myosin heavy chain isoform development. On day 17 of incubation, there was a significantly lower concentration of the embryonic myosin isoform in B/L embryonic breast muscle, suggesting accelerated maturation of these muscles in the B/L line embryos. At 21 d post-hatch, there was an increased proportion of adult myosin heavy chain isoform and a lower proportion of the neonatal myosin isoform at 21 d in the B/L chicks, the genetic differences were more pronounced in the larger P. major and this was also true at 14 d in this muscle. In summary, paternal genotype can effect cellular development in chicken breast muscle as early as 17 d in ovo and these differences persist post-hatch.

Key Words: myosin, embryo, pectoralis major, broiler, leghorn


Over the past 10 years, there have been significant changes in the growth and processing characteristics of commercial turkeys. Most of the breast meat is incorporated into further processed products and there has been an increased incidence of quality problems in breast meat from birds that have been subject to excessively high rearing temperatures. This anomaly has been likened to the PSE condition in swine. Transgenic technology is viewed as a promising technology for improving the profitability and quality of commercial poultry stocks. Chickens are also widely used as a vertebrate model system by developmental biologists. Unfortunately, there is no conventional method to generate transgenic chickens. Sperm-mediated gene transfer has been recognized as a potentially powerful alternative method, but the original results have been difficult to duplicate. We have developed a linker (mAbs) to bind with sperm and DNA. Using flow cytometry, it has shown cross-reactivity with sperm cells from all tested species, including pig, mouse, chicken, cow, goat, sheep, and human. mAb C has been characterized as a basic protein and has been shown to bind DNA through ionic interaction. We previously reported the use of this novel linker-based sperm-mediated gene transfer method (LB-SMGT) to successfully generate transgenic pigs, mice and chicken embryos. To illustrate the potential of LB-SMGT, we report here the generation of transgenic chickens overexpressing human interferon α or β. Expression of human interferon β was detected in 53% (18/34) of the sera collected from 5 week old F0 generation chickens. The sera from transgenic chicks expressing human interferon α also showed viral inhibition to the Newcastle disease virus (NDV/69/1036) by plaque inhibition assay. Furthermore, the transgene was stably transmitted into the F1 generation at a high success rate (at least 62.5% in our initial screen, 15 out of 24 F0 birds) demonstrated by Southern blot analysis. Our data demonstrates that LB-SMGT can efficiently generate transgenic chickens.

Key Words: Transgenic, Chicken, LB-SMGT (linker-based sperm-mediated gene transfer


Nutrition A Minerals

157 Response of heat-distressed broilers fed diets supplemented with zinc amino acid complex (Availa® Zn) and vitamin E. M. O. Smith1, O. Puminn1, and T. Ward2. 1 The University of Tennessee, Knoxville, TN, 2 Zinpro Corporation, Eden Prairie, MN.

Broilers were used to evaluate the response of heat-distressed chickens fed diets differing in fat source and supplemented with zinc amino acid complex (Availa® Zn) and vitamin E. Basal mash diets were prepared from a common corn and soybean meal source and contained either equivalent amounts of soybean oil or animal fat. Basal diets were supplemented with vitamin E (40 IU per Kg diet) and either 40 mg or 100 mg Zn per Kg diet. Birds were raised on floor pens then transferred to wire cages in two environmental chambers on day 22. One chamber was maintained at 23.9 C (thermonutral, TN) while the other cycled between 23.9 and 35 C (heat distress, HD) until day 49. Birds were slaughtered and the bursa of Fabricius, spleen, and thymus glands collected. Carcasses were divided into market portions and parts yield as a percent of total carcass determined. Heat distress adversely affected (P<.05) all variables examined. Birds fed diets containing soybean oil as the fat source and supplemented with 100 mg zinc tended to have increased weight gain and lower feed conversion ratio. In addition, spleen weight as a percent of carcass weight was greater (P<.05) for birds receiving 100 mg zinc. Results indicate that heat distress influences growth rate and carcass composition and that feeding supplemental zinc amino acid complex may be beneficial under these conditions.

