

wk of age located at 15cM ($P < 0.05$) expressing significant dominance effects ($P < 0.01$). Chromosome 3 potentially contained two QTL for tibial BMD at 35 wk of age located at 84 and 143cM ($P < 0.01$) and one QTL for 35 wk BW at 147cM ($P < 0.05$). All three QTL on chromosome 3 expressed significant additive effects ($P < 0.01$). The QTL located on chromosomes 1 and 3 explained 2.7 and 4.0% of the residual phenotypic variation for BMD of the humerus and tibia at 35 wk of age, respectively. No QTL were identified on chromosomes 1 and 3 for other traits in the analysis. Identification of additional QTL associated with BMD may facilitate selection of birds for improved bone strength through marker assisted selection. Research supported by Midwest Poultry Consortium and NRI Competitive Grants Program / USDA No. 2002-03394.

Key Words: Bone Mineral Density, Quantitative Trait Loci, Chicken

445 Molecular characterization of chicken SOCS2 gene. G. Y. Zhou* and F. C. Leung, *Department of Zoology, The University of Hong Kong, Hong Kong, China.*

Suppressor of cytokine signaling 2 (SOCS2) has been demonstrated to involve in postnatal growth in mouse, negatively regulating a wide variety of cytokine signaling like growth hormone and interleukin-6 through the JAK-STAT pathway. In Chicken, using alternative transcriptional starting sites, two transcripts of SOCS2 named variant 1 and variant 2 were discovered by 5' RACE assay. Besides, two SOCS2 proteins encoded by the variants were identified and they are composed of 156 aa and 207 aa, respectively. In order to illustrate its genomic structure, a chicken BAC clone containing the SOCS2 gene was characterized by sequencing. It was found that chicken SOCS2 gene comprises only two exons and one intron, while in human or in mouse, SOCS2 gene consists of three exons and two introns. These differences may reveal the evolutionary relationship between mammals and birds. On the other hand, RT-PCR showed that the two SOCS2 mRNAs were distributed widely in both male and female adult chicken, but the expression levels of them varied from organ to organ. In summary, chicken SOCS2 gene may modulate somatic growth of chicken as shown in mouse and

PSA-Nutrition: Alternate Ingredients and Gastrointestinal System

447 Relative toxicity of gossypol isomers in laying hens. M. M. Lordelo*¹, A. J. Davis¹, M. C. Calhoun², and N. M. Dale¹, ¹*Poultry Science Department, University of Georgia, Athens,* ²*Texas A&M University Research Center, San Angelo.*

Cottonseed meal has been proposed as a protein source for poultry diets, but concern over the presence of the potentially toxic factor, gossypol, has limited its use. Gossypol is a polyphenolic compound that exists as either a positive (+) or negative (-) isomer. An experiment was conducted to determine the relative toxicity of each gossypol isomer in laying hens. Twenty-five individually caged Hy-Line W36 43 wk-old layers were fed a corn/soy diet supplemented with either 0, 200 (+), 400 (+), 200(-) or 400 (-) mg/kg of pure gossypol isomer for 20 d (5 pens /treatment). Feed intake, egg production and egg weight were monitored daily. Birds were weighed on d 1 and d 20. All eggs were individually opened and scored for yolk discoloration using a scale of 0 (no discoloration) through 10 (complete discoloration). Subsequently, yolks were separated for gossypol analysis. At the end of the experiment, tissue samples were collected for determination of gossypol isomer levels. Total egg production was equivalent for birds fed either the control or the (-) isomer diets. Birds fed the (+) isomer, however, had lower ($P < 0.05$) total egg production. After d 10, egg weight was significantly decreased from birds fed either level of the (+) isomer when compared to the control-fed birds. Eggs produced by the layers fed the (+) isomer had severe yolk discoloration. Although average egg yolk discoloration scores were equivalent between birds fed either the control diet or the diets supplemented with the (-) isomer, there were a few eggs with a score of 3 detected for the (-) isomer treatment but not for control treatment. Total feed intake was lower for birds consuming the 400 mg/kg level of (+) isomer when compared to the birds on the other treatments. Final body weights were not different between the controls and the other treatments. Tissue and yolk accumulation of the (+) gossypol isomer was higher than the (-) isomer. Additionally, there was no racemization of the isomers in the tissues and yolks of the laying hens. The results

the physiological relevance among the two isoforms of SOCS2 requires further investigation.

