

**M12 Ghrelin and reproduction in the broiler breeder hen.** M. E. Freeman\* and A. J. Davis, *University of Georgia, Athens.*

Ghrelin is a hormone produced predominantly in the proventriculus of birds in response to energy status. There are two forms of circulating ghrelin, unacylated ghrelin (UAG) and acylated ghrelin. The two forms share the same amino acid sequence but UAG undergoes an acylation of its third amino acid residue to become acylated ghrelin which can bind to the ghrelin receptor (GHSR). There is increasing evidence that ghrelin directly affects reproduction in mammalian species. Previously we reported that GHSR mRNA was expressed in both the theca and granulosa cells of the preovulatory follicles of the broiler breeder hen ovary and that fasting increased GHSR mRNA expression in the theca cells. The goal of the current research was to determine if plasma levels of total or acylated ghrelin increased in fasted broiler breeder hens and if ghrelin influenced progesterone (P4) production in cultured granulosa cells. Blood samples were collected from hens 6 and 96 hours after feeding. Plasma was extracted from each blood sample and acidified to prevent degradation of acylated ghrelin. Using synthesized acylated chicken ghrelin (Phoenix Pharmaceuticals) it was determined that Millipore's total ghrelin RIA kit was not suitable for measuring total ghrelin levels in hen plasma, but their acylated ghrelin kit was validated. The concentration of plasma acylated ghrelin was significantly greater in the samples collected from the hens after 96 hours of fasting versus those collected at 6 hours. In 4 replicate experiments, granulosa cells were isolated from the F1, F3, and small yellow follicles from 3 hens. The cells for each follicle size were then cultured in M199 or M199 containing 50 ng/mL acylated ghrelin, 50 ng/mL LH, or 50 ng/mL of ghrelin and LH. The addition of ghrelin to the granulosa cell culture media did not alter P4 production or GHSR mRNA expression nor did it impact the stimulation of P4 production and the depression of GHSR mRNA expression by LH in cultured cells from the hierarchical follicles. The results indicate that fasting elevates plasma ghrelin levels in hens, but that elevated levels of ghrelin likely do not directly affect granulosa cell production of P4 or mRNA expression of GHSR.

**Key Words:** Ghrelin, RIA

**M13 Method for isolating and culturing immature chicken oocytes.** C. R. James\*, W. D. Berry, S. S. Oates, and L. M. Stevenson, *Auburn University, Auburn, AL.*

Studies focusing on avian oocytes and their development are in need of advancement, and isolation and culturing techniques are important aspects of this advancement. This study is focused on dispersing and isolating the oocytes of immature chickens. The ovaries of immature chickens were removed and placed in ice-cold calcium/magnesium free Hanks balanced salt solution (HBSS). The ovaries were then washed several times in HBSS containing antibiotics/antimy-

cotics, and cut into very small pieces. An enzyme solution containing Type 2 collagenase, hyaluronidase, and pronase was introduced to the sample tissues. This mixture was placed in a shaking water bath at 37°C for 45 minutes. After this incubation period, the mixture was filtered through a 100-micron filter and centrifuged at 250x g for four minutes. The cell pellet was very gently resuspended by trituration in Media 199. This solution was again centrifuged at 250x g for eight minutes. This pellet was again gently resuspended by trituration in Media 199. The resulting avian cells were placed into culture flasks and incubated in CO<sub>2</sub> conditions for at least one hour. The immature avian oocytes were then examined. This work was supported by the Alabama Agricultural Experiment Station and the U.S. Poultry and Egg Association.

**Key Words:** Cell culture, Oocyte isolation, Avian oocyte, Cell dispersal, Immature oocyte

**M14 Energy source levels in the liver of three-day-old broilers and their associations with percent incubational egg weight loss and time of hatch.** R. W. Keirs\*<sup>1</sup>, E. D. Peebles<sup>1</sup>, D. A. Braasch<sup>1</sup>, and P. D. Gerard<sup>2</sup>, <sup>1</sup>Mississippi State University, Mississippi State, <sup>2</sup>Clemson University, Clemson, SC.

Liver lipid (LL) concentrations of 3-d-old broilers were found to be positively correlated to their time of hatch (TOH;  $P \leq 0.03$ ). Conversely, liver glycogen (LGLY) concentration of 3-d-old chicks was negatively correlated with 0-18 d percent incubational egg weight loss (PEWL;  $P \leq 0.05$ ). Furthermore, positive correlations were noted between concentrations of LGLY and liver glucose (LGLU;  $P \leq 0.005$ ), and between concentrations of LGLY and liver protein (LPRO;  $P \leq 0.0001$ ). Yolk lipid (YL) concentration was also negatively correlated with relative yolk weight ( $P \leq 0.0001$ ). During incubation, PEWL was significantly higher for chicks that hatched at 480 h compared with those that hatched at 486 h. The LL of 3-d-old chicks was significantly higher when they hatched at 492 h than when they hatched at 480 h; whereas, LGLU increased numerically with TOH between 480 and 486 h, and again between 486 and 492 h. Because PEWL is a function of eggshell conductance and the incubational environment, the embryo must compensate for increases and decreases in PEWL through alterations in TOH and the utilization of available energy sources. Lipid reserves in the chick liver may be conserved when hatched from eggs with lower PEWL rates and with a longer TOH. The accumulation of LL with TOH may impact the utilization of alternate energy sources including LPRO, LGLU, and LGLY. Adjustments in PEWL can be made through changes in the incubational environment in accordance with eggshell conductance. Resulting PEWL may directly affect TOH and its modification may be necessary to optimize the utilization of available energy reserves, leading to improved broiler performance.