Key Words: Zinc amino acid complex, Broilers, Heat-distress
Since zinc accumulation on cropland has generated environmental concerns, dietary manipulation may be a strategy to reduce zinc content in livestock and poultry manure. An experiment was conducted to assess the effects of dietary zinc source and dietary zinc concentration on zinc excretion during weekly intervals from 0.45 days of age. A total of 704 Ross x Ross 308 day-old male chicks was randomly distributed into 80 half-brood cages (10 cages per diet). A 10-day supplemental zinc inclusion conducted on Days 10, 17, 24, 31, 38, and 45 to measure zinc excretion on a DM basis. Treatments consisted of feeding a corn-soybean meal basal diet (30 ppm Zn) and supplementing the diet with gradient concentrations of zinc from zinc sulfate or Availa-Zn zinc amino acid complex. The treatments were as follows: 1) Basal diet, 2) Basal diet + 20 ppm zinc from zinc sulfate, 3) Basal diet + 40 ppm zinc from zinc sulfate, 4) Basal diet + 80 ppm zinc from zinc sulfate, 5) Basal diet + 20 ppm zinc from Availa-Zn, 6) Basal diet + 40 ppm zinc from Availa-Zn, 7) Basal diet + 80 ppm zinc from Availa-Zn, and 8) Basal diet + 40 ppm zinc from zinc sulfate + 40 ppm zinc from Availa-Zn. Each treatment was represented by 11 replications. Adding progressive concentrations of zinc increased final body weight (P < 0.03). Broilers fed gradient concentrations of zinc supplied by Availa-Zn had decreased cumulative feed conversion ratio resulting in a zinc source x zinc concentration interaction (P < 0.05). On Day 10, supplemental zinc basal diet with gradient concentrations of zinc increased zinc excretion (P < 0.001). On Day 17, zinc excretion increased both on an absolute basis (P < 0.001) and when zinc excretion was expressed as a percentage to zinc intake (P < 0.001) with gradient concentrations of supplemental zinc. These data indicate zinc excretion can be reduced by 34 and 53%, respectively, on Days 10 and 17, but decreasing the supplemental zinc concentration to 20 ppm can have an adverse affect on final body weight.

**Key Words:** Zinc, Manganese, Broiler, Pulmonary hypertension, Amino acid

### 159 Cardio-pulmonary evaluations of cold-challenged chicks from parents fed supplemental zinc and manganese amino acid complexes

A 4-wk experiment was conducted to determine the effects of corn particle size on body weight (BW), rickets incidence (RI), tibia ash, gizzard weight, and gizzard content pH. One hundred and ninety-two 1-day-old Hybrid hens were randomly allocated into four dietary treatments (18 pens). A corn-soybean meal based diet was formulated to contain calcium at 1.20% and non-phytate phosphorus at 0.40%. Four treatments (trts) were fed, varying only by corn particle size. Corn ground by a roller mill (trt 1) was used to make a 1.75 mm (trt 2), 6.35 mm (trt 3) hammer mill screen. Three replications (4 pens) of each treatment group (96 total) were placed into a grower unit. Three replications with six pens per pen for each treatment. Body weight and feed intake were measured weekly, while gizzard weight, and gizzard contents pH were measured on day 28. Tibia ash and RI were determined on days 14 and 28. As particle size increased, gizzard weight (p=0.011), pH of gizzard contents (p=0.096), 14-day tibia ash (p=0.056), 28-day tibia ash (p=0.012), and 14-day RI (p=0.011) increased linearly. Rickets incidence on day 28 was not affected (p=0.761). As particle size increased, 14-day BW decreased linearly (p=0.012), but day 28 BW was not affected (p=0.696). Feed efficiency (gain: feed) at 14 and 28 days was not affected. These results demonstrate that phytate phosphorus utilization in turkey pouls is increased when particle size of corn is increased.

