

to help improve bird performance and reduce pathogen loads. In Exp. 1 in southern Japan, Bs was added to all broiler feeds (0 or 3×10^5 CFU/g), and excreta collected at 2 ages. At 14 d, in the Bs flock Lac increased ($P < 0.05$) and Salmonella were not detected vs 4.97 Log_{10} CFU/g excreta in the negative control flock. At 49 d, *Clostridium perfringens* (3.22 vs 2.66 Log_{10} CFU/g excreta; $P < 0.05$) and Salmonella (4.07 vs 3.31 Log_{10} CFU/g excreta, $P < 0.01$; $20/20$ vs $10/20$, $P < 0.05$) were reduced in the Bs flock. Two trials were conducted at a US broiler company to compare Bs fed flocks vs previous antibiotic growth promoter (AGP; for necrotic enteritis prevention) fed flocks. Excreta was collected at 35 d. In Exp. 2, Lac ($P < 0.001$) and Lac/TA% (22.9% vs 52.2% ; $P < 0.05$) were higher and Enterobacteriaceae (coliforms) lower ($P < 0.01$) in Bs birds. Livability was higher and farm condemnations lower in 7 Bs flocks vs 4 previous AGP flocks ($P < 0.01$), and calorific conversion was lower in 7 Bs flocks vs 902 simultaneous flocks ($P = 0.014$). In Exp. 3a, Lac ($P < 0.001$) and Lac/TA% (21.2 vs 58.5% ; $P < 0.01$) were higher in Bs birds. In Exp. 3b (same control as Exp. 3a), Lac ($P < 0.001$) and Lac/TA% (21.2% vs 54.8 and 59.5% ; $P < 0.001$) were higher and *Clostridium perfringens* lower ($P < 0.05$) in Bs birds. The Bs C-3102 flocks had higher intestinal (excreta) Lac or Lac/TA%, lower pathogen counts, and/or improved performance, compared to simultaneous (or previous) negative control or AGP flocks.

Key Words: Bacillus Subtilis C-3102, Lactobacilli, Pathogens

301 Effect of synbiotic feed additive in comparison to antibiotic growth promoter on performance and health status of broilers. M. Mohnl*¹, Y. Acosta Aragón¹, A. Acosta Ojeda², B. Rodríguez Sánchez², and S. Pasteiner¹, ¹BIOMIN GmbH, Herzogenburg, Austria, ²Instituto de Ciencia Animal, San José de las Lajas La Habana, Cuba.

The present trial was conducted to evaluate the efficacy of a synbiotic product in comparison to a commonly used AGP (antibiotic growth

promoter) on broiler performance during a 42 day study. 525 one-day-old male chicks (Cuban hybrid EB 34) were randomly distributed to 3 experimental groups with 7 replicates per group and 25 animals per replicate. Experimental groups included a non-treated control group, a group which received a synbiotic product (Biomin® PoultryStar) via the drinking water on the first three days and for three consecutive days at each feed change and an AGP group which received Avilamycin (40 ppm) via the feed. The animals were fed a standard corn-soy ration in a three diet feeding program (starter (1- 14), grower (15- 28), finisher (29- 42)). Feed and water were provided *ad libitum*. The birds were kept under observation for 42 days and performance parameters like body weight and feed intake were measured weekly. Furthermore daily weight gain and feed conversion ratio (FCR) were calculated. Clinical inspections and necropsies were conducted and mortality was registered daily. After 42 days body weight and FCR of birds which received the synbiotic product or the AGP were significantly higher ($P < 0.05$) and feed intake was lower when compared to control group. Synbiotic group and AGP group increased body weight by 2.04% and 1.99% respectively in comparison to control. Mortality could be reduced in treatment groups in comparison to control (control group: 2.8%, synbiotic group: 0.9%, AGP group: 0.9%). In the present study the synbiotic product had a comparable potential to improve broiler performance as Avilamycin and might therefore be a promising alternative to the use of AGPs in broiler production.

Key Words: Synbiotic, Antibiotic Growth Promoter, Broiler Performance

Nonruminant Nutrition: Poultry Nutrition - Breeder and Laying Hen Nutrition and Broiler Environment

302 The effect of feed restriction programs and growth curves on reproductive performance, stress and metabolism in broiler breeder hens. M. de Beer*¹, J. P. McMurtry², D. M. Brocht², and C. N. Coon³, ¹Aviagen, Huntsville, AL, ²USDA-ARS, Beltsville, MD, ³University of Arkansas, Fayetteville.