**Key Words:** Broiler, Incubational egg weight loss, Liver glycogen, Liver lipid, Time of hatch

## Nutrition I

**M15 Comparative analysis of nutritive value of three common species of aquatic plants as sources of protein in broiler production.** B. O. Iyamu\*<sup>1</sup>, F. A. Iyoha<sup>2</sup>, C. O. Imarhiagbe<sup>1</sup>, and E. O. Uwagboe<sup>3</sup>, <sup>1</sup>Ministry of Agriculture and Natural Resources, Benin City, Edo State, Nigeria, <sup>2</sup>College of Education, Benin City, Edo State, Nigeria, <sup>3</sup>Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria.

Three common species of aquatic plants in the tropics; water hyacinth *Eichornia crassipes*, water fern *Azolla africana* and Duck weed *Spirodela polyrrhiza* were freshly harvested, washed and killed by heating at a temperature of 105°C for 35 minutes. Temperature was reduced to 70°C, dried for 72hrs and pulverized. Analytical methods for crude protein, ash, ether extract, crude fibre and moisture content of the plants were determined using AOAC (1990). The proximate chemical analysis result revealed that the crude protein content of the plant ranges from 22.8 to 28.9 % for the three aquatic plants. There is no significant difference in crude protein for water fern and duck weed (27.8±0.6% and 26.8±0.2% respectively,  $P \leq 0.05$ ) while significant difference exists for water hyacinth (21.8±0.6%,  $P \geq 0.05$ ). The mineral constituents of the plants varied among species with duck weed having the highest values for Na, Ca, and Fe.

Duck weed had highest EAA values except for methionine which was highest in water fern (0.73%). At 20% inclusion level of the aquatic plants replacement of fish meal it was revealed that weight gain of broilers fed with water fern and duck weed were not significantly different ( $P \leq 0.05$ ) and should be encourage for adoption by poultry farmers. In conclusion, the value of EAA in dehydrated aquatic plants such as water fern and duck weeds is quite comparable to most forage leguminous crops used for poultry diets.

**Key Words:** Comparative, Nutritive, Aquatic, Plants, Broilers.

**M16 The hypocholesterolemic mechanisms of dietary *Rhodobacter capsulatus* in laying hens.** A. G. Miah\*, U. Salma, and H. Tsujii, *Shinshu University, Nagano, Japan.*

The present study was designed to investigate the hypocholesterolemic mechanisms of dietary *Rhodobacter capsulatus* by determining the hepatic cholesterol and bile acid, fecal cholesterol and bile acids, and studying the incorporation

of 1-<sup>14</sup>C-palmitic acid into lipids and lipid fractions in hepatocytes. A total 32 laying hens (20-week old) were assigned into 2 dietary treatment groups, and fed diets supplemented with (0.04%) or without *R. capsulatus* for 60-day feeding period.

The dietary *R. capsulatus* reduced hepatic cholesterol 46% and triglycerides 32%, and increased bile acids 33%, respectively compared to the control diet over a 60-day of feeding period. The dietary supplementation of *R. capsulatus* significantly increased ( $P < 0.05$ ) the excretion of cholesterol, triglycerides and bile acids through feces. Among the lipid fractions, incorporation of 1-<sup>14</sup>C-palmitic acid into the phospholipids fraction was significantly decreased ( $P < 0.05$ ), and coincidentally, the incorporation of 1-<sup>14</sup>C-palmitic acid into triglycerides and cholesterol fractions were significantly increased ( $P < 0.05$ ) by *R. capsulatus* supplemented diet compared with the control diet. In conclusion, the dietary *R. capsulatus* induced the hepatic metabolism of lipids, lipid fractions and bile acids, and reduced the concentration of cholesterol and triglycerides in serum and egg-yolk through increasing the fecal excretion of cholesterol, triglycerides and bile acids.

**Key Words:** Cholesterol, Hypocholesterolemic mechanisms, Incorporation, Laying hens, *R. capsulatus*

**M17 Effects of guar meal against eimeria tenella infection in broiler chicks.** S. M. Hassan\*, A. K. El Gayar, D. Caldwell, C. A. Bailey, and A. L. Cartwright, Texas A& M University, College Station.

Guar meal contains relatively high levels of saponins which are known to have antiprotozoal activity and may be effective against coccidiosis. A 2x2 factorial experiment investigated the impact of guar meal (0 or 5%) corn-soy starter diets on chicks unchallenged or challenged with *Eimeria tenella*. At one day of age, one hundred twenty unsexed Ross x Ross broiler chicks were randomly distributed among four treatment groups. Chicks were challenged with 5x10<sup>3</sup> sporulated oocysts of *E. tenella* in 0.5 mL at 10 d of age by oral gavage. Weekly body weight, feed conversion and mortality were recorded for chicks fed from 0 to 21 d of age. Oocysts per gram feces were recorded from 6 to 10 d post infection. All chicks were slaughtered at 21 d of age to determine cecal lesion score and duodenal pH. Body weight of unchallenged and challenged chicks fed 0% guar meal were significantly higher than those fed 5% guar meal at 2 wk of age. Unchallenged chicks fed 0% guar meal diet were heavier than unchallenged and challenged chicks fed 5% guar meal at 3 wk of age. Unchallenged chicks fed either 0 or 5% guar meal showed lower feed conversion ratios than challenged chicks fed 5% guar meal. No significant differences were observed between challenged chicks and the other groups at the 2nd wk of age. Unchallenged chicks fed 5% guar meal were significantly lower feed conversion ratios than those fed 0% guar meal, but no significant differences were observed between unchallenged and challenged chicks that were fed 0% or 5% guar meal at the 3rd wk of age. Challenged chicks fed 0% guar meal had significantly higher oocysts per gram feces than the others only at 7 d post infection. No significant differences among treatment groups in mortality, cecal lesion score and duodenal pH were observed. Results indicated that including 5% guar meal in the diet of chicks challenged with *E. tenella* decreased oocysts per gram feces, but without effect on body weight and feed conversion ratio.