Key Words: SOCS2, Variants, Growth Hormone

446 Molecular cloning and characterization of a broiler small intestine Type IIb sodium phosphate cotransporter gene. F. Yan^{1,4}, C. Ashwell^{2,3}, and R. Angel¹, ¹*Department of Animal and Avian Sciences, University of Maryland, College Park,* ²*Growth Biology Lab., Animal and Natural Resources Institute, USDA-ARS, Beltsville, MD,* ³*Department of Poultry Science, North Carolina State University, Raleigh,* ⁴*Department of Poultry Science, University of Arkansas, Fayetteville.*

Intestinal absorption and renal resorption play a critical role in overall homeostasis of phosphorus in chickens. Using RNase-Ligase-Mediated Rapid Amplification of cDNA Ends (RLM-RACE) PCR, we have obtained a cDNA from the broiler small intestine, that encodes a type IIb sodium-dependent phosphate transporter. The cDNA has an open reading frame of 2022 base pairs and predicts a protein of 674 amino acids with the calculated molecular mass of approximately 74 kDa. Amino acid hydrophathy predicts eight transmembrane domains, with intracellular NH₂ and COOH termini. The Na/Pi IIb cotransporter has high homology with other type II Na/Pi cotransporters, but low homology with the type I or type III Na/Pi cotransporters. The Na/Pi IIb transporter is located on chicken chromosome 4 at 73.61 Mb where a gene was predicted by the Ensemble database. A microsatellite marker is present within intron 5 of the genomic structure. Northern blot analysis demonstrated the presence of a single mRNA transcript present predominantly in the small intestine with the highest expression in the duodenum, followed by the jejunum and ileum. In situ hybridization indicated that the Na/Pi cotransporter mRNA is expressed throughout the vertical crypt-villus axis of the small intestine. Further study is needed to elucidate its physiological role in the intestinal absorption of phosphate in chickens.

Key Words: Small Intestine, Phosphorus, Absorption

indicate that the (+) gossypol isomer is responsible for the negative impacts associated with feeding cottonseed meal to laying hens.

Key Words: Gossypol Isomers, Cottonseed Meal, Laying Hens

448 Effect of increased heat processing on phosphorus (P) bioavailability in corn distiller dried grains with solubles (DDGS). C. Martinez Amezcua*, L. E. Markovic, and C. M. Parsons, *Department of Animal Sciences, University of Illinois, Urbana.*

A few previous studies have shown that heat processing may increase the bioavailability of phytate-P in some foodstuffs. Therefore, two chick experiments were conducted to determine the effect of various increased heat processing treatments on bioavailability of P in DDGS. In addition, two precision-fed cecectomized rooster assays were conducted to evaluate the effects of the heat treatments on amino acid digestibility, particularly lysine. For the chick assays, a P-deficient cornstarch-dextrose-soybean meal basal diet containing 0.10% nonphytate phosphorus was formulated. A standard curve was then constructed by adding 0.0, 0.05 and 0.10% P from KH₂PO₄ to the basal diet. For the DDGS treatments, a commercial sample of DDGS was obtained and then subjected to increased heat processing by autoclaving at 124 kPa and 121C or by heating in a drying oven at 121C. The various DDGS samples were then added to the P-deficient basal diet at levels of 7 to 14%. New Hampshire x Columbian male chicks were fed the experimental diets from Day 8 to 22 post-hatch, and growth performance and tibia ash were measured. Bioavailability of P was estimated using the slope-ratio method, where tibia ash was regressed on P intake from KH₂PO₄ or DDGS. In the first experiment, bioavailability of P in DDGS (% of total) was increased ($P < 0.05$) from 75 to 87% by autoclaving for 75 min. In the second chick assay, P bioavailability was significantly increased ($P < 0.05$) by autoclaving for 60 and 80 min, but not for 40 min. The effects of oven drying on P bioavailability were inconsistent. Lysine digestibility of DDGS determined by the cecectomized rooster assay was substantially decreased

by the heat treatments, particularly for autoclaving, which caused large reductions. The results of this study indicated that increased heat processing may increase P bioavailability in DDGS but will likely reduce amino acid digestibility, particularly for lysine.