**Key Words:** Particle size, Phosphorus utilization, Pouls

### 160 Influence of supplemental dietary iron compounds on performance and nutrient retention in broilers

Certain iron compounds may decrease facultative bacteria in the intestinal tract. The purpose of this study was to determine the effects of two iron compounds on broiler performance and nutrient retention. At 1-day-old, male broilers were assigned to diets in a 2 x 3 factorial experiment (5 pens/trt, 9 chicks/pen) from 0 to 21 d of age. Diets consisted of two nutrient densities [normal diet, ND (containing 3080 kcal/kg ME, 22% CP, 1.2% Lys, 0.5% Met, 0.43% non-phytate phosphorus (nPP), and 0.9% Ca) and a low diet, LD (containing 2520 kcal/kg ME, 18% CP, 0.98% Lys, 0.74% Met, 0.5% Ca)] and three iron mixtures [no iron mixture (Control) or one of two formulations at 4.4 ml/kg of feed]. The iron mixtures used were a mixture of iron salts (Ion) or a mixture of oxylahogenc compounds (pat. 4,880,638; Bioxy, Inc.; Oxy). Birds fed the Ion diet (568.6 g) were significantly heavier at 20 d of age than birds fed the Control diet (501.7 g; P<0.05). Body weights of birds fed the Oxy diet (536.1 g; P<0.05), however, were not significantly different from birds fed the Iont or Control diets. Phosphorus (P) retention from 18 to 20 d of birds fed the Iont diet (79.84%) was significantly greater than in birds fed the Oxy diet (65.88%; P<0.05), which was significantly greater than in birds fed the Control diet (57.92%; P<0.05). Nitrogen (N) retention from 18 to 20 d for birds fed the Ion diet (82.23%) was significantly greater than in birds fed the Oxy diet (71.22%; P<0.05), which was significantly greater than in birds fed the Control diet (69.06%; P<0.05). Differences in P and N retention due to iron mixture were more pronounced in the LD diets vs ND diets (nutrient density by diet interaction; P<0.01). Diet did not significantly affect villus height or crypt depth of the distal jejenum at 21 d of age. In this study, iron mixtures improved performance and increased nutrient retention in broilers from 0 to 3 wk of age.

**Key Words:** Iron compounds, Oxylahogenc compounds, Broiler, Nutrient retention
key words

Hyline W-36 and Hyline W-98 laying hens respond similarly to dietary available phosphorus levels.

A research trial was designed to determine if two laying hen strains, Hyline W-36 and Hyline W-98, have similar available phosphorus (AP) requirements. Experimental treatments were arranged in a 2x3 factorial design with the two strains and three levels of dietary AP (0.10, 0.14, and 0.45%) in a corn-soybean meal diet (17% CP and 3.8% Ca). The three diets were fed to six replicate groups of 12 hens of each Hyline strain from 20-42 wk of age. During the first four weeks only, egg production of the W-98 hens was significantly greater (P <0.05) than the W-36 hens. Body weight, egg weight, egg mass, feed intake and AP intake were higher for the W-98 hens compared to the W-36 hens throughout the 22 wk period. Both strains fed the 0.10% AP diet first exhibited decreased egg production at 28 wk and this dietary treatment was terminated at 35 wk of age due to low egg production.

Within each strain, there was no significant difference in egg production performance for hens fed 0.14 compared to hens fed 0.45% AP. Feed intake was significantly lower for hens fed 0.14 compared to hens fed 0.45% AP for both strains. The mean AP intake of W-36 hens fed 0.14 and 0.45% AP was 137 and 452 mg/hen/d, respectively, and the mean AP intake of W-98 hens fed 0.14 and 0.45% AP was 151 and 509 mg/hen/d, respectively. Post-mortem examination indicated no presence of goit in hens for any AP level and no differences in bone integrity among treatments. There were minor kidney histological abnormalities observed in both strains fed the 0.10% AP diet.

In conclusion, this research shows that Hyline W-36 and W-98, have similar available phosphorus (AP) requirements. Furthermore, both strains fed 0.14% AP diets performed similar to hens fed 0.45% AP. These results indicate that the minimal AP requirement for commercially available laying hens is substantially lower than many industry recommendations of 0.40 to 0.50% AP.

Key Words: Available Phosphorus, Laying Hens, Growth, Mortality

Hydrolysis of dietary electrolyte balance on broiler chickens exposed to thermoneutral or heat stress environments from 21 to 42 days of age or to acute heat stress at 44 days of age. S. Aparecido Borges, A. V. Fischer da Silva, J. Ariki, D. M. Hooge, and K. R. Cummings. 1Universidade Federal do Parana, Curitiba, Parana, Brazil, 2Hooge Consulting Service, Inc., Eagle Mountain, UT, 3Church & Dwight Co., Inc., Princeton, NJ.