**Key Words:** Guar meal, *Eimeria tenella*, Chicken, body weight, Oocyst

**M18 Evaluation of distiller's dried grains as a feed ingredient for laying hens and broilers.** B. Y. Jung\*<sup>1</sup>, P. D. Sedlacek<sup>1</sup>, A. B. Batal<sup>1</sup>, and L. R. Prewitt<sup>2</sup>, <sup>1</sup>University of Georgia, Athens, <sup>2</sup>Agreco, LLC, Chesterfield, MO.

Two experiments (Exp) were conducted to evaluate the feeding value of distiller's dried grains (DDG) using a special fractionated process on laying hen and broiler performance. In Exp 1, five diets were fed to 15 replications of 6 Hy-line W36 laying hens per treatment. The five dietary treatments consisted of a commercial layer diet with 0, 3, 6, 9, or 12% DDG. Egg production was measured daily and egg weights were measured weekly for mean egg weight and total egg mass. In addition yolk color, haugh units, and specific gravity were measured every four wk. The addition of 3% DDG to the commercial layer diet significantly ( $P$

$> 0.05$ ) improved egg production and egg mass over the positive control (0% DDG). However, there was no difference in egg production between the diets with 6, 9 and 12% DDG as compared to the positive control or the diet with 3% DDG. There was no significant difference in specific gravity, haugh units, yolk color, body weight, or feed efficiency during the first 5 wks (21 to 26 wks of age) due to the addition of up to 12% DDG. This experiment will be carried out to 41 wks of age. In Exp 2, 1-d-old male broiler chicks were placed in Petersime battery boorders and maintaining on a 24 h lighting schedule in a thermostatically controlled room. Chicks were randomly assigned to 6 dietary treatments (0, 3, 6, 9, 12, and 16% DDG) with 8 replicate pens containing 6 chicks each. Body weight gain and feed intake were measured on 0, 7, 14 and 20 d of age. The addition of 3% DDG to the diet significantly improved ( $P > 0.05$ ) weight gain as compared to the broilers fed the diet with 0, 6, 9, 12 and 16% DDG. Increasing the level of DDG in the diets to 16% significantly ( $P > 0.05$ ) depressed weight gain, feed intake, and feed efficiency as compared to the 0 or 3% DDG diets, likely due to a deficiency in lysine. The addition of 3% DDG to a commercial layer or broiler diet significantly improved performance and thus, DDG (up to 6%) is a highly acceptable feed ingredient for poultry diets.

**Key Words:** Distiller's dried grain, Laying hens, Broilers

**M19 Dried distillers grains with solubles in laying hens ration (Phase I).** M. K. Masa'deh\* and S. E. Scheideler, University of Nebraska, Lincoln.

A study was conducted to test the effect of Dried Distillers Grains with solubles (DDGS) inclusion rates in laying hens on feed intake, body weight and egg parameters for phase one of production. Two hundred eighty-eight Bovan White laying hens were fed diets containing 0, 5, 10, 15, 20, or 25% DDGS from 24 to 46 weeks of age. The diets were formulated to provide 2775 Kcal/kg ME (metabolizable energy), 16.5% protein, 0.83% lysine and 0.75% TSAA. Six hens were placed per cage with 8 replicate cages per dietary treatment in an unbalanced randomized complete block design. Average feed intake was similar ( $p > 0.1$ ) between treatments with an average of 109g/hen/d. Average hen weights were similar ( $p > 0.1$ ) between dietary levels of DDGS. There was no difference in hen weight gain ( $p > 0.1$ ) between treatments. However, hen fed 20 & 25% DDGS had lower weight gain (100g) compare with 0, 5, 10, or 15% DDGS (140g). Egg production was not affected by dietary DDGS levels ( $p > 0.1$ ) averaging 91% EP. Egg wt. was significantly ( $p < 0.1$ ) affected by DDGS treatment. Hens fed 0, 5, 10, 15, 20 or 25% DDGS had an average egg wt. for the trial of 60.6, 60.4, 60.8, 60.0, 59.0, and 59.0 grams respectively. There was no difference ( $p > 0.1$ ) in egg Haugh unit, albumen height, and specific gravity between the levels of DDGS. Yolk color increased with increasing DDGS level with the highest Roche color fan score ( $p < 0.05$ ) of 7.2 for hens fed 25% DDGS. In Summary, feeding up to 25% DDGS during Phase I of production had no negative effects on feed intake, egg production, haugh unit and specific gravity; and improved yolk color at the highest levels. However, increasing DDGS level beyond 15% cause a reduction in egg weight.

**Key Words:** DDGS, Dried distillers grains with solubles, Laying hens

**M20 Evaluation of DDGS as an alternative ingredient for broiler chickens.** M. Y. Shim\*<sup>1</sup>, G. M. Pesti<sup>1</sup>, R. I. Bakalli<sup>1</sup>, P. B. Tillman<sup>2</sup>, and D. Hoehler<sup>3</sup>, <sup>1</sup>University of Georgia, Athens, <sup>2</sup>Ajimoto Heartland LLC, Chicago, IL, <sup>3</sup>Degussa Coporation, Kennesaw, GA.

