Nutrition I

16 Effect of a prebiotic (Fructomix) and peppermint essential oil on growth performance, digestibility, and gut cell morphology of male broilers. N. Khodambashi Emami, A. Samie,* and H. R. Rahmani, Isfahan University of Technology, Isfahan, Iran.

Due to increasing concerns about the use of antibiotics, a 6 week experiment was conducted to evaluate a prebiotic (Fructomix) and peppermint essential oil as potential alternatives to antibiotic growth promoters. Total of 288 Ross 308 male broilers were used in a 2 × 3 factorial arrangement with 4 pens per treatment and 12 chicks per pen. Chicks were fed either a basal diet (treat 1) or the basal diet supplemented with 200 ppm peppermint oil (treat 2), 400 ppm peppermint oil (treat 3), 500 ppm Fructomix (treat 4), 500 ppm Fructomix plus 200 ppm peppermint oil (treat5) or 500 ppm Fructomix plus 400 ppm peppermint oil (treat6). Treatment means were tested for significance using the General Linear Models procedure of SAS software. Weight gain (g/bird/d) of chicks fed treat 2 (44.91) was significantly higher, compared with treat 6 (41.31). Feed intake was similar in all treatments. Feed conversion ratio was significantly better in treat 2 (1.75) compared with treat 3 (1.86) and 6 (1.89). Treat 2 had significantly (P < 0.05) higher crude protein digestibility (86.45%) in comparison with other treatments except treat 3 (79.88%). Results showed that ether extract digestibility were significantly (P < 0.05) decreased in treatments 4 (75.61%), and 6 (73.75%) compared with 1 (85.82%) and 2 (84.86%). At d 42, 2 birds per pen were killed by cervical dislocation to determine duodenum and jejunum cell morphology. Duodenum villus height (VH) was significantly (P < 0.05) higher in treatments 1 (1404μm) and 2 (1428μm) compared with treatments 3 (1282μm) and 6 (1294μm). Duodenum villus height to crypt depth ratio (VH: CD) was significantly (P < 0.05) higher in treatments 2 (5.40) and 5 (5.22) compared with treatments 3 (4.04) and 6 (4.15). Jejunum VH, crypt depth and VH: CD was similar in all treatments. Peppermint oil at 200 ppm concentration can act as a growth promoter by improving weight gain, digestibility and duodenum cell morphology in broilers.

Key Words: peppermint oil, Fructomix, growth performance, digestibility, morphology

17 Relationship between amino acid concentration and digestibility using the two amino acids digestibility datasets. M. Tahir,* and G. M. Pesti1, 2Agricultural University, Peshawar, Khyber Pakhtunkhwa, Pakistan. 2University Georgia, Athens.

Commercial companies databases (Evonik Degussa, ED, chick assays; and Ajinomoto Heartland, AH, rooster assays) were analyzed to test the hypothesis that amino acid (AA) digestibility = f (AA concentration) in the feed. Digestibility should be a property of the feed ingredient and not related to the concentration. Casual observation of a rooster assay database suggested that AA digestibility was related to its concentration. If the AAs concentration during an assay has a big affect on its digestibility, then the results may not be valid at different levels. It is generally assumed that nutrient digestibility does not change between classes of birds, and AA digestibility values generated with roosters are widely used in feed formulation for broilers, laying hens and turkeys. Total AA concentration (TAA) and digestible amino acids (dAA) averaged 6% and 14% higher in the AH than ED database, respectively. Variation around the regression line between databases increased with increasing dAA concentration. Differences in assay type were quantitative as slopes of dAA = f (TAA concentration) were positive for 19 of 20 ingredients in each database. However, in one analysis, the influence of concentration on digestibility was very unlikely to be due only to chance (P < 0.0006) as evidenced by concentration x assay type interaction. Removing AAs having lowest (TRP) or highest (ILE) concentration were not critical to the conclusion that dAA = f (TAA concentration). The effect of AA concentration on its digestibility was very similar for each AA except CYS. This relationship was also appeared to be related to the CP level in the ingredients and deviations from the mean were much larger with lower vs. higher protein supplements. Data from 3 research articles confirmed this relationship to not just be due to the different samples in the different databases. Therefore, to best predict digestibility of any AA in any ingredient, its intended concentration in the diet should be known. Further, AA digestibility values (% of diet) from the different databases are clearly not interchangeable.