Key Words: DDGS, Phosphorus, Lysine

449 High protein corn distiller dried grains as a feed ingredient. C. Abe*¹, N. J. Nagle², C. Parsons³, J. Brannon¹, and S. L. Noll¹, ¹University of Minnesota, St. Paul, ²National Bioenergy Center, Golden, CO, ³University of Illinois, Urbana.

Hydrolyzed distillers dried grains (HDG) were obtained from the National Renewable Energy Laboratory. The sample was submitted for determination of proximate components, sugar, starch, amino acid, and minerals. For digestible amino acid determination, cecatomized chicken roosters were used. Growing turkeys were used for the determination of TMEn. HDG was evaluated for feeding value by inclusion into a basal diet at 0, 5, 10, 15, and 20%. The corn-soybean meal based turkey starter diet was formulated to provide similar levels of ME, digestible lysine (lys) and methionine (met), calcium, and phosphorus. Male poult (Large White) were fed a commercial starter diet until 3 d of age. At 3 d of age, they were weighed and assigned into cages such that there was an equivalent cage body weight. Poults were fed the experimental diets to 18 d of age (Ten replicate cages/seven poults/cage). At the end of the trial, two poults per pen were randomly selected, euthanized, and internal organs (spleen, heart, liver, gastrointestinal tract, bursa) weighed. Results (as fed) for ash, DM, fat, fiber, protein, starch and sugars were 1.43, 95.9, 10.7, 3.9, 57.8, 1.6, and 2.0%, respectively. Lys, arginine (arg), tryptophan (trp), threonine (thr), cystine (cys) and met content as % of protein were 1.99, 2.63, 0.34, 3.14, and 2.1%, respectively. Digestibility coefficients of lys, arg, trp, thr, cys and met were 68.1, 79, 64, 75.2, 78.3 and 85.9% respectively. TMEn was 2692±78 kcal/kg as is. There was significant linear decrease ($P<0.01$) at 11 day of age in average daily gain (ADG) and feed intake as HDG level was increased and a cubic effect ($P<0.02$) in ADG during 11 to 18 days. In conclusion, up to 10% of HDG can be included in turkey starter diets although higher levels may be possible after two weeks of age.

Key Words: Turkey, Corn, Distillers Dried Grain

450 Mucin dynamics in the chicken gastrointestinal tract. A. Smirnov*, Z. Uni, and D. Sklan, *Hebrew University, Rehovot, Israel.*

The absorptive surface of the small intestine is covered by a layer of mucus secreted by goblet cells which acts a barrier influencing transport between luminal content and epithelial cells. Bacterial lipopolysaccharide, growth-factors, nutrients and nutritional conditions participate in regulation of mucin biosynthesis. Mucin glycoproteins modulate adherence of different bacterial species that have a role in gut health. In this study methods of analysis of mucin dynamics were established and the influence of nutritional manipulations on mucin function in chicks investigated in two different nutritional settings. In the first experiment chicks were starved for 48 hr, and in the second chicks were fed with diets with added antibiotic or probiotic. Mucin mRNA expression, mucin glycoprotein concentration, mucus adherent layer thickness and goblet cell size and numbers were measured in the jejunum. A 371-bp cDNA fragment of the chick small intestine mucin gene was isolated and was 60% homologous to human mucin MUC5AC. Mucin mRNA expression was analyzed by semi-quantitative RT-PCR. mRNA expression increased by 480% and mucin glycoprotein by 216% in the jejunum of starved chicks. Goblet cell size was increased by starvation by 100% in the jejunum. Measuring the thickness of the mucus adherent layer revealed that increased protein synthesis did not result in a thicker mucus layer. On the contrary, the mucus adherent layer exhibited a 36% decrease in jejunum of the starved chicks. This may be explained by a higher rate of mucus layer degradation in starved chicks or by changes in mucin secretion from goblet cells. Feeding antibiotic and probiotic additives changed mucin dynamics, goblet cell morphology, mucin gene expression and mucin glycoprotein concentrations. These changes may be due to alterations in the intestinal microflora. This study has indicated that regulation of mucin production, secretion and turnover in

the chick small intestine is altered by nutritional manipulations. These changes influence mucosal function and defense.