An experiment was conducted to compare everyday (ED) and skip-a-day (SK) feeding programs and early slow growth (SLOW) and broilerized (BROIL) treatments. Feed restriction programs were implemented from 4 weeks to 5% production. The SLOW group was fed to reach 75% of standard BW by 12 weeks, and then to reach standard BW by 21 weeks. The BROIL group was fed *ad libitum* till 7 weeks and then severely restricted to reach standard BW by 21 weeks. Parameters measured included BW, uniformity, age at sexual maturity (SM), total and settable egg production, body composition, liver size and composition, *in vitro* lipogenesis (IVL), metabolic hormone levels and heterophil to lymphocyte ratio (H/L). The trial period lasted 45 weeks. Birds fed ED grew more efficiently than SK or SLOW. The BROIL treatment had significantly worse feed utilization than all

other groups. Frame size was consistently greater in BROIL pullets and consistently smaller in SLOW pullets. Birds fed ED reached SM before SK, who in turn reached SM before SLOW or BROIL birds. Egg production was significantly higher in ED than SK, which in turn was higher than either SLOW or BROIL. Liver weight and IVL was elevated in SK and SLOW pullets above ED pullets during rearing. Liver weight and IVL were lower in BROIL pullets than other groups during rearing, but after photostimulation dramatic increases in liver weight and IVL resulted in this trend being inverted by 27 weeks. As an indicator of stress, H/L ratios were elevated above ED pullets in SK, SLOW and BROIL pullets at various times during rearing. Corticosterone and T3 levels were elevated in SK and SLOW birds during rearing. IGF-1 was higher in ED than SK birds during rearing. Feeding regimens and growth curves have a major influence on efficiency, metabolism and reproductive performance in broiler breeders.

Key Words: Broiler Breeder, Growth Curve, Metabolism

303 Effects of feeding programs during rearing on carcass fatty acid profiles and serum α_1 acid glycoprotein levels in broiler breeder hens. M. de Beer*¹ and C. N. Coon², ¹*Aviagen Inc, Huntsville, AL*, ²*University of Arkansas, Fayetteville*.

Skip-a-day feeding programs are widely employed during rearing to improve pullet uniformity. An experiment was conducted to determine the effect of everyday and skip-a-day feeding programs on fatty acid (FA) composition and serum α_1 acid glycoprotein (AGP) levels of broiler breeder hens. A total of 420 day old broiler females were randomly assigned to 12 pens at 35 chicks per pen. Chicks were full fed to 10 days, and then fed restricted amounts of feed everyday until 28 days. At 28 days, 6 randomly selected pens were changed to skip-a-day (SK) feeding while the other 6 were fed everyday (ED). The diet and total feed allocation was identical for both ED and SK pullets throughout the trial. At 20 weeks of age 8 pullets from each group were killed. All birds were fed ED after 25 weeks of age. At 40 weeks, a further 8 birds from each group were killed. Abdominal fat samples were obtained from each of the killed birds and analyzed for FA composition. Further, blood samples were obtained from 16 birds from each group at 40 weeks of age. Plasma samples were analyzed for AGP levels using a commercially available radial immuno-diffusion tray. Data was analyzed by ANOVA procedures using JMP 6.0 and means were separated using student's T-test. At 20 weeks SK birds had higher levels of C16:1 and C20:0 than ED birds. ED birds had higher levels of C18:2, C18:3, C20:2, C20:3 and C20:4. Mono-unsaturated FA levels were higher in SK birds while poly-unsaturated FA levels were higher in ED birds. By 40 weeks, C16:0 and C16:1 were marginally higher in SK birds while only C20:2 was still higher in ED birds. Serum AGP level did not differ between ED and SK hens at 40 weeks. However, serum AGP did correlate with both total egg production ($P < 0.01$) and last 7 days egg production ($P < 0.01$). In summary, SK feeding programs tend to increase the level of saturation of abdominal fat in broiler breeder hens. Serum AGP levels, while not affected by ED or SK feeding programs, do correlate strongly with egg production.

Key Words: Feeding Programs, Fatty Acids, Acute Phase Protein

304 Broiler and breeder feeding programs have different effects on the inflammatory response. A. Mireles Jr.* and S. Kim, *Foster Farms, Modesto, CA*.