Key Words: amino acids, digestibility, concentration, rooster, chick

18 Effect of dietary nucleotide supplementation on performance and development of the gastrointestinal tract of broilers fed semi-purified diets and challenged with Coccivac-B. B. Jung*SC and A. B. Batal, University of Georgia, Athens.

Two experiments were conducted to determine the effects of Torula yeast (TY) as a dietary nucleotide supplementation on performance and intestinal tract development of birds. In a 2 × 2 factorial design, one hundred and 60 8-1 d-old Cobb 500 male broilers were placed in battery brooders in 6 replicate pens containing 7 chicks each and were randomly assigned to 2 experimental diets in the presence or absence of Coccivac-B challenge (×25 of a dosage volume). In experiment 1, birds were fed a casein based diet with 0 or 0.25% supplementation of TY for 7 d. In experiment 2, birds were fed a crystalline amino acids (AA) mixture based diet with 0 or 0.25% of TY supplemented diet for 13 d. In experiment 1, the Coccivac-B challenge and the supplementation of 0.25% TY to the casein based diet did not affect broiler performance, relative small intestinal weight and lesion scores significantly from 5 to 12 d. Villous height and crypt depth of broilers fed diets supplemented with 0.25% TY were shorter than birds fed the casein diet without the TY supplementation but, the birds challenged with Coccivac-B had longer villous than the birds that were not challenged. In experiment 2, the Coccivac-B challenge and 0.25% TY supplementation to the crystalline AA based diet did not affect performance from 5 to 18 d. However, from 9 to 12 d, 0.25% TY supplementation increased feed intake. Birds fed diets supplemented with 0.25% TY or challenged with Coccivac-B had heavier relative jejuna weights than the birds fed the crystalline AA control diet or without challenge at 12 d. Also, birds challenged with Coccivac-B had higher villous height and crypt depth at 12 d but, at 18 d the crypt depth was lower. In conclusion, the Coccivac-B challenge (the dosage volume ×25) to the birds fed semi-purified diets may not be enough to reduce performance but the challenge may increase villous height. The supplementation of 0.25% TY may increase relative jejuna weight of birds fed semi-purified diets at 12 d of age.

Key Words: Torula yeast (TY), casein, crystalline amino acids, morphology, Coccivac-B


Previous research suggested that the beneficial effect of enzyme supplements on broiler performance could be influenced by the sodium chloride (salt) content of the diet. A broiler experiment was conducted to determine the effect of the inclusion of phytase (Pase) or a carbohydrase-protease cocktail (CPC) that contained protease, xylanase, and amylase
on broilers fed diets containing 2 levels of added salt. A total of 1024 1-d-old Ross 344 × 708SF males were randomly distributed among 32 pens. There were 8 dietary treatments that consisted of 2 salt levels: 0.25% or 0.5%, and one of 4 energy/enzyme combinations: positive control (PC), negative control (NC), NC+Pase, and NC+CPC. The PC diets were formulated to be 100 kcal ME/kg higher than the NC diets. In the 0.25% salt diets, sodium bicarbonate was added to increase the sodium content of the diets to 0.21% Na, which was the same as for the 0.50% salt diets. Pen BW and feed consumption (FC) were measured at 0, 16, 35, and 42 d of age, and mortality was weighed and recorded twice daily to calculate the adjusted feed conversion ratio (AdjFCR). At 16 d of age an interaction (P < 0.05) was observed between dietary salt level and energy/enzyme combination where dietary Pase improved AdjFCR when combined with the 0.25% salt level, but not with the 0.50% salt level. In contrast, 16 d AdjFCR was improved in the CPC birds when the diet contained 0.50% salt but not when 0.25% salt was included. Also, at 16 d of age CPC birds had the highest FC (P < 0.05) when fed 0.25% salt, while CPC birds consuming 0.50% salt had the lowest FC. At 35 and 42 d of age, broilers fed the NC and NC+Pase diets were heavier (P < 0.05) than PC and NC+CPC broilers. However, no differences were observed in AdjFCR for any of the energy/enzyme combinations at these ages. However, at 35 d broilers fed the 0.50% salt diets consumed less feed (P < 0.01) than broilers fed the 0.25% level diets. Based on these results, it was possible to conclude that salt levels in the diet could be affecting dietary enzyme function during early stages of life.