Key Words: Chick, Small Intestine, Mucin

451 Diurnal variations and quantitative determination of the generation of carboxylic acids by microbial fermentation in the crop of the domestic turkey. S. A. Johannsen*¹, M. J. Hensley³, M. A. Rasmussen⁴, R. Griffith³, and C. G. Scanes^{1,2}, ¹Department of Animal Science, Iowa State University, Ames, ²Biomedical Sciences, Iowa State University, Ames, ³Veterinary Microbiology and Preventive Medicine, Iowa State University, Ames, ⁴National Animal Disease Center, Animal Science, Iowa State University, Ames.

The roles of avian crop include storage of ingesta but it may allow fermentation. It has been shown recently in the chicken that carcass contamination can be attributed to bacterial colonization of the crop tissue when the organ ruptures during evisceration. The present studies examine intra-luminal fermentation in the crop of young turkey poults. The following carboxylic acids were detected in the crop contents: formic, acetic, butyric, lactic, valeric, caproic, oxalic, phenyl acetic, succinic and fumaric acids. Unexpectedly, propionic, isobutyric and isovaleric acids were not detectable. At the beginning of the scotophase, there were considerable ingesta in the crop of turkey poults. During the scotophase, there were changes in the amount and characteristics (pH and carboxylic acid concentrations) of the crop contents. A progressive reduction in the contents was observed. Increases in the numbers of lactobacilli during the period of subjective night were observed. The pH of the contents decreased; for example declining from 5.9 one hour after the onset of the scotophase to 5.0 nine hours after the onset of the scotophase in control turkey poults. During the scotophase, there were linear increases the concentration of lactic, valeric and caproic acids (approximately 7 fold increases over 8 hours). There were decreases in the crop concentrations of formic, oxalic and succinic acids during the scotophase. Chronic addition of lactose or *Lactobacillus* sp. to the diet exerted modest effects on the carboxylic acid concentration in the crop contents. These data indicate the importance of microbial fermentation in the crop of poults and provide evidence of diurnal variation. These factors may have an impact upon metabolism and nutrition of the turkey and poultry in general.

Key Words: Turkey, Fermentation, Crop

452 Effects of delayed placement on Villus characteristics and barrier functions of the small intestine of the newly hatched turkey. L. P. Potturi*, J. Patterson, and T. J. Applegate, *Department of Animal Sciences, Purdue University, West Lafayette, IN.*

The objectives of the research were to determine the effect of delayed access to feed, on villus development, bacterial translocation and salmonella attachment potential in turkey poults during the first wk after hatching. Poults were either given ad libitum access to water and feed immediately after hatch (FED), or delayed access to water and feed for 48 h (DLY). In the first study, the FED poults had 50 μ m longer villi, 6.8 μ m wider villi and 5.9 μ m deeper crypts when compared to the DLY poults at 5 d post-feeding ($P<0.05$). The DLY poults had fewer goblet cells per villus when compared to FED poults on 5 d post-feeding ($P=0.016$). The FED poults had a significant increase in the number of proliferating enterocytes in the villus, when compared to DLY poults, on 1, 2, and 5 d post-feeding. Apoptotic labeling was higher in DLY group compared to the FED group on 1, 2 and 5 d post-feeding. In the second study, the DLY poults had higher numbers of aerobic bacteria in the ileal digesta and ileal tissue, when compared to the FED poults on 1 d post-feeding ($P<0.05$). The number of aerobic bacteria translocated to the spleen by 5 d post-feeding was less when compared to 1 d post-feeding ($P\leq 0.05$). The FED and DLY poults challenged with salmonella were not significantly different in the number of salmonella isolated from the ileal tissue. Higher numbers of salmonella were isolated from both the treatment groups on 5 d post-feeding relative to 1 d post-feeding ($P=0.0006$). In conclusion, early access to ad libitum feed in poults stimulated the growth and development of small intestinal villi and their absorptive surface while delayed access to feed resulted in

delayed enterocyte proliferation and greater enterocyte apoptosis during the first wk post-hatch. Delayed placement increased the numbers of aerobic bacteria in the small intestine of poult shortly after hatch.

