

Monday, January 24
Nutrition
Room: B313

S12 Dietary protein concentration regulates the mRNA expression of chicken hepatic spot 14 protein. M. Hidalgo*, A. Davis, *The University of Georgia*.

Based on a series of four experiments, in which broiler chicks were allowed free access for 1.5, 3, 6 or 24 h to a low (13 g/100 g diet) basal (22 g/100 g diet) or high (40 g/100 g diet) protein diet, we previously reported that hepatic malic enzyme activity and lipid content varied with dietary protein concentrations. Furthermore, the changes in malic enzyme activity were correlated with corresponding changes in the mRNA expression of this enzyme. By 3 h, malic enzyme mRNA expression was significantly greater in chicks fed the low protein diet and significantly lower in chicks fed the high protein diet compared with chicks fed the basal diet. Spot 14 is a protein transcriptional factor that regulates the expression of several lipogenic enzymes such as malic enzyme. To determine if spot 14 could be regulating the previously observed changes in malic enzyme mRNA expression, the mRNA expression of spot 14 was examined by Northern Analysis using total RNA previously isolated from the series of four experiments. There were no differences in the hepatic expression of the mRNA for spot 14 at 1.5 h between the chicks fed any of the dietary treatments. At 3 h spot 14 mRNA expression was significantly ($P < 0.05$) reduced in chicks fed the high protein diet compared with the chicks fed the low and basal diets. At 6 and 24 h, spot 14 mRNA expression was significantly reduced in chicks fed the high protein diet and significantly enhanced in chicks fed the low protein diet compared with chicks fed the basal diet. The results indicate that the hepatic mRNA expression of spot 14 is regulated by dietary protein intake in broiler chicks. In addition, the results suggest that the initial increase in the expression of malic enzyme mRNA in broiler chicks fed a low protein diet may not be associated with changes in spot 14 mRNA expression.

Key Words: Spot 14, Lipogenesis, Dietary protein

S13 The relative toxicity of gossypol isomers in broiler breeder hens. M. Lordelo*¹, M. Calhoun², N. Dale¹, A. Davis¹, *¹University of Georgia, ²Texas A&M University*.

Gossypol is a polyphenolic compound found in cottonseed meal. It occurs naturally in either a positive (+) or negative (-) isomeric form. The majority of the negative effects caused by feeding broilers diets containing gossypol have now been linked to the ingestion of the (-) isomer. In laying hens, however, the consumption of the (+) isomer of gossypol is responsible for decreased feed intake, egg production and egg weight. More importantly, the degree of egg yolk discoloration associated with the presence of gossypol was only objectionable when the (+) isomer was fed to layers. Thus, there is a clear indication that the (+) isomer of gossypol is toxic to laying hens and the (-) isomer of gossypol is toxic to broilers. To establish if these previously observed differences in gossypol toxicity were related to age or genetic differences between the birds, 15 individually caged Cobb 500 fast-feathering 44 wk-old broiler breeder hens were fed a corn/soy diet supplemented with 0, 400 (+), or 400 (-) mg/kg of pure gossypol isomer for 18 d (5 pens / treatment). Egg production and egg weight were monitored daily. All eggs were individually opened and the yolks were scored for discoloration. Total feed intake was lower ($P < 0.05$) in breeder hens consuming the (-) isomer when compared to the birds fed the other two diets. Birds fed the (+) isomer had lower total egg production than birds fed the control diet, and after d 15, birds ingesting the (+) isomer of gossypol ceased egg production. No differences were noted in egg production and egg weight between birds consuming the (-) isomer and those fed the control diet. Eggs produced by broiler breeder hens fed the (+) and (-) isomer had severe and mild yolk discoloration, respectively. The results from the current and previous experiments indicate that the (-) isomer of gossypol is detrimental to feed intake in broilers of any age, but does not affect feed intake in laying hens. In addition, the (+) isomer of gossypol is responsible for egg discoloration in both laying and broiler breeder hens. Thus, gossypol toxicity does appear to be influenced by bird genetics, but not by bird age.