Key Words: salt, enzymes, phytase, carbohydrase, broiler

20 Effects of various dietary and water sulfur concentrations on chick performance and water intake. J. Green*1SC, B. J. Kerr2, R. L. Payne3, and M. E. Persia1, 1Iowa State University, Ames; 2UDSARS, Ames, IA; 3Evonik-Degussa Corp, Kennesaw, GA.

Concern over sulfur (S) toxicity in poultry species has arisen partially due to increased use of dried distillers grains with solubles (DDGS) and other high S containing feed ingredients in combination with high S concentration in rural water. We hypothesized that supplementation of corn-soybean meal-DDGS diets with up to 1% lysine-sulfate or an equal amount of S in the form of sodium sulfide would not reduce the performance of growing chicks given access to either high- or low-S water. A 14 d assay was conducted with 480 male Ross broiler chicks allotted into 16 treatments of 6 replicate groups of 5 chicks each. The treatments were arranged in an 8 × 2 factorial with 8 diets: control, lysine-sulfate at 0.25%, 0.50%, and 1.00% (0.014, 0.028 and 0.056% supplemental S, respectively), sodium sulfide at 0.03%, 0.07%, and 0.14% (0.014, 0.028 and 0.056% supplemental S, respectively), and 0.8% of supplemental dietary S form copper and zinc sulfate were fed to chicks receiving either a normal- or high-S water source. All diets were formulated to meet or exceed industry based nutrient requirements. Lysine-HCl was supplemented to maintain equal concentrations of Lys in all diets. Chicks were fed standard pre-test diets until 4 d of age when chicks received ad libitum access to experimental water and diets. Weight gain, feed intake, feed efficiency and water consumption were determined over the 4 to 18 d experimental period. There were no significant interactions between diet and water source. No dietary S treatment resulted in a significant difference from the control fed birds regardless of source or concentration of S. There was a significant but unexplained increase in weight gain and water intake with increasing water S. Under experimental feeding conditions, including the use of dietary DDGS and high-S water, supplementation of diets with up to 1.0% lysine sulfate did not result in reduced performance in comparison to control fed chicks.

Key Words: broiler, sulfur, lysine-sulfate, performance

21 Effect of supplemental lysine and glycine in low crude protein corn-soybean meal diets on growth performance of broilers. A. M. Waguespack*1SC, S. Powell1, T. D. Bidner1, L. L. Southern1, and R. L. Payne2, 1Louisiana State University Agricultural Center; Baton Rouge; 2Evonik-Degussa Corporation, Kennesaw, GA.