Two pen trials on new litter were conducted to evaluate water intake effects of increasing levels of sodium chloride (NaCl) or bicarbonate (NaHCO3) in broiler chicken diets containing monensin and bacitracin-md. In Exp. 1, a total of 1,000 chicks were fed corn-soy diets (20.1 and 18.2% crude protein; 2,900 and 2,950 kcal AME/kg) containing NaCl at levels of 0.30, 0.45, 0.60, 0.75, or 0.90%. High levels of NaCl (0.60, 0.75, or 0.90%) increased water intake and water to feed ratio from 21 to 42 d, and increased water intake from 21 to 42 d (P <0.05). From 0 to 42 d, these levels of NaCl increased (P <0.05) body weight, water intake, water to feed ratio, and litter moisture. Therefore, the extra NaCl increased body weight but raised litter moisture. In Exp. 2 conducted in summer, a total of 1,400 male chickens were fed NaHCO3 at levels of 0, 0.5, 1.0, or 1.5% from 21 to 49 or 35 to 49 d. A corn-soy basal grower diet with 20% crude protein and 3,200 kcal AME/kg was utilized. A factorial arrangement [(2 x 3) +1 treatments] with five replicate pens of 40 birds each per treatment was used. No treatment effects were found on weight gain, feed intake, feed conversion ratio, mortality, carcass yield, main part yield, or abdominal fat. Back yield was reduced (P <0.05) by KCl. The best weight gain and feed conversion ratio (P <0.05) by NaHCO3 was at the 0.90% level. The increase in water intake per unit increase in dietary sodium was lower when the source was NaHCO3 (Exp. 2) than when the source was NaCl (Exp. 1). Litter moisture was closely related to water intake.

Key Words: Dietary electrolyte balance, Litter moisture, Sodium bicarbonate, Sodium chloride, Water

Physiological effects of dietary electrolyte balance on broiler chickens exposed to thermoneutral or heat stress environments from 21 to 42 days of age or to acute heat stress at 44 days of age. S. Aparecido Borges, A. V. Fischer da Silva, J. Ariki, D. M. Hooge, and K. R. Cummings. 1Universidade Federal do Parana, Curitiba, Parana, Brazil, 2Hooge Consulting Service, Inc., Eagle Mountain, UT, 3Church & Dwight Co., Inc., Princeton, NJ.

Two trials were each conducted with 24 individually caged broiler chickens in environmental chambers. In Exp. 1, colostomized Ross males 21 d of age were kept in thermoneutral (22.5±3.5°C) or cyclic heat stress (22.5±3.5°C for 14 h and 33.6±2°C for 10 h daily) conditions to 41 d of age. Dietary electrolyte balances (DEB; Na + K - Cl, mEq/kg) of 140, 240, or 340 were made by adding NaCl, NaHCO3, and NH4Cl, plus KClO3 to achieve the highest level. A 2 x 3 factorial arrangement with four birds per treatment was used. Urinary excretion of Na+, K+, and Cl− increased (P<0.01) according to their concentration in feed, but under heat stress their excretion diminished compared to thermoneutral environment. Electrolyte balance was higher (P<0.01) for broilers receiving 240 or 340 mEq/kg. The highest DEB level caused higher urinary volume. The urinary route was favored for maintaining hydroelectrolytic homeostasis in broilers. In Exp. 2, acute heat stress at 44 d was caused by raising temperature from 24 to 32°C in 30 min, 32 to 36°C in 30 min, 36 to 37°C in 15 min, and 37 to 41°C in 15 min, with peak temperature held for 15, 60, 90, or 360 min (relative humidity 42±7%). The DEBs were 0, 120, 240, or 360 mEq/kg. A split plot ("before" and "after") experimental design was used with four broilers (replicates) per treatment. Heat stress increased heterophils to lymphocyte ratio, body temperature, panting, blood Cl and pH, and decreased blood pCO2 and HCO3−, resulting in respiratory alkalosis. Both DEB increased acid-base balance, and during heat stress the best physiological responses were obtained with 140 or 240 mEq/kg diets. High DEB (360 mEq/kg) caused respiratory alkalosis independent of environmental temperature.