The utilization of the co-product of ethanol production distillers dried grains with solubles (DDGS) was examined. Cobb x Cobb 500 commercial broilers were housed in floor pens (35 birds per pen) for 42 days across 6 pens per treatment. Corn, soybean meal, DDGS and poultry grease based diets were formulated for starter (0 - 18 d), grower (18 - 35 d) and finisher (35 - 42 d) phases on a digestible amino acid basis. Supplementation of L-Lysine HCl, L-Threonine and crude protein level increased with each increase in DDGS inclusion. Basal (0% DDGS) and summit (24% DDGS) diets were blended to obtain the 8 and 16 % DDGS diets, which were subsequently pelleted. DDGS was evaluated as an alternative ingredient to estimate growth performance, carcass quality and pellet durability. Body weight gain (BWG) at the end of the starter phase (d 18) was increased

when birds were fed DDGS (avg. = 0.717 kg) versus all corn (0.688 kg). BWG (2.496, 2.487, 2.469 and 2.494 kg) and feed utilization were similar at 42 days (1.686, 1.715, 1.715 and 1.711 kg/kg) for birds fed 0, 8, 16 and 24 % DDGS, respectively. Fat pads (0.058, 0.054, 0.049 and 0.048 kg) and breast meat yields (0.475, 0.486, 0.468 and 0.489 kg) were also similar at 42 days for 0, 8, 16 and 24 % DDGS respectively. Carcass quality did not show any differences up to 24 % DDGS compared to the corn and soybean control diet. Since DDGS and fat levels increased together, increased fat and DDGS levels decreased pellet durability. In the finisher phase, pellet durability was 74.20, 69.51, 60.18 and 49.66 % for 0, 8, 16 and 24 % DDGS, respectively. DDGS can be a good alternative ingredient for broiler chickens, provided diets are formulated and balanced based on digestible amino acids.

**Key Words:** DDGS, Broiler, L-Lysine HCl, L-Threonine

**M21 Evaluation of the feeding value of glycerin for poultry.** P. D. Sedlacek\*, A. B. Batal, and A. Jones, *University of Georgia, Athens.*

Increased government pressure for biofuels has led to a significant increase in biodiesel production resulting in increased cost for fat. Glycerin, a by-product of biodiesel production, may be used as an alternate source of fat in broiler diets. Thus, the purpose of this study was to evaluate the nutritional and feeding value of glycerin. The proximate analysis, TME<sub>n</sub>, mineral content, and fatty acids of four glycerin samples were determined. The TME<sub>n</sub> of the glycerin samples ranged from 4800-6700 kcal/kg. The samples had approximately 25-35% fat, 8-12% moisture, 4% ash. The methanol content ranged from 0.01 to 1.8%. Minerals present in greater than trace amounts were calcium and potassium at 70 and 800 ppm, respectively. The principle fatty acids of the glycerin samples were oleic acid and linoleic acid. One of the glycerin samples was added to a broiler diet as a partial fat replacement and fed in a 42 d experiment. Six diets were fed to eight replications of 40 chicks consisting of: 1) a positive control with 3.6% poultry fat (3,085 Kcal/kg); 2) a negative control with 1% poultry fat (2,920 Kcal/kg); 3) 5% glycerin, 1% poultry fat (3,085 Kcal/kg); 4) 2.5% glycerin, 1% poultry fat (3,085 Kcal/kg), achieved by blending treatment 1 and 3 in a 1:1 ratio; 5) 2.5% glycerin, 1% poultry fat (2175 Kcal/kg), achieved by blending treatment 2 and 3 in a 1:1 ratio; and 6) 7.5% glycerin, 1% poultry fat (3,085 Kcal/kg). There were no significant differences in weight gain or feed intake between the positive and negative control diet or the 2.5% glycerin diet (3,085 kcal/kg). Weight gain and feed intake decreased significantly for the 2.5% glycerin (2175 kcal/kg), 5% and 7.5% glycerin diets for all periods except the grower period. During the grower period there were no differences in weight gain or feed intake and no differences in feed efficiencies were observed. The reduction in body weight gain and feed intake with increasing levels of glycerin may be due to the high methanol content of the glycerin used (1.7% methanol). Glycerin may be used at low levels (2.5%) as a partial fat replacement in broiler diets.

**Key Words:** Glycerin, Poultry fat, Broiler diet

**M22 The interactive effects of glycine, total sulfur amino acids, and lysine addition to corn-soybean meal diets on growth performance and serum uric acid of 0-to 18-day old broilers.** S. Powell\*, T. D. Bidner, and L. L. Southern, *LSU Agricultural Center, Baton Rouge.*

Research was conducted to assess Gly addition to corn-soybean meal diets for broilers (Ross 308 or 708) with varying levels of TSAA and Lys. Treatments had 5 to 8 reps with 5 or 6 broilers per pen. Diets in all experiments (Exp.) were fed without or with Gly (total 2.32% Gly+Ser). All diets contained 0.25% L-Lys•HCl except in Exp. 1, where no crystalline Lys was added. In Exp. 1, the Lys level was 1.26% with TSAA:Lys of 0.72 and 0.76, and without or with Gly. Gain (ADG), feed intake (ADFI), and gain:feed (GF) were not affected by Gly; however, GF was increased in broilers fed the 0.76 TSAA:Lys ( $P < 0.07$ ). Glycine increased GF at the 0.72 TSAA:Lys but decreased GF at the 0.76 TSAA:Lys (TSAA:Lys × Gly,  $P < 0.03$ ). In Exp. 2, the Lys level was 1.26% with TSAA:Lys of 0.51, 0.68, 0.72, and 0.76, and without or with Gly. Glycine did not affect ADG, ADFI or GF; however, increasing TSAA:Lys linearly increased ( $P < 0.01$ ) ADG, ADFI, and GF and the response was quadratic for ADG and GF. Experiment 3 was

similar to Exp. 2 except the Lys level was 1.35%. Glycine increased ( $P < 0.03$ ) GF and decreased ( $P < 0.04$ ) serum uric acid (SUA); also, increasing TSAA:Lys linearly and quadratically ( $P < 0.02$ ) increased ADG, ADFI, and GF. In Exp. 4, broilers were fed 2 levels of Lys (1.26 and 1.35%), 3 levels of TSAA:Lys (0.72, 0.76, and 0.80), and without or with Gly. Glycine increased ADG ( $P < 0.02$ ) and GF ( $P < 0.01$ ). The increase in GF with Gly was not the same for all TSAA:Lys (TSAA:Lys × Gly,  $P < 0.07$ ). Increasing Lys increased ( $P < 0.01$  to 0.10) ADG, ADFI, and GF. Glycine increased ADG and ADFI more in broilers fed the 1.35% Lys (Lys × Gly,  $P < 0.09$ ). Glycine increased SUA in broilers fed 1.26% Lys but decreased SUA in broilers fed 1.35% Lys (Lys × Gly,  $P < 0.01$ ). Glycine decreased SUA in broilers fed the TSAA:Lys of 0.80 but not at the other TSAA:Lys (TSAA:Lys × Gly,  $P < 0.08$ ). These data indicate that Gly increased GF and decreased SUA in diets with 1.35% Lys.