An experiment was conducted with Ross 708 broilers to determine the effect of feeding increasing levels of supplemental Lys without or with added Gly in low CP diets from 0 to 10 d of age (P1), and the subsequent effects of feeding these diets from 10 to 24 d of age (P2). Diets were corn soybean meal based (C-SBM) and were formulated to contain 1.27% standardized ileal digestible (SID) Lys for P1 and 1.10% SID Lys for P2. Treatments were replicated with 6 floor pens (3 male and 3 female) with 25 or 20 broilers each. During P1, the treatments were 0, 0.05, 0.10, 0.15, and 0.20% supplemental Lys without and with supplemental Gly to a total Gly+Ser level of 2.42%. The TSAA and Thr levels were held constant relative to SID Lys in all diets, and Val, Arg, and Ile were not added to any diet. Feed intake was greater and G:F was lower (P < 0.02) in males than in females. Daily gain was not affected by diet (P > 0.10). Feed intake was decreased by the 0.20% Lys level (quadratic, P = 0.02), but not at lower levels of Lys. Glycine addition decreased ADFI except at the 0.10% level of Lys (Gly x Lys, P = 0.06). Gain:feed was decreased by Lys supplementation except at the 0.15 and 0.20% level (quadratic, P < 0.02). During P2, a common diet with 1.10% SID Lys was fed to all broilers. Average daily gain, ADFI, and G:F were greater in males than in females. Also, ADG was not affected during P2 by diets fed during P1 (P > 0.10). Glycine addition decreased ADFI in broilers fed 0 or 0.05% supplemental Lys, but not at higher levels (Gly x Lys, P < 0.01). Gain:feed was increased by Lys supplementation (linear, P < 0.08), but the effect was most evident at supplemental Lys levels of 0.15 and 0.20% (Lys x Gly, P < 0.10). The results of this experiment indicate that up to 0.15% supplemental Lys can be added to a C-SBM diet without or with Gly supplementation without reducing growth performance of d 0 to 10 broilers; however, addition of Gly to this diet improved G:F. Glycine addition in P1 decreased ADFI and increased G:F in P2, but the responses were most evident in birds previously supplemented with 0 to 0.10% Lys.

Key Words: broiler, glycine, lysine, low crude protein
Broiler responses to diets varying in digestible lysine, valine, and isoleucine from 21 to 35 and 35 to 49 days of age.

L. N. Rose*, R. D. Mitchell, R. L. Payne, and W. A. Dozier, III, Auburn University, Auburn, AL, Evonik Degussa, Kennesaw, GA.

This study examined growth and meat yield responses of broilers provided diets varying in digestible lys (1.344, experiment 1; 1.408, experiment 2) were randomly distributed into 64 pens (0.09 m²/bird) at 1 d of age and fed common diets until 21 or 35 d of age. Broilers were fed experimental diets from 21 to 35 d (experiment 1) and 35 to 49 d (experiment 2) with each treatment replicated 8 times. Treatments were arranged factorially with 4 digest Lys levels with 2 Ile and Val ratios. Digest Lys levels ranged from 0.93 to 1.08% and 0.84 to 0.99%, respectively for experiments 1 and 2, in increments of 0.05%. In both experiments, digest Val and Ile ratios were formulated to 79 and 67 and 74 and 62, respectively. Ratios of digest Val and Ile were based upon digest Lys of 1.08 and 0.99% from 21 to 35 and 35 to 49 d of age, respectively. Digest Lys × digest Ile and Val ratios did not (P ≥ 0.05) affect growth or meat yield in either experiment. Feed conversion linearly decreased (P ≤ 0.01) in broilers fed gradient concentrations of digest Lys in each experiment. Increasing digest Ile and Val ratios decreased (P ≤ 0.02) feed intake and feed conversion (1.67 vs. 1.62, experiment 1; 2.04 vs. 2.01, experiment 2) in each experiment. Moreover, feeding broilers gradient concentrations of digest Lys resulted in quadratic increases (P ≤ 0.01) in total breast meat yield from 21 to 49 d of age. These data indicated that feeding diets with adequate digest Val and Ile ratios and high concentrations of digest Lys (1.08%, experiment 1 and 0.94%, experiment 2) optimized feed conversion of Heritage male broilers from 21 to 49 d of age.

Key Words: amino acid, broiler, lysine, isoleucine, valine

Effects of feeding distillers dried grains with solubles on broiler performance, carcass traits and selected intestinal characteristics.