Key Words: Dietary electrolyte balance, Heat stress, Hematology, Respiratory alkalosis, Sodium
167 Effect of zinc and manganese amino acid complexes (Availa®Z/M) on broiler breeder production and immunity. J. Khajarem1, C. Ratanasethakul2, S. Khajarem5, Terry L. Ward4, Timothy M. Falkler5, and A. Bruce Johnson1. 1Department of Animal Science, Faculty of Agriculture, 2Department of Medicine, Faculty of Veterinary Medicine, Khon Kaen University, Khon Kaen, Thailand, 3Zinpro Corporation, Eden Prairie, MN.

Five hundred twenty female and eighty male one-day-old Cobb broiler breeder chicks were used to determine the effect of trace mineral source on growth, uniformity, egg and chick production, and vaccine titers. Chicks were assigned randomly to two treatments with ten replications of twenty-six females and two replications of twenty males during 0 to 20 wk of age and 9 replications per treatment during the laying period (20 to 65 wk of age); pullets and cockerels ratio 25:4. Treatments included a control diet containing only inorganic Zn (75 ppm as ZnO) and Mn (90 ppm as MnSO4) or a diet containing 40 ppm Zn and 40 ppm Mn amino acid complexes (Availa-Z/M) in combination with 60 ppm Zn from ZnO and 60 ppm Mn from MnSO4. Developing birds fed Availa-Z/M numerically had decreased mortality (males and females) and improved uniformity (males) during 0 to 20 wk of age. Hens fed Availa-Z/M had increased egg production (P < 0.10) and number of setting eggs (P < 0.05), and lower (P < 0.05) number of downgrade eggs. Supplemental Zn and Mn in the form of Availa-Z/M increased (P < 0.05) the number of chicks per hen and economic net profit per hen over the control group. The results from seven consecutive ages (4, 8, 12, 16, 20, 28 and 34 weeks of age) of blood analysis showed a consistent and steady increase in New Castle disease, infectious bursal disease and infectious bronchitis titers in broiler breeder females fed Availa-Z/M. The results from this study show that supplementation of Availa-Z/M in broiler breeder diets improved breeder performance, increased net profit, and increased vaccine titers (the humoral immune system), which is beneficial to broiler breeder health.

Key Words: Broiler Breeder, Chick Production, Immune Response, Manganese Amino Acid Complex, Zinc Amino Acid Complex

168 Effect of Availa® Zn and ZnSO4 on Laying Hen Performance and Egg Quality. Y.M. Gao1, R. Yang1, J. Yuan1, T.L. Ward2, and T.M. Falkler2. 1China Agricultural University, Beijing, China, 2Zinpro Corporation, Eden Prairie, MN.

51-week-old Bovan laying hens were randomly allotted to 10 groups with seven replicates of 15 birds each. The birds were raised to 59 wk-of-age and fed corn-SBM diets that differed in Zn level and form, ZnSO4 vs. Availa-Zn (ZnAA). Treatments were A: Control (no supplemental Zn, 30 ppm Zn from feedstuffs); B: 40 ppm Zn (ZnSO4); C: 80 ppm Zn (ZnSO4); D: 120 ppm Zn (ZnSO4); E: 160 ppm Zn (ZnSO4); F: 40 ppm Zn (ZnAA); G: 80 ppm Zn (ZnAA); H: 120 ppm Zn (ZnAA); I: 160 ppm Zn (ZnAA); and J: 40 ppm Zn (ZnAA) and 40 ppm Zn (ZnAA). Feed intake, laying percentage, egg weight, egg weight gain, egg and feed conversion, and feed cost were analyzed from the 2nd wk to wk 4 of age. Feed intake, egg production, and egg weight were increased by ZnAA. The yolk Zn concentration was elevated more (P = 0.03) in the ZnAA group than in the ZnSO4 group. The results from this study show that supplementation of the diet with ZnAA had a positive effect on egg production and egg weight, which is beneficial to the laying performance of laying hens fed ZnAA. No improvement in eggshell thickness was observed in this experiment. Anti-BSA antibody production increased in a dose-response manner as supplemental Zn increased (P < 0.01). Antibody production in layers fed ZnAA was numerically higher than from layers fed ZnSO4. Activities of AKP and CA were numerically higher in groups fed ZnAA compared to ZnSO4 at iso-levels of Zn. The yolk Zn concentration was elevated more by ZnAA compared to ZnSO4 (P < 0.05).

