broiler diets.

Key Words: amino acid, synthetic methionine, natural methionine, broiler

116 Effect of excess lysine and methionine on immune system and performance of broilers. M. Bouyeh,* *Islamic Azad University, Rasht branch, Guilan, Iran.*

The present work was carried out to investigate the effects of excess dietary lysine (Lys) and methionine (Met) on some blood immune parameters and the performance of broiler chicks. Three hundred male Ross 308 broilers were allotted to 5 groups, each of which included 4 replicates (15 birds per replicate) in a completely randomized design. The treatment groups received the same basal diet supplemented with Lys and Met (as TSAA) in 0, 10, 20, 30 or 40% more than NRC (1994) recommendation. The collected data were analyzed by SPSS software and Duncan test was used to compare the means on a value of $P < 0.05$. The results indicated that the 2 highest levels of Lys and Met treatments (30 and 40% more than NRC recommendation) led to significant increase in blood lymphocytes and decrease in heterophils and ratio of heterophils to lymphocytes as a stress index ($P < 0.01$). There was a linear increase in Newcastle antibody parallel with increasing dietary Lys and Met in 42 d of age ($P < 0.01$) but not 21d. Carcass efficiency, breast muscle yield, heart and liver weight were also increased by the 2 highest levels of Lys and Met ($P < 0.05$), whereas feed conversion ratio (FCR) was the least in these 2 treatment groups ($P < 0.05$). Addition Lys and Met 40% more than NRC tend to significant decrease in body weight gain ($P < 0.05$) but there was no significant effect of treatments on thigh and leg yield. The finding of this experiment showed that increasing Lys and Met to diets of today broiler in excess of NRC recommendations can improve immune system functions, FCR, abdominal fat deposition, breast meat yield and carcass efficiency. Results reported here support the hypothesis that it is possible to produce more healthy and economic poultry meat by supplementation excess Lys and Met to broiler diets.

Key Words: lysine, methionine, immune system, broiler

117 Withdrawn.