The objective of this study was to compare the performance and acute phase response to *E. coli* lipopolysaccharide (LPS) of chicks fed a breeder or a broiler feeding program. The experimental design was a 2 feeding programs (Breeders vs. Broilers) X 2 Stress Levels (Control vs. LPS) with 25 chicks/treatment. Breeder diets were lower in protein and energy than broiler feeds. Birds were fed test feeds for 35 d. On 35 d, 50 chicks (25 Breeder + 25 Broiler) were injected 1 mg LPS/Kg body weight subcutaneously. Birds were euthanized 150 m post-injection. LPS stress increased spleen weight and body temperature, and it decreased serum Ca and N. Birds fed broiler were heavier ($P < 0.05$) than birds fed breeder feed (1.9 vs. 0.7 Kg). 150 m post-stress, relative body losses were larger ($P < 0.05$) for birds on breeder vs. broiler feed (6.63 vs. 4.87%). Liver weight of stressed Breeders was larger ($P < 0.05$) than that of Broilers (0.23 vs. -0.01%) and spleen weight was lower (0.11 vs 0.13%, $P < 0.05$). The febrile response was lower ($P < 0.05$) for Broilers vs. Breeders (0.2 vs. 0.9 C), and Breeders had higher ($P < 0.05$) levels of serum A-1 alpha glycoprotein than Broilers (365 vs. 306). Birds on broiler feed had higher ($P < 0.05$) serum Ca (92

vs 87) & total N (4764 vs 3856 PPM) than birds receiving breeder feeds. Compared to breeder feeds, broiler feeds down-regulate an inflammatory response.

Key Words: Acute Phase Response, Broilers, Breeders

305 Effect of the level of methionine, linoleic acid, and added fat in the diet on productive performance and egg quality of brown laying hens in late phase of production. H. M. Safaa^{1,2}, M. P. Serrano¹, D. G. Valencia¹, X. Arbe³, R. Lázaro¹, and G. G. Mateos*¹, ¹*Universidad Politécnica de Madrid, Spain*, ²*Cairo University, Egypt*, ³*Cantos Blancos S.L., Guadalajara, Spain*.

A total of 960 Lohmann Brown laying hens were used to study the effect of methionine (0.31 vs. 0.36%), linoleic acid (1.12 vs. 1.60%), and added fat (1.1 vs. 3.0%) level in the diet on productive performance and egg quality from 56 to 75 weeks of age. There were eight treatments arranged factorially (2 x 2 x 2) and six replicates of 20 hens per treatment. No interactions among main effects were detected and therefore, only main effects are presented. Few effects were observed among dietary treatments for body weight, daily feed intake, feed conversion ratio, egg production rate, egg weight, egg mass, and mortality rate. For the entire experiment, methionine level did not affect laying hen performance ($P > 0.10$). However, from 60 to 67 wk of age an increase in methionine from 0.31% to 0.36% increased the proportion of large eggs (> 63 g) from 79.8% to 85.9% ($P < 0.05$). Increasing the linoleic acid content of the diet from 1.12% to 1.60% did not modify any productive trait at any age ($P > 0.10$). Increasing the level of added fat from 1.1% to 3.0% increased the percentage of extra-large (> 73 g) eggs from 20.4 to 22.8% but the difference was not significant ($P > 0.10$). However, from 64 to 67 wk of age, an increase in fat content tended to increase the percentage of extra-large eggs ($P < 0.10$). Percentage of broken eggs, shell-less, and dirty eggs were not affected by treatment ($P > 0.10$). The Roche Color Fan score of eggs was higher in hens fed 3.0% added fat than in hens fed 1.1% added fat (12.5 vs. 11.8; $P < 0.05$). We conclude that laying hens, late in the production cycle, do not need more than 1.12% linoleic acid in the diet and that an increase in methionine and fat content may result in a slight increase in the commercial value of the eggs.

Key Words: Laying Hen, Linoleic Acid, Egg Quality

306 Performance and egg quality of laying hens fed diets containing different levels of total and digestible amino acids. D. E. Faria*, H. R. B. Souza, A. L. Santos, and P. W. Rizzoli, *University of Sao Paulo (FZEA/USP), Pirassununga, SP, Brazil*.