**Key Words:** Broiler, Glycine, Lysine, Sulfur amino acid, Uric acid

**M23 The efficacy of OptiPhos® for improving growth performance and bone mineralization of male broilers fed phosphorus-deficient diets.** L. A. Oden\*, D. Hyatt, A. E. Klein, S. K. Pohl, and J. T. Lee, *Texas A&M University, College Station.*

An experiment was conducted to evaluate the effectiveness of OptiPhos® in liquid and dry form on male broiler growth performance and bone mineralization when fed phosphorus-deficient diets from 1 to 21 d of age. Diets were corn and soybean meal based and calculated to contain an available phosphorus content of 0.20% (P-deficient). Liquid OptiPhos® L2500 was applied to P-deficient diets at 250 FTU/kg and 500 FTU/kg, while the dry form, OptiPhos® PF, was applied at 250 FTU/kg. Liquid application consisted of spray applying onto crumbles following the pelleting process. A diet containing 0.35% available phosphorus (P-adequate) was included as it has been previously shown to maximize growth performance and bone mineralization of battery-reared male chicks from 1 to 21 d of age. Three hundred and sixty Cobb male broilers were randomly placed in brooder batteries and fed one of five treatments: P-adequate, P-deficient, P-deficient + 250 FTU/kg of OptiPhos® L2500, P-deficient + 500 FTU/kg of OptiPhos® L2500, and P-deficient + 250 FTU/kg of OptiPhos® PF. Treatments consisted of six replicates with 12 broilers per pen. Body weights and feed consumptions were determined on d 7, 14, and 21. On day 21, tibias were removed for bone ash determination. The P-deficient diet increased mortality ( $P < 0.05$ ), decrease body weight ( $P < 0.05$ ) and bone ash percentage compared to all other treatments. Phytase supplementation of P-deficient diet increased ( $P < 0.05$ ) weight gain and ash percentage at all inclusion levels. OptiPhos® L2500 added at 500 FTU/kg and OptiPhos® PF at 250 FTU/kg increased body weight to a level higher ( $P < 0.05$ ) than broilers fed the P-adequate diet and reduced feed conversion ratios ( $P < 0.05$ ) compared to P-deficient and P-adequate fed broilers. These data indicate that OptiPhos® supplementation in liquid and dry form can enhance broiler growth characteristics and bone mineralization when fed diets containing deficient levels of available phosphorus.

**Key Words:** Broiler, Bone ash, Phytase, Performance

**M24 Response of vaccinated starting broilers to diets with varying levels of crude protein with and without gelatin supplementation.** R. Lehman\*<sup>1</sup>, J. Hess<sup>1</sup>, D. Höehler<sup>2</sup>, and E.T. Moran, Jr.<sup>1</sup>, <sup>1</sup>Auburn University, Auburn, AL, <sup>2</sup>Degussa Feed Additives, GA.

Vaccination for coccidiosis is preferred to dietary inclusion of coccidiostats given the consumer's preference for antimicrobial free feed. Previous experimentation indicated that NEAA, particularly glycine and proline, from gelatin enhanced mucosal repair in vaccinated broilers and relieved early stress of vaccination. The value of gelatin for this relief in vaccinated broilers was investigated at increasing levels of dietary crude protein (CP). Day-old male Ross X 708 broilers were spray vaccinated for coccidiosis with Coccivac®-D prior to placement into 64 floor pens (23 chicks/pen) with used litter. Isocaloric corn-soybean meal starter diets were formulated to provide 20, 21, 22, and 23% CP while the minimum requirements for all EAA were maintained through supplementation of commercial free forms as needed. Gelatin was either excluded from formu-

lation or included to a fixed amount of 2%. Each feed was steam pelleted and presented in crumb form. Birds received the 8 experimental feeds to 3 weeks of age. Increasing the amount of protein in the diet led to increased feed intake ( $P < 0.001$ ) as well as feed conversion ( $P < 0.01$ ). Birds fed diets supplemented with 2% gelatin had improved feed conversion ( $P < 0.01$ ) and a decrease in feed consumption, although the difference was not statistically significant. Subsequent AA analyses indicated that isoleucine and valine were marginally adequate with the 20% CP feed, regardless of gelatin. Gelatin is of commercial significance because of its prevalence in most animal source feedstuffs. Glycine-proline in gelatin appears to favor formation of membrane-associated and secretory mucins that are immediately involved in mucosal integrity. Vaccination for coccidiosis likely creates an intense temporary need for mucin and, in turn, the amino acids, threonine-serine and glycine-proline, of which it is composed.