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Distillers dried grains with solubles (DDGS) has become an available, and often economical option for incorporation into commercial poultry diets. A 2 × 5 factorial study (2 pre-finisher DDGS levels vs. 5 finisher DDGS levels) evaluated the dietary inclusion effects of feeding 2 levels (0 vs. 14% DDGS) in a broiler diet during the starter and grower phases (0–14 to 28 d; 40 replicates/treatment) and subsequently feeding these a finisher phase diet (28–42 d) with either 0, 7, 14, 21, or 28% DDGS (10 treatments, 8 replicates/treatment). Growth and meat yields were determined at 42 d of age, and the liver dissected and measured for its relative weight and glycogen content. The intestine was used for measurement of ileal viscosity, and bacterial quantification via selective media and real-time PCR on cecal and ileal contents for Clostridium perfringens, Escherichia coli and Listeria monocytogenes. When analyzing using selective media, an interaction was observed for E. coli and L. monocytogenes in the ileum, and L. monocytogenes in the ceca. During the starter phase, birds receiving DDGS in the diet exhibited significantly higher feed conversion (P < 0.01) than those that received no DDGS. The same feed conversion effect occurred in the 0–28 d period (P < 0.001), in addition to a significant decrease in weight gain (P < 0.05) among the birds receiving DDGS versus those without. During the finisher phase, as DDGS increased in the diet past 14%, a decrease in weight gain (P < 0.01) and feed intake (P < 0.01) was observed when compared with the control (0% DDGS). Dressing percentage declined once DDGS exceeded 14% of the finisher diet (P < 0.001). Increasing DDGS in the finisher diet led to an increase in relative gizzard weight (P < 0.001). DDGS can be incorporated into commercial broiler diets with minimal negative effects on growth and production, although it does appear to affect some aspects of gut microflora and functioning at 42 d of age.

Key Words: amino acid, broiler, lysine, isoleucine, valine

Apparent metabolizable energy and amino acid digestibility of low oligosaccharide soybean meal fed to broiler chickens.

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Two experiments were conducted to evaluate the effects of low-oligosaccharide soybean meal (LO-SBM) on AMEn and amino acid (AA) digestibility from 28 to 32 d of age. Prior to experimentation, conventional soybean meal (CSBM) and LO-SBM were analyzed for crude protein, sucrose, raffinose, stachyose, starch, acid-detergent fiber, neutral-detergent fiber, and cellulose composition. Analyzed values (%), CSBM and LO-SBM were 47.7 and 54.7, 6.95 and 8.38, 0.71 and 0.21, 6.79 and 1.56, 0.89 and 1.24, 5.54 and 3.52, 8.09 and 4.60, and 5.53 and 3.74, respectively. In experiment 1, 576 male Ross × Ross 708 chicks (12 birds per pen; 0.45 m² per bird) were randomly assigned to 48 pens (16 replicate pens per treatment). Three dietary treatments were fed from 18 to 32 d of age. A 48 h excreta collection period was conducted for AMEn determination from 29 to 31 d of age. Treatment 1 consisted of a basal diet formulated to contain corn, distillers dried grains with solubles, peanut meal, and poultry by-product meal as the primary ingredients. Treatments 2 and 3 consisted of 70% of the basal diet plus 30% CSBM or LO-SBM, respectively. Birds fed the LO-SBM had a significantly higher AMEn (2,435 vs. 2,241 kcal/kg, P = 0.011) compared with the CSBM. In experiment 2, 288 male Ross × Ross 708 chicks (12 birds per pen; 0.45 m² per bird) were randomly assigned to 24 pens (12 replicate pens per treatment) and fed 1 of 2 semi-purified diets. Dietary treatments contained 43% CSBM or LO-SBM as the sole protein source. Standardized ileal digestibility coefficients of Met, Lys, Thr, Val, and Ile were significantly higher (P < 0.001) for CSBM compared with LO-SBM. Conversely, total Met, Lys, Val, and Ile composition of LO-SBM was 2 to 3 percentage points numerically greater than that of CSBM resulting in higher (P < 0.02) digestibility values for these 4 essential AA. These results indicated that LO-SBM had higher AMEn and digestible Met, Lys, Val, and Ile values than the CSBM source.