This experiment was carried out to evaluate the performance and egg quality of laying hens fed diets containing different levels of total and digestible amino acids. A hundred ninety two Hy-Line Brown hens, 54 wk of age, were randomly distributed in a 2 x 4 factorial scheme: feed formulation criterion (total and digestible amino acids) and amino acid levels in the diet (100%, 95%, 90%, and 85% of the methionine, lysine and tryptophan requirements), totalizing eight treatments and five replicates of four birds each. Performance (feed intake, energy intake, egg production, egg weight, egg mass, and feed conversion) and egg quality (albumen percent, yolk percent, Haugh unit, shell percent, shell thickness, and specific gravity) characteristics were

evaluated. Egg production was influenced by the amino acid levels in the diet, showing significant positive linear response. There were interactions for egg mass and feed conversion where the best results were observed when digestible amino acids with 100% of the requirements were used. There were no effects of the treatments on feed intake, energy intake, egg weight, and on internal and external egg quality characteristics. It was concluded that the performance of laying hens can be improved when the diets are formulated based on digestible amino acids concept.

Key Words: Feed Formulation, Nutrition, Poultry

307 An examination of broiler energy need for ambient temperature dependent homeostasis, protein and fat accretion and effective caloric value. A. Beker* and R. G. Teeter, *Oklahoma State University, Stillwater.*

An experiment was conducted in calorimeter chambers to investigate energy and oxygen need for body weight homeostasis, efficiency of metabolizable energy (ME) use for maintenance, exponent needed to convert live body weight to metabolic weight for fed and fasted broilers, zone of thermoneutrality, efficiency of energy use for protein (K_p) and fat (K_f) accretion, as well as the effective caloric value (ECV) of ambient temperature. The study utilized 8 weight groups of Cobb x Cobb broilers housed under 3-5 ambient temperatures (AT) per weight grouping, consuming feed at 4 levels (0, 5, 10% of body weight (W), and adlib). Data indicated that energy (Kcal/W^{0.75}/d) and oxygen (l/W^{0.75}/d) need for homeostasis declined curve linearly per unit metabolic weight as weight increased from 0.09 to 1.95 kg^{0.75}. Results, however, were impacted by AT. Relative to birds consuming feed ad libitum, maintenance needs averaged 33% of consumption. The exponent, to linearize live body weight with heat production (HP) of birds fed to W homeostasis, was determined to be 0.758 with birds strictly housed at TN. Further, the exponent to linearize HP of fasted birds was 0.679. The zone of thermoneutrality, at body weight homeostasis, was inversely related to metabolic weight, expressed as: $TN=32.64425-(5.91277*MWT)$ ($R^2=0.99$) and curvilinearly related to W as: $TNMBR=32.6466-(94.4603*W)-(0.7660*W^2)$;($R^2=0.99$). Proportional differences in protein and fat accretion were utilized, along with efficiency of retained energy, to estimate K_p and K_f as simultaneous equations. Efficiency of accretion for energy use above maintenance was estimated as 78.7% for lipid and 67.6% for protein. Values for K_p and K_f using regression analysis were found unreasonable, presumably due to co-linearity between intake and accretion variables. The ECV of AT, quantified as a multiple of bird maintenance energy need was found to fall between 1 to 3 % of maintenance energy per Kg body weight.

Key Words: Broiler, ECV, Homeostasis

308 Antibiotic + electrolyte intervention minimizes damage in broiler performance during abrupt severe heat stress. A. Mireles Jr.* and S. Kim, *Foster Farms, Modesto, CA.*

Gut bacteria likely have a role during heat stress through an inflammatory reaction. The objective of this study was to examine the effect of antibiotics and electrolytes (OTC) in the water of heat stressed battery chicks at 3 ages. The experimental design was a 3 age (36, 25, and 15 d) X 2 water (Control, + OTC) X 2 heat stress (Control, Heat Stressed)

factorial, with 5 replicate cages each. An attempt was made to maintain similar stock densities. All birds were raised in cages for the first 14 days. OTC water was introduced at the time of stress. Control room temperature was 25.6 - 26.7°C. Heat stressed room was increased 2.2°C/hour to 37.8°C and cycled back for 2 days. Weight gain was affected by age, heat stress, water, and interactions ($P < 0.05$). 15 and 25 d chicks were not affected by heat or water. 36 d heat stressed chicks on control water lost 227 g in 2 days ($P < 0.05$) compared to heat stressed on OTC or non-stressed chicks. During heat stress, total serum N and serum Ca increased (0.46 vs. 0.48%; 101 vs 107 PPM, $P < 0.05$). OTC decreased ($P < 0.05$) total N in all 36 d birds (0.47 and 0.52% vs. 0.45 and 0.50%) and increased ($P < 0.05$) serum Ca (95 and 108 vs. 102 and 110 ppm). Serum pH was inversely related to serum Ca ($R^2=0.24$, $P < 0.05$). Water treatment can minimize damage in 36 d old broilers caused by abrupt heat stress.