Key Words: Layers, Zinc, Availa-Zn, Eggshell Quality


Male and female broilers were fed high available phosphorus corn (HAP) and its normal isogenic corn (NIC) using a commercial type three-feed regimen under summer conditions. Ross x Cobb 500 chicks were placed sexes separate in pens (25/ pen: 13.7 m2/ pen) with new pine shavings litter then reared to 7 weeks of age. Corns were analyzed for total P (0.26% HAP vs. 0.24% NIC) and non-phytate P (0.17% HAP vs. 0.02% NIC). The basis for the latter was calculating % feed vs. aval P (0.3 wk, 1.0 Ca & 0.45 Av; P: 3.5 wk, 0.9 Ca & 0.4 Av; P: 6.7 wk, 0.85 Ca & 0.35 Av). Although each corn had different CP, amino acid, and ME contents, feeds with HAP and its NIC provided similar percentages of grain at each stage of production (0.3 wk, 53.8 vs. 53.5; 3.5 wk, 60.4 vs. 60.0; 6-Twk, 63.8 vs. 63.3 for the HAP and NIC, respectively) as well as non-phytate P and total Ca through each period because of adjustments of dicalcium phosphate and limestone, but additional phytin P associated with the NIC led to increased % tot P (0-3 wk, 0.64 vs. 0.71; 3.5 wk, 0.57 vs. 0.65; 6-Twk, 0.51 vs. 0.59). All feeds were steam-pelleted. HAP generally facilitated an increased percentage pellets which had an improved PDI when compared to feeds having the NIC. Litter at 49 days had reduced P content with birds given HAP; however, moisture and N levels were similar to those when the NIC had been fed. Summer conditions depressed live performance and broilers receiving each type corn were similar in body weight and feed conversion. Abdominal fat and carcass yield after processing as well as the proportion of parts with subsequent bone-out were also similar with the use of each corn. Instron breaking strength of femurs obtained from deboning of thighs was used to estimate skeletal integrity and there were no differences between birds receiving each corn. HAP has the advantage of improving pellet quality in feed manufacture while providing additional available P for formulation. The live performance of broilers grown under moderate summers conditions was unaffected as a result of using either the HAP or NIC as was carcass quality and skeletal integrity. Males and females responded to each source of corn equivalently.

Key Words: Broiler performance, Carcass quality, HAP corn, Litter P content, Pellet quality


A study was conducted with 400 turkeys (B.U.T.A.) to assess the efficacy of low-phytic acid corn (NDLP, Exseed Genetics) to reduce excreted P from growing-finishing turkeys without marring growth or skeletal nature, as compared to yellow dent corn (YDC). Birds were randomly allotted to 16 pens, 25 birds/pen, starting at six wks of age and were fed and weighed on a three-wk interval basis. Four treatments (trts) were fed with four replications per trt. Dietary trts were formulated to provide non-phytate P (npP) at 0.50, 0.42, 0.38, or 0.32% in Trt 1 (YDC) from 6-9, 9-12, 12-15, 15-18 wks, respectively with a Ca:npP of 2.1. Treatment 2 (YDC) was formulated to have 0.2 % less npP than Trt 1. Treatments 3 and 4 (NDLP) were formulated to have npP at 0.43, 0.35, 0.31, or 0.25%. Phytase (Natuphos 600G®; BASF) was added to Trt 4 at 1 kg/ton to