Key Words: Broiler breeders, Cottonseed meal, Gossypol isomers

S14 Effect of dietary glycine on intestinal *Clostridium perfringens* populations and a-toxin production in broiler chickens. J. P. Dahiya*¹, D. Hoehler², D. C. Wilkie¹, A. G. Van Kessel¹, M. D. Drew¹, *¹University of Saskatchewan, Saskatoon SK, Canada, ²Degussa Corporation, Kennesaw GA, USA*.

The amino acid content of broiler diets has a significant impact on gut bacterial populations and disease. Previous studies reported that intestinal populations of *C. perfringens*, the causative agent of necrotic enteritis, are correlated with diets high in glycine. To establish a direct causative link, two trials were conducted to examine the effect of dietary glycine levels on gut *C. perfringens* populations and a-toxin production. In each trial, 12 cages of 4 birds were provided with a medicated, ideal protein-balanced starter diet for first 2 weeks after hatch. From d 14 onwards, 3 cages of 4 birds each were randomly assigned to one of 4 different ideal protein-balanced diets containing 0.75, 1.58, 3.04 or 4.21% glycine. Diets were isoenergetic (3.20 Mcal/kg ME) and met NRC nutrient requirements. All birds were orally gavaged with a *C. perfringens* type A broth culture from d 14 to 20 and euthanized on d 28. Approximately 80% of the birds became dull, depressed and diarrheic for first 5-10 days after gavaging with 8.33% and 6.25% mortality in trials 1 and 2 respectively. Lesion scores were significantly higher in the birds fed the 3.04% glycine diets compared to those fed diets containing 0.75% glycine in both experiments ($P < 0.05$). *C. perfringens* populations in the cecum varied quadratically with increasing dietary glycine with the maximal response seen at 2.98 and 3.11% glycine in experiments 1 and 2 respectively. *Lactobacillus spp.* counts in cecum declined significantly with increasing levels of glycine in both experiments. The a-toxin concentration in ileal contents was significantly higher in birds fed the 1.58% glycine diet compared to rest of the diets ($P < 0.05$). It is concluded that dietary glycine level has a significant effect on *C. perfringens* populations in broiler chickens and should be considered a predisposing factor for necrotic enteritis in broiler chickens.

Key Words: Broilers, Glycine, *C. perfringens*, Necrotic enteritis, Alpha toxin

S15 Effects of dietary crude protein and amino acid balance on the early body weight gain response of broilers to dietary lysine. P. Plumstead*¹, N. Paton², H. Romero-Sanchez¹, N. Leksrisompong¹, J. Brake¹, *¹Department of Poultry Science, North Carolina State University, ²Akey*.

A study was conducted to test effects of crude protein (CP) and amino acid balance on the body weight gain (BWG) of broilers in response to dietary lysine. Two lysine deficient basal diets were formulated to contain either 22.3% CP (Low CP) or 27.2% CP (High CP). The basal diets were each supplemented with Lysine-HCl to create eight diets containing 0.85%, 1.08%, 1.19%, and 1.30%, or 1.12%, 1.22%, 1.32%, and 1.45% digestible lysine for the Low CP and High CP diet series, respectively. A third series of diets (Balanced CP) was created by proportionately blending one intermediate diet from each of the High CP and Low CP diet series to form diets containing graded CP levels of 22.3%, 23.9%, 25.6% and 27.2% with the same lysine to CP ratio and a fixed ideal ratio of indispensable amino acids to lysine. The study utilized 800 Ross 308 male broiler chicks distributed across 80 floor pens with eight replicate pens per treatment. Data were subjected to multiple regression analyses and means separation using orthogonal contrasts was performed to characterize the nature of the response to incremental digestible lysine within each diet series. The 21 d BWG of birds on the Low CP diet series was best described by a quadratic function ($P < 0.001$) with the digestible lysine requirement for BWG estimated to be 1.12%. By contrast, the response in BWG to digestible lysine on both the High CP and Balanced CP diet series was only linear in nature ($P < 0.001$). The absence of a response plateau for BWG to dietary lysine precluded the determination of the digestible lysine requirement at the higher levels of CP evaluated. These data confirm that broilers are able to respond linearly to incremental dietary protein containing an ideal balance of amino acids. Further, the response of broilers to L-lysine supplementation of low protein diets may be limited due to inadequate quantities of dispensable and indispensable amino acids.