Key Words: apparent metabolizable energy, amino acid digestibility, soybean meal, broiler

Effects of corn source on the relationship between in vitro protein solubility and ileal nutrient digestibility.


Broiler response to exogenous enzymes may be directly related to intrinsic nutrient digestibility. Intrinsic nutrient digestibility can vary...
due to agronomic conditions, processing, and variety, even among corn sources of similar proximate composition. This study compared 6 corn sources on in vitro protein solubility (IPS) and ileal nutrient digestibility in broilers. Twelve corns were analyzed for gross energy (GE), N, moisture, crude fat (CF), IPS, and vitreousness. Nitrogen-corrected apparent metabolizable energy was predicted using these values. Of the 12 initial corns, 6 were selected that had similar proximate composition but low, moderate, or high (2 corns each) IPS and predicted AMEn. Predicted AMEn and IPS of the 6 corns ranged from 3,143 to 3,395 kcal/kg and 25.7 to 49.2%, respectively. Five hundred and 4 (12 per pen; 0.45 m² per bird) Ross × Ross 708 male broiler chicks were fed experimental diets (99.5% corn and 0.50% TiO₂) from 28 to 30 d of age. On d 30, the digesta contents of the distal ileum (a section spanning 4 to 30 cm upstream from the ileocecal junction) were collected from 8 birds per pen. Feed and digesta were analyzed for Ti, GE, N, CF, and starch. Apparent ileal digestibility of N, CF, and starch did not differ (P > 0.05) among sources of corn. The apparent ileal digestible energy (IDE) of the 6 corns averaged 3,323 kcal/kg. Pooled IDE means for low, moderate, and high predicted AMEn were 3,268, 3,319, and 3,383 kcal/kg, respectively. On average, IDE of the 2 corns with the highest predicted AMEn was 115 kcal/kg higher than that of the 2 corns with the lowest predicted AMEn (P = 0.001). Predicted AMEn was positively correlated with IPS (r = 0.966; (P < 0.001) and IDE (r = 0.613; P < 0.001). Solubility of protein explained 62% of the variation in IDE among the corns (P < 0.001). These results indicate that corns with similar composition varied in their digestible energy content and that solubility of protein is a major predictor of digestible energy in corn.

Key Words: corn, ileal digestible energy, proximate composition, chicks

27 Bioavailability and retention of phosphorus in dicalcium phosphate anhydrous (DCPA) for broilers. J. W. Charal*SC, T. D. Bidner, S. Powell, and L. L. Southern, Louisiana State University Agricultural Center, Baton Rouge. This research was conducted to determine the relative bioavailability (RBV) of P and retention of P and Ca in DCPA compared with monocalcium phosphate (MCP). Ross 708 broilers were allotted to treatments with 6 replicates with 6 broilers per pen. The broilers were housed in battery cages and fed from 0 to 18 d of age. Analyzed P and Ca were obtained for DCPA (22.7 and 29.1%) and MCP (20.7 and 17.6%). Diets were formulated on a non-pylate P (nPP) basis, Ca was kept constant at 1%, and chromium oxide (0.5%) was added as an indigestible marker. A positive control (0.45% nPP) and 4 deficient levels (0.25, 0.30, 0.35, and 0.40% nPP) with MCP, and 3 deficient levels (0.25, 0.30, and 0.55% nPP) with DCPA were used. Excreta samples were collected from d 15 to 17. Gain, feed intake, and G:F were not affected by P source (P > 0.10), but ADG was increased (P < 0.05) by P level. With identical inclusion of dietary nPP levels, broilers fed MCP had greater (P < 0.05) bone breaking strength (BBS) and tibia ash than those fed DCPA, and both variables responded linearly (P < 0.001) to nPP inclusion level. Phosphorus (PI) and Ca (Cal) intake were similar for both sources (P > 0.10) with dietary calculated values of P and Ca; however, P retention (PR, g/d) was greater (P < 0.05) for DCPA than for MCP. Using dietary analyzed Ca and P values resulted in lower (P < 0.05) PI and Cal for broilers fed DCPA, and consequently lower PR (P < 0.05). Retention of Ca was not affected by P source (P > 0.10). Multiple linear regression (MLR) was used with BBS, ash, and PR for RBV of P in DCPA (R-square = 0.50). The estimated RBV of DCPA relative to MCP using calculated dietary P values were 86, 91 and 111% of MCP, respectively. The MLR with analyzed P values in the diets resulted in similar RBV for MCP and DCPA (98 to 104 of MCP). These results suggest that DCPA has no negative effects on growth, feed intake, or efficiency of broilers, but decreased BBS and ash. The decrease in BBS and ash was due to a lower intake of Ca and P from DCPA based on analyzed dietary values of Ca and P.