**Key Words:** Gelatin, Coccidiosis, Vaccination, Crude protein, Broiler

**M25 Dynamics of total tract nutrient retention of broilers with age and enzymes supplementation.** O. A. Olukosi\* and O. Adeola, *Purdue University, West Lafayette, IN.*

Four-hundred and fifty broiler chicks were used in a 21-d experiment to study the dynamics of total tract nutrient retention with age and enzyme supplementation. At 1 d of age, the broilers were allocated to 5 treatments in a randomized complete block design. The treatments were: (1) positive control (PC) with adequate P and metabolizable energy (ME); (2) negative control (NC) marginally deficient in P and ME; (3) NC plus phytase supplemented to supply 1,000 FTU/kg; (4) NC plus enzyme cocktail added to supply 650, 1,650 and 4,000 U/kg of xylanase, amylase and protease (XAP), respectively; and (5) NC plus phytase and XAP at levels in 3 and 4, respectively. The diets were corn-wheat-soybean meal based and were fed throughout the experiment. Excreta were collected on the last 3 d of every wk and analyzed for dry matter, N, energy, P, and Ca. Overall, total tract retention of all the nutrients increased with age ( $P < 0.01$ ) with total tract retention being at the lowest in wk 1. Dry matter retention improved ( $P < 0.05$ ) above the level in NC treatment by supplementation of phytase alone both in wk 1 and 2 but not in wk 3. Nitrogen retention was improved ( $P \leq 0.05$ ) by phytase supplementation alone throughout the 3 wk of the experiment. Combination of phytase and XAP only improved ( $P < 0.01$ ) N retention in wk 3. Phytase alone or combined with XAP improved ( $P < 0.05$ ) phosphorus retention at all ages of the broilers. Total tract Ca retention was improved ( $P \leq 0.05$ ) by supplementation of phytase alone or in combination with XAP in wk 1 and 2. Cocktail of XAP improved ( $P < 0.05$ ) Ca retention in wk 1 and 3. Improvement in P retention by phytase supplementation decreased from 16 percentage points in wk 1 to 5 percentage points in wk 3 whereas for N, the improvement decreased from 5 percentage points in wk 1 to 3 percentage points in wk 3. It is concluded that the potential for phytase to reduce nutrient excretion in manure is greatest at early age and decreases as the bird grows older.

**Key Words:** Age, Broilers, Enzymes, Nutrient retention

**M26 The glycine requirement of broilers fed low crude protein, corn-soybean meal diets.** A. Waguespack\*<sup>1</sup>, T. Bidner<sup>1</sup>, L. Southern<sup>1</sup>, and R. L. Payne<sup>2</sup>, <sup>1</sup>LSU Agricultural Center, Baton Rouge, <sup>2</sup>Degussa Corporation, Kenosaw, GA.

Three experiments (Exp.) were conducted to determine the Gly requirement in a low CP, corn and soybean meal diet with 0.25% L-Lys•HCl, a level which previously has been shown to maximize growth performance of Ross x Ross 708 broilers. Experiments were conducted with male Ross 308 (Exp. 2) or 708 (Exp. 1 and 3) broilers in brooder batteries from 0 to 18 d posthatching. Treatments contained 7 replicates with 6 birds per replicate. Diet 1 was the positive control (PC) diet with no Gly or L-Lys•HCl. Diets 2 to 8 contained 0.25% L-Lys•HCl and added crystalline Gly in 0.125% increments from 0 to 0.75%. Diet 9 was formulated to be isonitrogenous to the 0.75% Gly diet by supplementing 1.47% L-Glu. The addition of Glu did not affect ( $P > 0.10$ ) daily gain (ADG), feed intake (ADFI) or gain:feed (GF) compared with broilers fed the 0% Gly added diets, except for GF in Exp. 2 ( $P < 0.01$ ). Broilers fed the PC diet had greater

GF in all Exp. and ADG in Exp. 3 than broilers fed the 0% Gly diet ( $P < 0.10$ ). Broilers fed the PC diet had decreased ADFI in Exp. 2 than broilers fed the 0% Gly diet ( $P < 0.10$ ). Glycine addition to the diet did not affect ADG in any Exp. nor ADFI in Exp. 1 and 3 ( $P > 0.10$ ). In Exp. 1, Gly addition linearly increased ( $P < 0.001$ ) GF, but a requirement estimate could not be made with either a single or two-slope broken line analysis. In Exp. 2, Gly addition linearly ( $P < 0.05$ ) decreased ADFI and had a linear and quadratic increasing effect ( $P < 0.10$ ) on GF. A single slope, breakpoint analysis of GF estimated the Gly + Ser requirement to be 2.085% in a diet with 0.25% L-Lys•HCl ( $P < 0.05$ ). In Exp. 3, Gly addition tended to linearly increase ( $P = 0.11$ ) GF. A single slope, breakpoint analysis of GF estimated the Gly + Ser requirement to be 2.239% in a diet with 0.25% L-Lys•HCl ( $P = 0.37$ ). When the GF data from all 3 Exp. were combined, a single slope, breakpoint analysis estimated the Gly + Ser requirement to be 2.078% ( $P < 0.03$ ). The response to Gly is not a result of added nitrogen from Glu. Based on GF, there is a consistent response to added Gly.

**Key Words:** Broiler, Glycine, Requirement, Low crude protein

**M27 Serum uric acid as a response to assess amino acid adequacy of a diet.** A. Donsbough\*, S. Powell, T. Bidner, and L. Southern, *LSU Agricultural Center, Baton Rouge.*