Key Words: Broiler, Protein, Lysine, Amino acid, Requirement

S16 Influence of the D₃ supplementation in the maternal diet on the performance and bone abnormalities of the progeny. A. Atencio*, H. M. Edwards, G. M. Pesti, J. P. Driver, *Poultry Science Department, University of Georgia.*

Six experiments (Exps) were conducted using Ross x Ross chicks hatched from broiler breeder hens fed various levels of D₃ to determine the effect of the maternal diet on the performance and general health of the progeny. Six levels of D₃ (0, 125, 250, 500, 1,000 and 2,000 IU/kg of diet) were fed to the hens from 25 to 66 weeks of age, however at 36 weeks of age hens that were receiving the 0 level of D₃ were switched to a diet containing 4,000 IU/kg. Chicks hatched from these hens at 27, 41, 29, 36, 45 and 52 weeks of age were kept separate according to the maternal diet and used in Exps 1, 2, 3, 4, 5 and 6, respectively. All Exps were conducted in a UV-light free environment. A corn and soybean meal based vitamin D₃ deficient diet was used in all Exps. Exps 1 and 2 were conducted with complete randomized designs with the maternal diets as the treatments and Exps 3, 4, 5 and 6 were conducted with split plot designs, with D₃ in the chicks' diet as the whole plot and D₃ in the maternal diet as a subplot. Chicks in Exps 1 and 2 were fed the vitamin D₃ deficient basal diet while in Exps 3 and 4 chicks were fed the basal diet supplemented with four levels of D₃ (0, 100, 200 and 400 IU/kg of diet) and chicks in Exps 5 and 6 were fed six levels of D₃ (0, 200, 400, 800, 1600 and 3200 IU/kg of diet). The highest body weight gains were observed in chicks hatched from hens fed the highest levels of D₃; however in Exps 1 and 3 differences were not significant at P < 0.05. Higher levels of D₃ in the maternal diet reduced the incidence of Ca rickets in Exps 3 and 6 and increased tibia ash in Exps 2 and 6. Body weight gain and tibia ash, increased and Ca rickets incidence, decreased as the D₃ level in the chick diets increased. Chicks hatched from hens fed the highest D₃ levels had the highest body weight gains and chicks fed the highest D₃ levels (3,200 IU/kg) had the highest body weight and tibia ash and the lowest TD and Ca rickets incidence. Higher levels of D₃ in the maternal diet reduced the incidence of rickets and improved tibia ash, but the effects were somewhat inconsistent.

Key Words: Broiler breeders, Progeny, Vitamin D₃

S17 Dietary Yarrow (*Achillea millefolium*) for broiler chickens fed diets using different fat sources. M. R. Lewis^{*1}, S. P. Rose¹, A. M. Mackenzie¹, S. Eskinazi², ¹Harper Adams University College, ²BFI Innovations.

Limitations concerning the use of antibiotics as growth promoters have stimulated the search for alternatives in order to remain competitive. Herbs contain many components with a wide range of active principles. However, as yet limited data have been presented to support their efficacy or elucidate mode of action in practical poultry diets. As with traditional AGPs, it is thought that response to herbs is greater when birds are offered diets containing poorer raw ingredients. The aim of this study was to therefore to evaluate the effect of yarrow supplementation (1800mg/kg) on the growth performance and nutrient digestibility of growing broiler chickens fed starter diets containing 50g/kg of different fat sources (no added fat, NAF; soya bean oil, SO; crude palm oil, CPO; palm oil fatty distillate, POFD). Mash diets were offered to caged male broilers between 10-21 days of age. Each treatment diet comprised 9 replicate cages of 3 birds. At 21 days of age, birds were killed by cervical dislocation, gizzard and small intestinal contents were removed, and bile acid concentrations (an indicator of gastrointestinal reflux) were determined. There were interactions between fat source and yarrow supplementation in daily weight gain (P=0.002) feed intake (P=0.036) and FCE (P=0.002) where yarrow fed birds performed better than unsupplemented controls when diets containing poor fat sources were offered (CPO and POFD), but not when NAF or SO diets were fed. Bile acid concentrations in the small intestine were not affected by yarrow supplementation. However, bile acid concentrations in the gizzard were elevated in yarrow fed birds (0.215 and 0.303U/g wet weight for control and yarrow fed birds respectively, P<0.001). In addition, there was a yarrow x fat source interaction (P=0.004) where the increased gizzard bile acid concentrations seen in yarrow fed birds were seen mainly when poor fat diets were fed (-7% NAF; +26% SO; +43% CPO; +212% POFD for yarrow relative to controls). The effect of yarrow on fat digestion explains the beneficial effect on broiler growth performance when poor quality fats are fed.