Key Words: Poult, Delayed Placement, Intestinal Development

453 Effect of dietary amino acid content on intestinal populations of *Clostridium perfringens* in broiler chickens fed high-crude protein diets. D. C. Wilkie*, A. G. Van Kessel, L. J. White, and M. D. Drew, *Dept. of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.*

Necrotic enteritis is a disease affecting poultry caused by *Clostridium perfringens* and is a concern to producers worldwide. Previous studies have reported that dietary protein has a significant effect on gut *C. perfringens* populations. Thus, a better understanding of the relationship between dietary protein and gut *C. perfringens* populations may result in improved control of this disease. An experiment was performed to examine the effect of dietary amino acid content on intestinal levels of *C. perfringens*. Broiler chickens (N = 192) were fed a non-medicated starter diet (31.5% crude protein) for 14 days after hatching and were orally challenged with 1 mL per day of an overnight culture of *C. perfringens* on days 14-21. On days 14-28 the 2 pens of 12 birds each were fed 1 of 7 diets containing 40% crude protein with fish meal, meat/bone meal, feather meal, corn gluten meal, soy protein concentrate, pea protein concentrate, or potato protein concentrate as the primary protein source. An eighth diet containing 23% crude protein was fed as a control. No clinical necrotic enteritis was observed, however the birds fed fish meal, meat/bone meal, feather meal and potato protein concentrate had significantly higher cecal *C. perfringens* counts than the birds fed corn gluten meal, soy or pea protein concentrates or the control diet (P < 0.05). In the ileum, *C. perfringens* counts in the birds fed fish meal, meat/bone meal and feather meal were significantly higher than in the birds fed corn gluten meal, soy or pea protein concentrates or the control diet (P < 0.05). Correlation analysis was done between the amino acid content of the diets and *C. perfringens* numbers in ileum and cecum. The glycine content of the diets was significantly correlated with *C. perfringens* numbers in ileum (r = 0.923; P < 0.05) and cecum (r = 0.840; P < 0.05). No other significant correlations were observed. The results suggest that the glycine content of diets is an important factor predisposing broilers to the intestinal overgrowth of *C. perfringens* and clinical necrotic enteritis.

Key Words: Clostridium Perfringens, Broiler Chicken, Amino Acid

454 Molecular tracking of *Bifidobacterium animalis* colonization in the gastrointestinal tract of broiler chickens using quantitative real time PCR (qPCR). S. A. Briggs*¹, T. J. Dumonceaux¹, B.G. Goldade¹, J. K. Marshall¹, J.E. Hill², S. M. Hemmingsen², and A. G. Van Kessel¹, ¹University of Saskatchewan, Saskatoon, SK, Canada, ²National Research Council, Saskatoon, SK, Canada.

To evaluate molecular quantification of specific bacteria in the intestine a qPCR assay was developed to enumerate *Bifidobacterium animalis* (ATCC 27536) using PCR primers designed on chaperonin 60 gene sequence, SYBR Green fluorescence detection of PCR product accumulation and a standard curve based on genomic DNA extracted from pure *B. animalis* culture. Primer specificity was confirmed with standard PCR and a panel of genomic DNA from 30 bacterial species, including 7 *Bifidobacterium* spp. Specific amplification of *B. animalis* in a complex background was confirmed by sequencing of PCR products generated from cecal contents. To test the assay in vivo, 216 broiler chickens were arranged in a 2X3 factorial design, such that birds (6 birds/pen) were fed a corn-soy starter diet (CP 20.8% AME 3.1 kcal/g) containing 0, 1.5 or 3% guar gum (GG) and orally gavaged with 10⁸ cells of *B. animalis* or water on days 1, 3, 5, 7 and 9 after hatch. Bifidobacteria(BA), coliforms(CO) and *B. animalis* genomes were enumerated using Beerens agar, MacConkeys agar and the qPCR assay, respectively in ileal and cecal contents collected on days 7, 14 and 21 after hatch. Addition of 1.5 and 3.0 % GG to diets increased (P<0.05) BA in ileum on day 14 and increased BA, CO and *B. animalis* genomes in cecum on all sampling days. Gavage increased (P<0.05) *B. animalis* genomes detected in ileum on day 21 but not days 7 or 14. In cecum, gavage increased (P<0.05) BA detected in all diets on day 7 and in the 0% GG diet on day 21, however, gavage did not affect the number of CO or *B. animalis* genomes in cecum. DNA extracted from only 1 of 15 colonies isolated

from pooled cecal contents cultured on Beerens agar could be amplified with *B. animalis* specific primers. Results demonstrate that qPCR assays can be used to enumerate bacteria in intestinal contents of poultry and offer markedly improved specificity vs. culture-based analysis.