Key Words: broiler, phosphorus, anhydrous

28 Practical assessment of a novel phosphorus source (poultry litter ash) on feed manufacture and feeding broilers. L. K. Shires*SC, S. A. Loop, K. G. S. Lilly, B. N. West, and J. S. Moritz, West Virginia University, Morgantown. Maximizing phosphorus availability and decreasing environmental impact are paramount in the current poultry industry. Gassing of litter may provide an economical means for heating a poultry house. Feeding resultant poultry litter ash (PLA) may represent a solution to manure application. PLA may provide a cost effective essential nutrient for poultry diets by the partial or complete replacement of rock phosphorus in broiler diets and improve feed manufacture variables. The objectives of this study were to assess PLA as an alternative mineral source for broiler diets and to assess PLA’s effects on feed manufacture variables. Dietary treatments in the current study consisted of 7 different formulations. Positive control (PC) and negative control (NC) diet formulations were created based on adequacy and deficiency of calcium and phosphorus. Four diets were formulated with varying levels of phosphorus and calcium to create a standard curve. Diet 5 was formulated to be similar to the PC with PLA to be compared with the standard curve. Diet 6 was formulated as a commercial diet. Diet 7 was formulated as a commercial diet with PLA. In diets 5 and 7, PLA replaced rock phosphorus addition. Diets 5, 6, and 7 were pelleted in random order each day, for 4 d to collect feed manufacture data. Pellet mill relative electrical energy usage was similar between diets containing rock phosphorus and diets replacing rock phosphorus with PLA. In addition, PLA was shown to significantly improve pellet quality. These 7 diets were randomly assigned to 56 pens of 11 male and 11 female Cobb 500 broilers from 1 to 21 d to assess the efficacy of PLA via broiler performance. On d 21, 5 birds per pen were selected for tibia extraction to obtain bone mineralization data. Diets containing PLA (diets 5 and 7) demonstrated negative effects for broiler weight gain and feed conversion, however bone mineralization was improved. These results indicate that PLA has available phosphorus and calcium, but the bioavailability is unknown.

Key Words: gassification, poultry litter ash, broilers, feed manufacture, bone mineralization