Key Words: *Achillea millefolium*, Yarrow, Fat

S18 Reduction of intestinal *Salmonella* spp. colonization in turkeys by dietary wheat, triticale and enzyme supplementation. A. A. Santos, Jr.*¹, P. R. Ferket¹, J. L. Grimes, F. B. O. Santos, ¹North Carolina State University.

Salmonella colonization in poultry may be influenced by the degree of competitive exclusion from enteric microflora affected by diet formulation. Two experiments were conducted to study the effects of grain-base formulation and dietary enzyme supplementation on intestinal *Salmonella* spp. colonization and performance of turkeys. In experiment 1 (EXP1), turkeys raised on litter floor were fed wheat/SBM- and corn/SBM-based diets with and without xylanase blends (XY1 & XY2, respectively) from 0-126 d. In experiment 2 (EXP2), turkeys raised in battery cages were fed corn-, wheat-, or triticale-based diets with and without XY1 from 0-28 d. In EXP1, 2500 EXU of XY1/kg or 325 EXU of XY2/kg feed was used, but 5500 EXU of XY1/kg was used in EXP2. In addition to growth performance, prevalence of *Salmonella* spp. in excreta (EXP1), and cecal *Salmonella* population (EXP2) was determined. In EXP1, XY2 supplementation improved 16-wk BW (14.6 vs 14.2 kg, P<.05), and FCR (2.6 vs 2.8 g/g, P<.01) as compared to corn-control treatment. XY1 supplementation did not affect growth performance. In EXP2, however, XY1 improved (P<.01) 14-d BW (300 vs 273 g), and 1-14 d FCR (1.29 vs 1.40). There was no enzyme supplementation effect on *Salmonella* spp. prevalence at 3, 9, 16, or 18 wk. *Salmonella* spp. were not recovered from pens receiving wheat-based diets, but 38% of the pens receiving corn-based diets were positive at 15 wk. In EXP2, *Salmonella* (>5.8 Log/g ceca) was detected in all pens at 7 d. *Salmonella* levels were higher (p<.05) in birds fed corn than other grains at 14 (8 vs 6 Log/g), 21 (6 vs 5 Log/g) and 28 (7 vs 4 Log/g) d. Among the wheat and triticale diets, enzyme supplementation reduced (p<.05) *Salmonella* levels at 14 (6 vs 7 Log/g), 21 (4 vs 6 Log/g), and 28 (4 vs 5 Log/g) d. Evidently, *Salmonella* colonization was discouraged by diets containing high non-starch polysaccharide content from wheat or triticale. Enzyme supplementation reduced *Salmonella* colonization in addition to improving growth performance in turkeys.

Key Words: Wheat, Enzyme, Growth Performance, *Salmonella*, Turkeys

S19 The Effects of in ovo feeding of protein and beta-methyl-beta hydroxybutyrate (HMB) on nutrient digestion and absorption in neonatal turkey poults. O. Foye^{*1}, P. Ferket¹, Z. Uni², ¹North Carolina State University, ²Hebrew University of Jerusalem.