Key Words: Poultry, qPCR, Bifidobacterium

455 The effect of glutamine on growth performance and the development of the gastrointestinal tract and immune system of broilers. S. M. Bartell* and A. B. Batal, *University of Georgia, Athens.*

Two experiments were conducted to evaluate the effect of glutamine (Gln) on growth performance, development of the gastrointestinal tract and immune system. Immediately after hatch six replicate pens of six chicks were randomly assigned to one of the seven (Experiment 1) or five (Experiment 2) dietary treatments for 21 d. On Day 0, 4, 7, 14, and 21 twelve chicks per treatment were sacrificed for thymus, spleen, bursa, duodenum, jejunum, ileum, bile, and blood sample collections and/or weights. In Experiment 1, the effect of 1 or 4% Gln addition to the feed, water, or both was compared to a corn-soybean meal (SBM) control diet. All diets were formulated to be isocaloric and isonitrogenous. Weight gain was significantly (P < 0.05) improved at 4, 14, and 21 d of age when chicks were fed diets with 1% Gln as compared to chicks fed the corn-SBM control (10% average improvement). The addition of 4% Gln to the water depressed (P < 0.05) growth performance through out the 21 d study and appeared to be toxic. There was an advantage of 1% Gln in the feed and water on the spleen and thymus weights. The addition of 4% Gln in the feed resulted in heavier duodenum and jejunum weights but a depression in weight gain. From experiment 1, 1% Gln supplementation to the diet was determined to be ample and most practical. Thus in experiment 2, 1% Gln was fed for 4, 7, 14, or 21 d after which time chicks were fed the corn-SBM control diet. Weight gain was significantly (P < 0.05) improved when chicks were fed 1% Gln as compared to chicks fed the corn-SBM control. The best performance was observed when the chicks were fed the diet with 1% Gln through out the 21 d study. The relative thymus weight of chicks fed diets with 1% Gln was higher than that of chicks fed the corn-SBM diet. In both experiments, concentrations of bile and plasma IgA were increased in the chicks fed diets with 1% Gln for 21 d. Our results indicate that the addition of Gln to the diet of broiler chicks improves growth performance and may stimulate development of the gastrointestinal tract and immune system.

Key Words: Glutamine, Gastrointestinal Tract, Broiler Chicks

456 Feeding a semi-purified diet induced early gut development in young turkey poults. Y. O. Fasina*¹, J. D. Garlich², H. L. Classen³, Z. Uni⁴, P. R. Ferket², and S. R. Mckee¹, ¹Auburn University, Auburn, AL, ²North Carolina State University, Raleigh, ³University of Saskatchewan, Saskatoon, SK, Canada, ⁴Faculty of Agriculture, Hebrew University, Rehovot, Israel.

Delayed access of newly hatched poultry to feed is known to result in higher poult mortality, sub-optimal intestinal development, and subsequent reduction in market weight. Sub-optimal functional maturation of the intestine early in the brooding period is one of the main constraints to optimal early growth of precocial birds (Konarzewski et al., 1990; Ricklefs et al., 1998). We propose that providing a diet that is capable of inducing intestinal maturation early in newly hatched poults is one way of improving early poult performance. Thus, an experiment was conducted to compare the ability of a corn starch-casein-based semi-purified diet (PD) and a conventional corn-soybean meal diet (SBD) to induce early intestinal development and growth in young poults. Each experimental diet contained 0.5 % titanium dioxide as an indigestible marker and was fed to 56 poults in four replicate pens (14 poults per pen) from 0 to 14 days of age. Body weight gain and feed efficiency of birds were recorded on days 7 and 14. Intestinal maturation was assessed by measuring the levels of brush border enzymes (maltase and alkaline phosphatase) on days 7 and 14. Fecal samples were collected during days 5 to 7 and days 12 to 14 of the experiment to evaluate nutrient digestibility. On day 7, although poults fed the SBD digested fat better (p < 0.05) than poults fed the PD, the latter poults had higher (p < 0.05) weight gain, feed efficiency and brush border enzyme levels. However, by day 14, the performance of poults fed the SBD improved such that the SBD treatment was similar or better to the PD treatment in all parameters assessed. It is concluded that the PD is superior to the

SBD in inducing early intestinal development in poults, but this benefit is significantly realized only during the first week of poult life.