Key Words: Heat Stress, Antibiotics, Gut Microflora

309 Dietary salt combinations for broiler chickens under subtropical summer conditions: Live performance, carcass, and blood responses. T. Mushtaq*¹, H. Nawaz¹, M. A. Mirza¹, M. Athar², M. M. H. Mushtaq¹, G. Ahmad^{3,1}, and U. Noreen¹, ¹University of Agriculture, Faisalabad, Pakistan, ²Hi-Tech Feeds, Lahore, Pakistan, ³Shamim Feed Industries, Bahawalpur, Pakistan.

The study was planned to investigate the best combination of Sodium (Na), potassium (K) and chloride (Cl) keeping the dietary electrolyte balance (DEB) at 250 mEq/kg. The desired dietary Na, K and Cl levels were adjusted by incorporating sodium bicarbonate (NaHCO₃), sodium chloride (NaCl), calcium chloride (CaCl₂), potassium chloride (KCl), ammonium chloride (NH₄Cl) and potassium sulphate (K₂SO₄). A total of 270 Male Starbro from grantparent flock was obtained and kept on 27 floor pens on new softwood shave litter up to 42 d of age in a completely randomised design. Nine (9) treatments varying in their Na, K and Cl contents were formulated using stochastic formulation method at 95% level of confidence and were offered to 3 replicates having 10 birds each. The minimum and maximum temperatures recorded were 31.1 and 38.4°C respectively with RH 56%. Diet containing Na=0.30%, K=0.80% and Cl=0.30% (with NaHCO₃ 0.42%, NH₄Cl 0.20%, CaCl₂ 0.19%, K₂SO₄ 0.04%) significantly improved body weight gain at 28 d. No significant effect of treatments was found on water consumption and mortality. A significant correlation ($r=0.34$) was observed between water intake and dietary Na. Water intake significantly improved FCR ($r=-0.30$) and weight gain ($r=0.56$) and lowered rectal temperature ($r=-0.35$). However, mEq ratio of K: Na of 2.4 and K: Cl of 2.0-2.5 significantly lowered mortality and serum bicarbonate contents. The diets with low Na (0.20%) and high K (1.08 or 1.19%) and Cl (0.40 or 0.50%) held mortality to 0% during the final week of age, compared to other diets. In conclusion, in heat stress the diet with 0.30% Na, 0.80% K and 0.30% Cl containing 0.19% CaCl₂, 0.04% K₂ SO₄, 0.42% NaHCO₃, and 0.20% NH₄Cl gave highest BWG 0-28 d (1,033 g) whereas the lowest FCR value of 1.71 was obtained.

Key Words: Dietary Electrolyte Balance, Broiler, Heat Stress

310 Response of growing broilers to digestible lysine and metabolizable energy levels in heat stress. G. Ahmad^{1,2}, T.

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The study was conducted to evaluate the response of heat stressed broilers to dietary digestible lysine (digestible Lys) and metabolizable energy (ME) during 14 to 35 d of age. Two levels of digestible Lys (0.8 and 1.0% with ideal protein concept) were used with 4 levels of ME (2.600, 2.700, 2.800 and 2.900 Mcal/kg) in 2 × 4 factorial arrangement. The average minimum and maximum temperature during the experiment was 27.7 and 41.3°C, respectively. Body weight gain (BWG) during the experiment was significantly ($P \leq 0.005$) affected by the digestible Lys × ME. The lowest BWG was observed when 0.8% digestible Lys was used with 2.900 Mcal of ME/kg. The feed intake was lower ($P \leq 0.046$) in high ME diets i.e., 2.800 and 2.900 Mcal/kg. The total digestible Lys intake during the experiment was significantly high ($P \leq 0.001$) for the birds fed on 1.0% digestible Lys as compared to that of 0.80% (14.48 vs. 11.89 g) with its significantly lower ($P \leq 0.001$) efficiency for weight gain (49.5 vs. 42.3). No significant effect of digestible Lys, ME or their interaction was observed on feed:gain, mortality, ME intake or ME efficiency for BWG.