Research was conducted to assess serum uric acid (SUA), urea nitrogen (SUN), and ammonia (SA) concentrations on amino acid (AA) adequacy of diets for broilers, 0 to 14 or 18 d old. Each treatment had at least 6 reps with 6 to 18 birds per pen (2 to 3 birds per pen were bled). Experiment 1 (Exp.) consisted of a diet (1.26% total Lys with 0.25% L-Lys•HCl) adequate or deficient in AA. Broilers were bled at the end of the Exp. with no fasting. Gain (ADG), feed intake (ADFI), and gain:feed (GF) were reduced ( $P < 0.03$ ) in broilers fed the AA-deficient diet, but SUA, SUN, and SA were not affected ( $P > 0.10$ ). Experiments 2 to 5 had 4 diets; a diet with 1.35% Lys (0.25% from L-Lys•HCl) with and without added Met (0 or 0.356%) or Gly (0 or 0.415%). The Met addition increased ( $P < 0.03$ ) ADG, ADFI, and GF in all Exp. The Gly addition increased ( $P < 0.07$ ) GF in all Exp. There was an increased response to Met with Gly added ( $P < 0.10$ ; Met x Gly) in ADG (Exp. 3 and 5), ADFI (Exp. 5), and GF (Exp. 4 and 5). In Exp. 2, birds were fasted for 2 h, bled, re-fed, and then bled at 0.5 and 1 h after feeding. After the 2 h fast, SUA, SUN, and SA were decreased ( $P < 0.10$ ) by Met, and SUA and SUN was decreased ( $P < 0.05$ ) by Gly. At 0.5 h postfeeding, SA was decreased ( $P < 0.01$ ) by Met. At 1 h postfeeding, SUN was decreased ( $P < 0.02$ ) by Gly. In Exp. 3, 4, and 5, birds were fasted for 2 h, fed for 20 min, bled at time 0 (immediately after eating), and then at 1, 2, and 3 h in Exp. 3; 2, 3, 4, and 5 h in Exp. 4; or at 2 h in Exp. 5. In Exp. 3, SUA and SUN were decreased ( $P < 0.02$ ) by Met at all times, and SA was decreased ( $P < 0.06$ ) by Met at 1 and 3 h. In Exp. 4, Met decreased SUA ( $P < 0.05$ ; 0, 2, and 5 h), SUN at all times ( $P < 0.04$ ), and SA ( $P < 0.02$ ; 0 and 4 h). Glycine decreased ( $P < 0.02$ ) SUN at 2 h. In Exp. 5, SUA and SUN were decreased ( $P < 0.04$ ) at 2 h by Gly and Met, and SUA was decreased more when the 2 AA were combined ( $P < 0.08$ ). In summary, SUA and to some extent, SUN can be used to assess responses to AA deficiency or adequacy in the diet.

**Key Words:** Broilers, Amino acid, Uric acid

**M28 In-ovo feeding and dietary  $\beta$ -hydroxy- $\beta$ -methylbutyrate effects on poul quality, growth performance and ileum microanatomy of turkey poults from 1 to 11 days of age.** D. V. Bohórquez\*<sup>1</sup>, A. A. Santos Jr.<sup>2</sup>, and P. R. Ferket<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Florida Hospital College of Health Sciences, Orlando, FL.

Mortality rates can reach 5% in turkey poults during the first week after hatch and the survivors' performance depends on early enteric development and health. Early feeding strategies such as *in-ovo*feeding (IOF) and/or dietary supplementation of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) may enhance poult vigour and early enteric development. A 2x2 factorial experiment was done to evaluate 2 incubation treatments (TRT) at 23E (control and 0.4ml of an IOF-solution) and 2 levels of HMB (0 and 0.1% of diet) fed from day of hatch to 11d. Poult activity (# lethargic birds/pen) was recorded at 1 and 4 hours after placement.

Body weight (BW) and cumulative feed:gain (cFCR) were determined at 4 and 11d of age. Ileum histomorphometry (8 villi/bird) were measured (10 poult/ TRT) at 1, 4 and 11d of age. Villus height (VH), crypt depth (CD), mucosal height (MH), Villus height-crypt depth ratio (V/C) and apparent villus surface area (VS) were determined. At hatch, there were no significant ( $P>0.05$ ) differences in BW between incubation TRT. One hour after placement, only 24% of IOF poult showed no activity compared with 46% of the controls (2.455 vs. 4.667 lethargic birds/pen,  $P<0.02$ ). At 1d, IOF poult had higher CD (1.251 vs 1.105  $\mu\text{m/g}$ ,  $P<0.01$ ) and MH (5.00 vs 4.436  $\mu\text{m/g}$ ,  $P<0.1$ ) than controls. At 4d, dietary HMB significantly reduced CD (1.317 vs 1.661 $\mu\text{m/g}$ ,  $P<0.1$ ), ML

(5.808 vs 6.349  $\mu\text{m/g}$ ,  $P<0.05$ ), and VS (380.6 vs 418.6  $\mu\text{m}^2/\text{g}$ ,  $P<0.01$ ). At 11d, only VS was significantly lower ( $P<0.05$ ) in IOF poult (309.3 vs 386.9  $\mu\text{m}^2/\text{g}$ ,  $P=0.05$ ) as compared to controls. But by then, IOF-treated poult had 5% higher body weights (240 vs. 228 g,  $P=0.05$ ) and 6% lower cFCR (1.266 vs 1.343 g:g,  $P<0.05$ ) than controls. *In-ovo* feeding enhanced eating activity and early enteric development (higher CD and VH) of poult, which may improve nutrient absorption and performance; although, these effects can be quenched by dietary HMB (0.1% of diet) during the brooding phase

**Key Words:** Poult quality, Performance, Gut health

## Environment & Management I

**M29 Livestock activities among Peri-urban households in Ibadan metropolis, Nigeria.** E. O. Uwagboe\*, J. O. Oladeji, and L. A. Akinbile, *University of Ibadan, Ibadan, Oyo State, Nigeria.*