Key Words: Turkey Poults, Early Intestinal Development, Semi-Purified Diet

PSA-Nutrition: Amino Acids and Vitamin/Mineral Nutrition II

457 Dietary lysine response by broilers in two photoperiods. O. C. Aimuwu* and M. S. Lilburn, *The Ohio State University/OARDC, Wooster.*

Within the broiler industry there is a move toward producing heavy broilers for the production of deboned breast meat. The management of heavy broilers typically involves some degree of photoperiod restriction to minimize the incidence of growth related anomalies (i.e. ascites). An experiment was conducted to establish a lysine response range for commercial broilers between 6 and 8 weeks of age. Diets were formulated to contain 0.70 (Control), 0.82, 0.94 and 1.06 percent total lysine. Acid insoluble ash (celite) was included in each diet to allow for ileal digestible lysine determination. Each diet was fed to broilers in four replicate floor pens (n=15 birds per pen) in each of two rooms. The birds in Room A had a 16 hour photoperiod beginning at 4 days of age whereas the birds in Room B had a 22 hour daily photoperiod. In each room, half the birds in each treatment were weighed and processed on days 15 and 16 of the experiment. In addition to body weight and feed conversion (pen basis), the weights of the pectoralis major and minor breast muscles were also recorded. The maximal response to lysine (body weight, breast muscle weight) occurred at 0.94 % total lysine (88% digestible lysine; $P < 0.05$). At the highest level of lysine (1.06 % total lysine, 92% digestible lysine) weight gain declined. There was a significant increase in lysine digestibility as dietary total lysine increased (Dig. Lysine = $60.5 + 29.9 \times (\text{total lysine})$; $r^2 = 0.72$; $P < .0001$). This was most likely due to the increasing proportion of synthetic lysine added as dietary total lysine increased. There were no significant photoperiod effects or diet by photoperiod interactions.

Key Words: Broilers, Digestibility, Lysine

458 A comparison of amino acid digestibility coefficients between chickens and turkeys. O. C. Aimuwu*¹, C. M. Parsons², and M. S. Lilburn¹, ¹*The Ohio State University/OARDC, Wooster*, ²*University of Illinois, Urbana.*

There is a paucity of information on comparative amino acid digestibility coefficients in chickens and turkeys. An ileal digestibility study with turkeys was conducted with five week-old turkey toms. Semi-purified diets were formulated with corn, wheat, soybean meal, meat and bone meal, feathermeal, and fishmeal as the sole sources of dietary protein. Toms were reared in litter floor pens until the beginning of the experiment (35 days) when they were moved into Petersime growing battery cages (3 toms per cage). Each diet was fed to three replicate pens and the experimental period was five days. Birds were killed by cervical dislocation on day 5 and ileal diesta was collected between Meckels diverticulum and the ileal caecal junction. Samples of each of the experimental diets were sent to the University of Illinois for true amino acid digestibility determination using cecectomized adult roosters. The coefficients for the essential amino acids (EAA) lysine, methionine, and arginine in corn were fairly similar between the species but threonine digestibility was considerably lower in turkeys (72%) than roosters (88.5%). The digestibility coefficients for arginine, lysine, and methionine in soybean meal were 4 to 6% higher in roosters and the threonine differences were similar to what was observed for corn. Some of these differences could be due to the measurement of apparent digestibility in turkeys versus true digestibility in roosters. There was good similarity between the species for most of the EAA in meat and bone meal whereas in fishmeal, EAA digestibility was consistently higher in roosters than in turkeys.