Key Words: Metabolizable Energy, Digestible Lysine, Heat Stress

311 The effects of dietary supplementation of L-Carnitine on egg production traits of white leghorns. W. Zhai^{*1}, S. L. Neuman², M. A. Latour¹, and P. Y. Hester¹, ¹*Purdue University, West Lafayette, IN*, ²*Guidant Corporation, St. Paul, MN*.

An earlier study in our lab has shown that yolk sac weights of progeny hatched from eggs of hens consuming 125 ppm L-carnitine were smaller than controls suggesting that carnitine improved the utilization of yolk fat by developing embryos. In addition, samples of yolks had 16.3 vs. 12.7 nanomoles of carnitine per gram of yolk in hens consuming carnitine as compared to controls, respectively (SEM=0.3, $P=0.001$). The effects of carnitine consumption on egg production traits are unknown; therefore, the current study determined if supplemental L-carnitine in White Leghorn diets affected egg production and egg traits. Diets were formulated to contain 0 or 125 ppm carnitine (analyzed values were 1 and 143 ppm, respectively). Diets were fed to birds beginning at hatch until 37 wk of age. Birds were transferred from pullet rearing cages to laying cages at 17 wk of age. Four hens were housed in each laying cage providing 549 sq cm/bird. Numbers of egg laid per cage were recorded daily and hen-day egg production was calculated monthly. Egg and shell traits were determined every 4 wk when the hens were 23, 27, 31, and 35 wk of age. Data were analyzed using ANOVA with repeated measurements using the mixed

model procedure of SAS. Hens consuming carnitine as compared to controls had similar egg production (84 and 86%, SEM=1, $P=0.30$), egg weight (53.6 and 53.6 g, SEM=0.3, $P=0.88$), yolk weight (13.7 and 13.7 g, SEM=0.1, $P=0.89$), relative yolk weight (yolk weight/egg weight, 25.5% and 25.4%, SEM=0.1, $P=0.54$), shell weight (4.85 and 4.85 g, SEM = 0.04, $P=0.96$), relative shell weight (shell weight/egg weight, 9.07 and 9.06%, SEM=0.05, $P=0.83$), and shell thickness (0.358 and 0.358 mm, SEM=0.002, $P=0.87$), respectively. It is concluded that consumption of L-carnitine from hatch to 37 wk of age had no effect on egg production and egg traits.

Key Words: Carnitine, Egg Production, Yolk Weight

312 Effects of corn particle size in a corn-soybean meal diet on chick growth performance and nutrient digestibility. C. M. Jacobs^{*}, P. L. Utterback, and C. M. Parsons, *University of Illinois, Urbana*.

Two experiments were conducted to evaluate the effects of corn particle size in a 23% CP corn-soybean meal diet when fed to young chicks. The first experiment was performed using New Hampshire x Columbian female chicks and the second experiment used Ross x Ross commercial male chicks. In both experiments, day old chicks were randomly assigned to one of four dietary treatments consisting of corns that were ground in a hammer mill using the following screen sizes: 1/16-in. (1.59mm) ground corn, 3/16-in. (4.76mm) ground corn, 5/16-in. (7.94mm) ground corn, or 6/16-in. (9.52mm) ground corn. Chicks were fed the experimental diets from 0-21 days post hatch. Growth performance, gizzard weight, and gizzard pH were measured in both experiments, and ME_n and apparent amino acid digestibility were determined at 7 and 21 days of age in the first experiment. When compared to the 1/16-in. ground corn, feeding the larger particle sizes had no significant ($P > 0.05$) effect on growth performance in either experiment. Feeding larger particle sizes caused an increase in relative gizzard weight (% of body weight) in both experiments, with the greatest increase occurring with the 6/16-in. ground corn. Gizzard pH in both experiments was unaffected by corn particle size. Corn particle size also had no significant ($P > 0.05$) effect on ME_n and amino acid digestibility values. There was, however, an age effect on amino acid digestibility and ME_n. Digestibility coefficients for most amino acids were higher ($P > 0.05$) at 21 days than at 7 days for all dietary treatments. The ME_n values also increased ($P < 0.05$) from 7 to 21 days for the 3/16-in. and 5/16-in. corn treatments. The results of this study indicate that feeding larger particle size corn increases relative gizzard weight and has no significant effect on growth performance, ME_n, and amino acid digestibility.

Key Words: Corn Particle Size, Growth Performance, Nutrient Digestibility