Early development of the food digestion and nutrient absorption is imperative for optimal growth and development of young poultry. Poults hatch with limited digestive capacity, which limit the availability of nutrients for early growth and development. Administering exogenous nutrients into the amnion of a developing embryo prior to internal pipping may alleviate post-hatch malabsorption problems. With this in ovo feeding technique, critical nutrients are orally consumed and presented to enteric tissues and may stimulate the activity of brush border enzymes and nutrient transporters before hatch. Two experiments were conducted in turkeys to determine the effects of in ovo feeding of protein and HMB on brush border uptake of the amino acid alanine and the brush border activity of leucine aminopeptidase (LAP) and maltase at 23 and 25 days of incubation and at hatch. At 21 days of incubation, 400 eggs were divided into four treatments: 1) non-injected control; 2) injected control of 0.4% saline; 3) 0.4% saline solution containing 18% egg white protein; and 4) 0.4% saline solution containing 18% egg white protein and 0.1% HMB. All poults were fed a typical starter diet ad libitum within 24 hours of hatch. On the day of hatch, in ovo feeding treatments 3 and 4 caused a 56% and 86% increase in brush border LAP activity, respectively, in comparison to the controls (P<0.05). Maltase activity on the day of hatch was enhanced by in ovo feeding of treatments 3 and 4. Brush boarder uptake of the amino acid alanine was the same for all treatments at days 23 and 25 of incubation, but was depressed by approximately 21% on the day of hatch in poults subjected to treatment 4 (P<0.05). Evidently, in ovo feeding of protein and/or HMB improved the digestive and absorptive capacity of poults at time of hatch, and this may indicate that they are more capable of assimilating nutrients needed for more rapid growth and development during the first few days after hatch.

Key Words: Turkeys, In ovo feeding, Brush boarder enzymes, Amino acid transporters, Digestion

S20 Impact of methionine source and excess choline or betaine on hepatic homocysteine remethylation in broilers from 21 to 35 d. P. B. Pillai^{*1}, A. C. Fanatico¹, M. E. Blair², J. L. Emmert¹, ¹University of Arkansas, ²Adisseo.

Experiments were conducted to assess the impact of excess choline (CHO) or betaine (BET) on hepatic homocysteine (HCY) remethylation in broilers fed graded levels of DL-methionine (DLM) or 2-hydroxy-4-methylthiobutanoic acid (HMB) from 21 to 35 d. In experiment 1 a corn-peanut meal diet deficient in methionine (MET; 0.21% digestible) and cysteine (CYS; 0.24% digestible) was fed; graded levels (0, 0.03, or 0.06%) of MET from DLM or HMB were fed in the presence or absence of excess CHO (0.25%) or BET (0.28%). In experiment 2 identical treatments were used, but the basal diet was CYS-adequate (0.35% digestible). There was no overall impact of CHO or BET on growth in experiment 1 or 2 ($P>0.05$), but weight gain and feed efficiency increased linearly ($P<0.05$) with increasing DLM or HMB. Stable isotope methodology revealed that in experiment 1 type or level of MET supplementation did not impact the quantity of HCY remethylated. However, HCY remethylation was increased ($P<0.05$) by addition of CHO and further increased by BET. Remethylation through the BET-dependent pathway was not impacted ($P>0.05$) by type or level of MET. Regardless of level or type of MET, CHO and BET reduced ($P<0.05$) HCY remethylation through the BET-dependent pathway. In experiment 2, when diets were adequate in CYS, the highest level of DLM or HMB reduced overall HCY remethylation. Similar to experiment 1, addition of CHO or BET increased ($P<0.05$) overall HCY remethylation, but the response was much higher in experiment 2 (adequate in CYS). Here also, suppression of BET-dependent remethylation occurred with addition of CHO and BET. Contrary to reports from other species, BET-dependent remethylation was well below 50% under all conditions. During this period, hepatic HCY remethylation was primarily affected by CYS level and excess CHO or BET, and did not differ with MET source, which correlates well with the absence of significant growth differences among birds fed DLM or HMB.

Key Words: Broiler, Choline, Betaine, Sulfur amino acids, HMB

S21 Impact of dietary methionine source and excess choline or betaine on hepatic homocysteine remethylation in broilers from 35 to 49 d. P. B. Pillai^{*1}, A. C. Fanatico¹, M. E. Blair², J. L. Emmert¹, ¹University of Arkansas, ²Adisseo.