Key Words: Digestibility, Roosters, Turkey

459 Valine needs of broilers from 21 to 42 days of age. S. A. Thornton*, S. J. Barber, A. Corzo, and M. T. Kidd, *Mississippi State University, Mississippi State.*

Valine is typically considered the fifth limiting amino acid in commercial broiler diets based on corn and soybean meal (CS). Three experiments

were conducted to evaluate Val needs for growth and carcass responses in Ross 508 broilers (d 21 to 42). All birds received a common diet from d 1 to 20. Experiment (Exp) 1 was a Val-test-diet validation experiment conducted with males randomly allocated across 30 battery pens (5 birds/pen). Dietary treatments for Exp 1 included: a test diet containing 0.72% Val (0.64% digestible (dig)) or 0.82% Val (0.73% dig) as achieved via L-Val supplementation, and a CS control diet containing 0.82% Val (0.73% dig) equaling NRC (1994) Val. Both Exp 2 and 3 were Val dose responses in male and female broilers, respectively. In Exp 2 and 3, birds were randomly distributed across 48 floor pens per Exp (12 birds/pen) and fed Val graduations (0.64 to 0.87% in 0.045% increments). In Exp 1, growth measurements were not affected ($P > 0.05$) by dietary treatments. Fat and carcass weight, and carcass yield did not differ ($P > 0.05$), but percentage fat was increased ($P \leq 0.05$) in birds fed low Val (15.6% CP) compared to birds fed the CS diet (18.0% CP). Because differences in BW gain ($P = 0.16$; 0.72% Val, 1.34 kg; 0.82% Val, 1.41 kg; and 0.82% Val in the CS control, 1.40 kg) did not occur, the test diet used to titrate Val in Exp 2 and 3 was decreased to 0.64% Val (0.57% dig). Quadratic responses in Exp 2 and 3 did not occur. Linear responses to increasing Val were observed for BW gain and feed conversion ($P \leq 0.05$) in males, and breast meat yield ($P = 0.07$) in females. Increasing Val to 0.73% (0.65% dig) improved ($P \leq 0.05$) BW gain and feed conversion in males, but not females, over broilers fed 0.64% Val (0.57% dig). Results indicate that diets based on CS containing 0.73% Val (0.65% dig) should support good live performance and processing traits for 21 to 42 d old males, but females may need less. The 21 to 42 d NRC (1994) Val recommendation of 0.82% is safe, but may be overestimated.

Key Words: Amino Acid, Broiler, Valine

460 Changes in the digestible lysine and sulfur amino acid needs of broiler chicks during the first 21 days posthatching. A. R. Garcia*, T. D. Troutman, and A. B. Batal, *University of Georgia, Athens.*

Two experiments were conducted to study the digestible lysine (DL) and sulfur amino acids (DSAA) requirements of broilers during the first wk of age, and to evaluate how the requirements change during the first 21 d. Male broiler chicks were randomly assigned to 5 replicate pens of 6 chicks per treatment from 0 to 21 d. The experimental diets, based on corn, soybean meal, and corn gluten meal (experiment 1), were formulated to be isocaloric and isonitrogenous, varying only in the level of the amino acid being tested. In experiment 1, the levels of DL used were 0.92, 1.02, 1.12, 1.22, 1.32%. In experiment 2, the levels of DSAA were: 0.65, 0.75, 0.85, 0.95 and 1.05%. Body weights and feed intake were recorded at d 4, 7 and 21, and body weight gain (BWG) and gain:feed ratio (GF) were calculated for each period. The digestible amino acid requirements were estimated by broken-line methodology, fitting the data to a quadratic curve (90%) and determining the first point at which the quadratic response curve intersects the plateau of the one slope broken-line. Estimated requirements reported herein are based on results of the broken-line analysis. In experiment 1, the DL requirement based on BWG and GF increased slightly with age, 1.02% at d 4 to 1.05% at d 7 and 1.12% at d 4 to 1.14% at d 7, respectively, with little to no change thereafter. The DL requirement based on BWG was lower than the estimated requirement based on GF. In experiment 2, the estimated DSAA requirement based on BWG gradually decreased from 4 to 21 d (0.85, 0.84 and 0.80% at 4, 7 and 21 d, respectively), whereas the requirement based on GF did not change during the first wk, but increased slightly from 7 to 21 d of age (0.75% at d 4 and 7 and 0.78% at d 21). Results from these studies suggest there is little change in the DL requirement during the first three wk posthatch. The observed decrease in the DSAA requirement during the first 21 d does not match the expected increase needed for feathering. Studies conducted to date do not support the