29 Effects of calcium and phosphorus levels in starter diets on Heritage broiler performance and mineral excretion at 49 days of age. M. R. DalmagrosSC, E. O. Oviedo-Rondón1, M. Costa1, K. Claassen1, R. Mitchell2, and H. Engster2, 1North Carolina State University, Raleigh, 2Perdue Farms Inc., Salisbury, MD. One experiment was conducted to evaluate the effects of Ca and P levels during starter period on performance, leg problems, bone traits, and mineral retention of Heritage broilers at 49 d of age. Starter diets were formulated to contain combinations of 4 levels of Ca (0.62, 0.76, 0.90, 1.04%) and 4 levels of nPP (0.31, 0.38, 0.45, 0.52%). 1,920 male and female chicks were identified and distributed in 64 pens with 15 chicks of each sex per pen. Corn-soybean meal diets with 10% inclusion of DDGS were used. Starter diets were fed to 17 d of age, and common grower and finisher diets from 17 to 35 d, and 35 to 49 d, respectively. BW, FI, and FCR were assessed at the end of each dietary phase. Ca and P retention were evaluated at 13 and 45 d of age. Gait scores, leg
problems, and individual BW were obtained at 42 d and flock uniformity was calculated. Bones were collected at 49 d, and BMD and BMC determined by DEXA. Data was analyzed by response surface methodology. Results indicated that Ca levels caused a quadratic effect \((P \leq 0.05)\) on FI, FCR, and BW gain for both sex, up to 17 d, but no significant effects of P levels were observed. There was no effect of Ca and P levels on flock uniformity at 42 d. At 49 d, Ca levels fed in the starter diets had quadratic effect \((P \leq 0.05)\) on BW gain only in females. No other significant effects of treatments on performance were observed. Feet ash % at 17d augmented linearly \((P \leq 0.01)\) as levels of Ca and P increased in females, while males were only affected by P levels. At 49 d, the BMD and BMC of females were not affected by Ca and P levels, but a quadratic effect \((P \leq 0.05)\) of P was observed in male BMD. Prevalence of leg deformities at 42 d were linearly influenced \((P \leq 0.01)\) by Ca levels. Ca and P retention at 13 d was impacted in quadratic manner by P levels and Ca retention decreased linearly as Ca increased. At 45 d, Ca levels fed in starter diets had quadratic effect on Ca retention, and Ca and P levels had linear effects on P retention. Ca and P levels in starter diets influenced bone traits and mineral retention of Heritage broilers at market age.

**Key Words:** calcium, phosphorus, broilers, bones, excretion

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**30 Use of ash phosphates from incinerated turkey litter and hen manure as a dietary supplement for broiler chickens.** H. K. Burley\textsuperscript{SC}, P. H. Patterson, R. M. Hulet, and T. L. Cravener, The Pennsylvania State University, University Park.

Turkey litter (TL) ash (13.7 t) was generated during the 2010 brooding season from a 586kW boiler made by Bio-Fuel Technologies LLC and an experimental belted hen manure (HM) ash was generated using a Coaltec Energy USA, Inc. gasification system. TL and HM ash contained 11.6 and 3.8% P and 19.4 and 25.1% Ca, respectively. Three corn and soybean meal diets with 1% Celite (3100 kcal/kg, 22% CP) were formulated with 1% Ca and graded levels of available P (avP) (0.20, 0.25 and 0.35%). TL and HM ash diets were formulated to have 0.35 and 0.27% avP, respectively, with 1% Ca. In a 4 wk study, 280 Ross x Heritage males were fed these diets and provided water ad libitum, with 7 pens per diet and 8 chicks per pen. Weekly feed intake (FI), body wt (BW), and mobility was monitored. At 28 d, ileal digesta was collected from carcasses to determine P and Ca digestibility. Legs were removed for tibia bone ash determination. BW was significantly reduced by the low P (0.20 and 0.25% avP) and TL and HM ash diets compared with the control (0.35% avP) diet in wks 2 and 3. However, in wks 1 and 4, the TL ash diet did not differ significantly from the control. Control and TL ash diet weekly BW gain averaged 83, 178, 296 and 391 g/bird at wks 1, 2, 3, and 4, respectively, and FI averaged 104, 270, 464 and 646 g/bird in wks 1, 2, 3, and 4, respectively. Both gain and FI were reduced for the low P and HM ash diets. Bird mobility was excellent for the control and TL ash diets in wk 4 (100 and 98.2%, respectively), but was significantly reduced for the low P (0.20 and 0.25 avP) and HM ash diets (60.0, 76.0 and 60.7%, respectively). Overall, mortality was high for the low P (0.20 and 0.25 avP) and HM ash diets (85.7, 39.3, and 55.4%, respectively) and low for the control and TL ash diets (1.8 and 3.6%, respectively). Based on BW, gain, and FI, the P in TL ash was utilized at 88.3, 84.0, and 89.4% efficiency, respectively, compared with the monocalcium phosphate used in the control diet and therefore may have recycling potential as a dietary phosphate.

**Key Words:** litter, ash, phosphate, digestibility, broiler