Experiments were conducted to assess the impact of excess choline (CHO) or betaine (BET) on hepatic homocysteine (HCY) remethylation in broilers fed graded levels of DL-methionine (DLM) or 2-hydroxy-4-methylthiobutanoic acid (HMB) from 35 to 49 d. In experiment 1, a corn-peanut meal diet deficient in methionine (MET; 0.20% digestible) and cysteine (CYS; 0.22% digestible) was fed; treatments consisted of graded levels (0, 0.03, or 0.06%) of MET from DLM or HMB (additions adjusted for 88% purity) fed in the presence or absence of excess CHO (0.25%) or BET (0.28%). In experiment 2, identical treatments were used, but the basal diet was adequate in CYS (0.30% digestible). In both experiments weight gain increased linearly ($P<0.05$) with the addition of DLM or HMB. Overall, CHO and BET did not ($P>0.05$) impact growth. Hepatic HCY remethylation studies using stable isotope technology revealed that in both experiment 1 and 2 type or level of MET supplementation did not impact overall HCY remethylation, but quantity of HCY remethylated was increased ($P<0.05$) by addition of CHO and especially BET. Cysteine adequacy in the diet did not result in increased remethylation in any of the treatment groups in experiment 2. The magnitude of CHO and BET response was much lower than what was observed in other growth periods, except in the 0.03% HMB treatment. Supplementing the various MET treatments with either CHO or BET reduced BET-dependent remethylation. In all the treatment groups in both experiments, BET-dependent remethylation was below 50% as opposed to reports from rat and human studies. Source or level of addition of MET or level of CYS in the diet did not ($P>0.05$) significantly affect HCY remethylation, whereas CHO and BET had a large impact on hepatic HCY remethylation in broilers during the finisher period.

Key Words: Broiler, Choline, Betaine, Sulfur amino acids, HMB

S22 The effect of alpha-galactosidase enzyme on performance of broilers fed corn-soybean meal diets. C. A. Keen^{*}, C. A. Fritts, F. Yan, P. W. Waldroup, University of Arkansas.

In addition to its protein component soybean meal contains a significant amount of carbohydrate, much of which is in the form of oligosaccharides that are poorly digested by monogastrics who lack alpha-1,6 galactosidase enzyme in the intestinal mucosa. Energy values for SBM for the pig are approximately 30% greater than for the chick. Improvements in ME of SBM for chicks of approximately 20% have been demonstrated by removal of oligosaccharides by ethanol extraction or by breeding. Addition of alpha galactosidase enzymes demonstrated approximately 10% improvement in ME in one study but others have failed to show any improvement. Three studies were conducted in the present experiment to evaluate the use of alpha galactosidase enzymes in corn-soy diets. Diets were formulated to meet current industry nutritional standards. Soybean meal was assigned ME values that were 10, 20, or 30% greater than the 2440 kcal/kg suggested by NRC. In two studies, poultry oil was kept constant at 2% so diets increased in ME as the assigned energy values increased. In the third study diets were kept isocaloric with modifications in level of poultry oil. Each diet was fed with or without a galactosidase enzyme at the rate of 1.5 kg enzyme per 1000 kg of soybean meal as suggested by the manufacturer. Trial one was conducted in battery pens while trials two and three were conducted in floor pens. In none of the studies did the addition of the alpha galactosidase enzyme result in improved performance of broilers as measured by body weight, feed conversion, caloric efficiency, or mortality. Response to galactosidase enzymes and other enzymes suggest that quality of the dietary ingredients used may be critical to the response. It is also possible that dosage levels may not have been sufficient to elicit a response.

Key Words: Soybean meal, Galactosidase enzyme, Oligosaccharides, Broilers

S23 The effect of alpha-galactosidase enzymes on performance of broilers fed corn-soybean meal diets. 2. Dose response studies. C. A. Keen^{*}, F. Yan, K. Y. Zhang, P. W. Waldroup, University of Arkansas.

Soybean meal contains a significant amount of oligosaccharide carbohydrates that are poorly digested by monogastrics who lack alpha-1,6 galactosidase enzyme in the intestinal mucosa. Studies on response to exogenous alpha galactosidase enzymes have been conflicting. Level of usage may be a critical factor in response to the enzyme. Two studies were conducted to evaluate response to different levels of enzyme. In the first study, diets were formulated with an assumed 20% increase in ME of soybean meal and fortified with 0, 1.5, 3.0, 4.5, or 6.0 kg enzyme/1000 kg of SBM. The manufacturer suggests the use of 1.5 kg/1000 kg SBM. Diets were fed in pelleted form. In the second study, diets were formulated with assumed 10% increase in ME of SBM and fortified with the same enzyme levels in mash diets. In the first study birds in floor pens were fed to 42 d; in the second study birds in battery pens were fed to 35 d. In no instance did the addition of the galactosidase enzyme appear to improve the utilization of metabolizable energy when added to the corn-soybean meal based diet. Energy utilization, expressed as ME kcal/kg gain, was basically the same across all levels of supplementation with the enzyme. Due to the low amount of energy provided by soybean meal in the diet, it may be difficult to actually detect improvements of only 10 to 20% in metabolizable energy of soybean meal when incorporated into the final diet.