The inception of Peri-urban agriculture in Nigeria especially livestock rearing to supplement the grossly inadequate protein intake of citizens is a welcome development. This study examined livestock activities among Peri-urban households in Ibadan Metropolis of Oyo state, Nigeria. Systematic random sampling technique was used to select 120 respondents out of 400 registered livestock farmers and questionnaire was used to elicit information from the respondents. Descriptive statistics such as frequency counts, percentages, charts were used for data presentation while Chi-Square was used for the analysis. The result revealed that all (100%) of the respondents are literate with primary education (57%) secondary (29%) and tertiary (14%); and 60% take poultry farming as their primary farming occupation. Majority (57%) of the respondents were within the age range of (30-50 years) with a mean age of 37 years. It was also revealed that the type of livestock mostly reared by the respondents was poultry (76%). Respondents indicated that benefits derived from rearing of livestock include; serving as source of protein food for the family (35%) and source of income (65%). Chi-Square result revealed that the primary occupation ( $X^2=21.62$ ,  $P\leq 0.05$ ), Marital status ( $X^2=28.55$ ,  $P\leq 0.05$ ), and constraints faced by the respondents ( $X^2=35.55$ ,  $P\leq 0.05$ ) are significantly related to their livestock activities. In conclusion, most of the livestock reared by the respondents is poultry and it serves as their primary farming occupation. Hence concerted efforts should be geared towards improving livestock production through training of the Peri-urban dwellers on improved technologies in poultry production. This will increase animal protein intake, enhance income and improve food security.

**Key Words:** Livestock, Peri-Urban, Households, Ibadan, Nigeria

**M30 Genomic analysis of the impact of aflatoxin on hepatic function of male broiler chicks.** L. P. Yarru\*, R. S. Settivari, E. Antoniou, D. R. Ledoux, and G. E. Rottinghaus, *University of Missouri, Columbia.*

The objective of this study was to determine the effects of dietary aflatoxin (AF) on hepatic gene expression in male broiler chicks. Seventy five day-old male broiler chicks were assigned to three dietary treatments (5 replicates of 5 chicks each) from hatch to day 21. The diets contained 0, 1 and 2 mg AF/kg of feed. Aflatoxin reduced ( $P<0.05$ ) feed intake, body weight gain, serum total proteins, serum Ca and P but increased ( $P<0.01$ ) liver weights in a dose dependent manner. Microarray analysis was used to identify shifts in genetic expression associated with the affected physiological processes in chicks fed 0 and 2 mg AF/kg of feed to identify potential targets for pharmacological/toxicological intervention. A loop design was used for microarray experiments with 3 technical and 4 biological replicates per treatment group. RNA was extracted from liver tissue and its quality was determined using gel electrophoresis and spectrophotometry. High quality RNA was purified from DNA contamination, reverse transcribed, and hybridized to an oligonucleotide microarray chip. Microarray data were analyzed using a 2-step ANOVA model and validated by quantitative real-time PCR. Genes with false discovery rates less than 12.5% and fold change greater than 1.4% were considered as differentially expressed. Compared with controls, various genes associated with energy production and fatty acid metabolism (carnitine palmitoyl transferase), growth and development (insulin like growth factor), antioxidant

protection (glutathione S transferase), detoxification (epoxide hydrolase), and immune protection (interleukins) were down-regulated, whereas genes associated with cell proliferation (ornithine decarboxylase) were up-regulated in birds fed AF. This study demonstrates that AF exposure results in physiological responses associated with altered gene expression in chick livers.

**Key Words:** Gene expression, Aflatoxin, Chick liver, Microarray analysis

**M31 Effect of pellet quality and manufacturing method on fat distribution in a commercial feed system.** C. Hancock\*, R. S. Beyer, C.M. Rude, K. Dobbelleare, and J. Burden, *Kansas State University, Manhattan.*

In the poultry industry, flock uniformity is critical. This study was designed to determine the effects of an industry pan feeder system on the proportion of pellets to fines in pelleted broiler feed and to examine the distribution of nutrients. Previous work indicated that an incremental increase from 8.7% fines in the first pan to 33.7% fines in the last pan was observed in feed with a pellet durability index (PDI) of 79 while an increase from 8.2% to 27.7% fines was observed in feed with an 85 PDI. Even when feed is sifted, an increase from 3.2% to 20.18% fines was observed in 79 PDI feed while an increase from 2.64% to 15.25% fines was observed in 85 PDI feed. A Chore-Time Model C2 Plus feed line with Brock feed bin and Model 75 auger line with surge bin was constructed with 93 pans spanning a 240 foot line. For these studies, feed was added directly to the surge bin. Feed was collected at pre-determined pans. In this trial, we examined pellets coated with 4.85% soybean oil and conducted fat analysis to determine fat distribution in select pans along the line. The pellets were placed in a Davis S-3 mixer and then coated with soybean oil by mixing for two min. The feed was then placed in the surge bin, passed through the feed line and collected at 12 pre-selected pans. The results indicated fines increased along the line from 1.53% to 2.49% while pellets decreased from 98.47% to 97.51%. The samples were extracted with ether and the fat content was determined. The results indicate that the fat content increased from 6.96% to 7.31% in the pellets and decreased from 7.94% to 7.69% in the fines. The difference in fat content indicates that nutrient inconsistencies in the line could contribute to uniformity problems in a flock. Further examination may be necessary to determine if other nutrients differ when feed is passed through long feeder systems.

**Key Words:** Feeding systems, Fat, Distribution, Pellet quality, Fines

**M32 Embryonic incubation and post-hatch transportation effects on intestinal nutrient transporter expression during the perinatal period in broilers.** A. Barri\*<sup>1</sup>, E. Wong<sup>1</sup>, R. Dalloul<sup>1</sup>, M. Wineland<sup>2</sup>, and A. P. McElroy<sup>1</sup>, <sup>1</sup>*Virginia Polytechnic Institute And State University, Blacksburg,* <sup>2</sup>*North Carolina State University, Raleigh.*

Modern broilers are incubated and hatched under guidelines established for poultry not capable of the tremendous growth parameters that the current genetic lines have. Evidence suggests that failure to satisfy optimum incubation requirements has potential to result in poor chick quality and decreased performance. Compromised development of the intestine pre-hatch or at hatch can result in delayed mucosal development and subsequent detrimental broiler performance.