Key Words: Soybean meal, Oligosaccharides, Galactosidase, Broilers

S24 Evaluation of pearl millet as a grain source for prestarter and starter broiler diets. A. R. García^{*}, A. B. Batal, N. M. Dale, M. B. Café, Department of Poultry Science, University of Georgia.

Pearl millet is attracting increased interest as a feed ingredient for poultry. Simultaneously, greater attention is being given to the nutrition of broiler chicks during the first week of life. The objective of the present research was to evaluate pearl millet as a grain for prestarter (from 1 to 4 or 1 to 7 days) and starter (from 1 to 14 days) broiler diets and compare it to two other commonly used grains. Three experiments were conducted in which isocaloric, isonitrogenous, low-energy diets were formulated based on corn, sorghum or pearl millet (PM) with soybean meal (SBM) common to all. A dextrose (D)/SBM diet served as a

highly absorbable carbohydrate control. Body weight gain and feed efficiency were determined at 4, 7, and 14 days. Intestinal viscosity and cecal aerobic, enterobacteria and lactic acid bacteria counts were measured once in each period (prestarter and starter). In all experiments, mortality was low and not affected by dietary treatment. Body weight gain and feed efficiency were generally greater but not always significantly for chickens fed the PM diet through 4, 7 and 14 days posthatch ($P < 0.05$). Intestinal viscosity and cecal bacteria were not significantly affected by diet. As a general trend, a positive dietary effect of PM on performance was maintained through both the prestarter and the starter period. The effect of PM was consistent throughout the experiments and proved highly satisfactory for both prestarter and starter periods. Results showed that PM appears to be as good and possibly better than the sorghum and corn employed in these studies for early chick performance. The reason for the improvements noted is not clear, but apparently is not related to intestinal viscosity or increased populations of beneficial bacteria.

Key Words: Prestarter diet, Grains, Pearl millet, Growth performance

S25 Effects of β -Mannanase in corn-soy diets on commercial Leghorns in phase III of the second cycle. G. Wu*, M. Bryant, R. Voitle, D. Roland, Auburn University.

β -Mannanase (Hemicell[®]) is a unique enzyme-based feed ingredient, which can hydrolyze β -mannan, an anti-nutritional fiber in feed. Because soybean meal contains β -mannan and its derivative, addition of β -mannanase may improve soybean-meal utilization. The purpose of this study was to evaluate the effect of β -mannanase on performance and profits of β -mannanase in commercial Leghorns fed corn-soybean meal based diets. In this experiment, three diets were formulated. The metabolizable energy content for Diet 1 (high-energy diet) was 2951 kcal/kg, which was 120 kcal/kg higher than Diet 2 (low-energy diet supplemented with β -mannanase) and Diet 3 (low-energy diet without β -mannanase). Hy-Line W-36 hens ($n = 720$, 98 wk old) were randomly divided into three dietary treatments (8 replicates of 15 hens per treatment). The trial lasted for 12 weeks. Overall average feed conversion in hens fed the low-energy diet supplemented with β -mannanase was similar to that of the high-energy diet, and both were significantly lower than the low-energy diet without β -mannanase ($P < 0.01$). β -Mannanase had positive influences on egg production and egg mass of hens fed the low-energy diet. No significant differences in feed intake, egg specific gravity, egg weight, mortality, body weight,

and body weight variability (CV) were observed among three dietary treatments ($P > 0.05$). β -Mannanase supplementation improved energy utilization of corn-soybean layer diets, and has the potential to reduce the cost of practical laying hen diets containing β -mannan.

Key Words: β -Mannanase, Energy, Hens

S26 Microbial ecology shifts in the small intestine of broilers during feed withdrawal. K. L. Thompson*, K. M. Burkholder, J. Patterson, T. J. Applegate, Purdue University.

Broilers are withheld from feed for 8 to 24 hr prior to processing to empty the gastrointestinal tract (GIT) and reduce potential carcass contamination from GIT contents. Intestinal microbial changes during feed withdrawal (FW) have not been thoroughly defined. Two experiments (Exp) were conducted to examine the effects of increasing periods of FW on the microbial ecology in the small intestine. In two Exp, male broilers were fed corn-soy diets in floor pens. In Exp 1, 62d-old broilers were subjected to FW for 0, 8, 12, and 24hr. Eight birds were euthanized at each time point and ileal mucosa was collected. Microbial communities were determined by isolating bacterial DNA, amplifying the V3 region of 16S ribosomal DNA, and performing denaturing gradient gel electrophoresis. The microbial profiles from birds at 0hr FW had higher similarity values than those at 8 or 24hr FW ($P < 0.05$), indicating that as FW time increased, uniformity of intestinal microbial populations decreased. Numbers of bands (an indicator of numbers of bacterial species present) at 0hr (9.13) were greater than those at 24hr (3.75; $P < 0.05$), suggesting a reduction in microbial species and diversity as FW time increased. In Exp 2, 28d-old birds were randomly assigned to one of 3 diets containing no additive (control), 30g/ton bacitracin (Ab), or 1 lb/ton CuSO_4 (Cu). At 42d of age, birds ($n=24$) were subjected to 0, 10, and 24 hr FW. Ileal tissue and digesta (at 0hr FW) were collected and analyzed as in Exp. 1. Diet did not significantly alter mucosa microbiota similarities (0, 10, and 24hr of FW were 63, 37, and 52%; 50, 18, and 86%; and 32, 32, and 48% similar for the control, Ab, and Cu diets, respectively) or digesta similarities (16% for each diet). Neither FW or diet had an effect on mucosal and digesta similarities or band numbers. Data from these studies suggest that FW alters the microbial community of the intestine by decreasing similarity of the communities as FW increases, but that individual differences between birds preclude treatment differences.

Key Words: Antibiotic, Broiler, Feed withdrawal, Intestine, Microflora

Monday, January 24 Environment/Management Room: B314

S27 Annual broiler litter production using recycled litter with and without top-dressing. C. D. Coufal*, P. R. Niemeyer, J. B. Carey, Texas A&M University.

Broiler producers are required to develop nutrient management plans for the disposal of litter materials from broiler grow-out facilities. Therefore, a key component of a nutrient management plan for a broiler production facility is to be able to accurately predict the amount of litter that will be produced on an annual basis. However, this type of data can be difficult to collect under large-scale commercial conditions. A long-term experiment was conducted in a controlled facility under conditions simulating commercial production to accurately access broiler litter production rates. Eighteen consecutive flocks were reared in an experimental broiler house managed as closely as possible to a commercial house. Rice hulls were used as the bedding material, and chicks and feeds were obtained from a commercial broiler integrator. In flocks 1-9, 562 broilers were reared in 4 large pens. Caked litter was removed between flocks, and the remaining litter recycled for the next flock. In flocks 10-18, the

recycled litter was split evenly into six pens. Three of these pens (420 birds) remained untreated, and three (420 birds) were top-dress with a thin layer (1-2 cm) of new litter between flocks following caked litter removal. Top-dressing of litter is used to reduce litter moisture, reduce caking and extend the useful life of litter without a complete clean-out. Cumulative litter production per kg of live marketed broiler (g/kg) was 170 g litter/kg, 79 g caked litter/kg and 249 g total litter/kg for untreated pens over all eighteen flocks. Top-dressing of litter significantly ($P < 0.05$) significantly reduced caked litter production in flocks 12-18. Less caked litter resulted in significantly increased litter production in flocks 14-18. As a result, no significant difference in total litter production was observed between the untreated and top-dressed pens for flocks 11 and 13-18 on a cumulative basis. This data can easily be used by broiler producers to predict the amount of litter and caked litter that will be produced on an annual basis under these types of management practices.

Key Words: Broilers, Litter production, Top-dressing