intake was greatest for broilers supplemented from 21 d or with 1.0% KCl. Carcass yield was highest and main parts yield lowest (P <0.05) in KCl-fed broilers. In Exp. 2 on new litter, there were five feed treatments with four pens of two chickens each per treatment from 42 to 49 d of age. The KCl was added to feed at 0, 0.5, or 1.0% or to drinking water at 0.25 or 0.50%. Diets contained monensin and bacitracin-md. Broilers were daily exposed to 25±1°C for 16 h, increasing to 25±1°C to 35±1°C over 2 h, at 35±1°C for 4 h, and decreasing to 25±1°C again, with relative humidity 63.5±5.5%. The KCl in feed or water did not influence weight gain, feed intake, feed conversion ratio, water intake, mortality, water to feed ratio, or dry matter excretion. Heat stress increased rectal temperature, blood hematocrit, hemoglobin, heterophils, and heterophil to lymphocyte ratio, but decreased erythrocytes, lymphocytes, Na, and K. The KCl in water helped regulate the level of erythrocytes and hemoglobin of broilers under heat stress. Heterophil to lymphocyte ratio and rectal temperature were useful as stress indices.

Key Words: Electrolyte balance, Heat stress, Hematology, Potassium chloride, Water.
provide at least 600 FTU/kg. Calcium was fed at the same concentration for Trts 2-4 which provided a 2:1 Ca:P ratio for Trt 3. Feed analysis of total P (TP) showed that dietary TP was consistently lower than formulated for Trt 1 except in the final phase and was not different from other trts from 6-9 wks. Excreta samples were collected at 15 wks, and litter samples at the end of the study for TP analysis. At 115 d, six birds per pen were killed to obtain leg and wing bones from one side of the carcass for bone strength analyses. Final average BW was 16.45 kg and was not affected by corn type (YDC=3930 kcal/kg, NDLP=3490 kcal/kg ME). No trt effects on BW, feed efficiency, ulna shear strength, shear stress or ash, or tibia bending strength were observed. Excreta and litter TP were decreased (p<0.001) by the lower dietary P trts (Trt 1=1.30, 1.48, Trt 2=0.89, 1.14, Trt 3=0.72, 1.10, Trt 4=0.57, 0.89 mg/g, respectively).

Results of this study showed that the low P diets did not negatively affect bone parameters when similar dietary P levels are fed prior to 9 wk of age and reduced P excretion on average by about one-third.

Key Words: Bone strength, Low-phytate corn, Phytase, Turkey

**Nutrition B**

**Feed Ingredients**

**171 The Effect of Feeding Hemp Seed Meal to Laying Hens.** F.G. Silversides*1,2 and M.R. Lefrancos3,1 Crops and Livestock Research Centre, Charlottetown, Prince Edward Island, Canada, 2 Nova Scotia Agricultural College, Truro, Nova Scotia, Canada, 3 Universit Laval, Ste-Foy, Quebec, Canada.

In Canada, it has been legal to grow cannabis cultivars with low levels of tetrahydrocannabinol since 1998. Hemp is grown for fibre or for seed, which is rich in long chain unsaturated fatty acids. Pressing the seed leaves a high protein meal (HSM) containing variable amounts of oil. Ninety-six DeKalb Sigma hens caged two to a cage in blocks of three cages were fed diets containing 0, 5, 10, or 20% meal for 4 wk starting at 43 wk of age. The HSM was obtained by cold-pressing seed of the cultivar Unica-b, which is normally grown for fibre. Diets were formulated to be isonitrogenous and isocaloric, with the HSM assumed to contain 0.900 kcal/kg AME (estimated based on 16.4% lipid) and 30.7% crude protein (measured). Hens were weighed at the start and end of the trial. Egg production was recorded daily, and feed consumption and egg quality were recorded weekly. At sampling, eggs were weighed and broken onto a flat surface where the height of the albumen was measured. Yolks were weighed, shells were dried and weighed, and weights of albumen were obtained by difference. Eggs were collected for fatty acid analysis in the fourth wk of feeding experimental diets. No significant differences were found between feed treatments for egg production, feed consumption, feed efficiency, body weight change, or egg quality. The lipids in the HSM were made up of 60% linoleic acid and 12% α-linolenic acid, with 16% oleic acid, and lesser amounts of palmitic, stearic, and γ-linolenic acid. Eggs produced by hens fed increasing levels of HSM had lower levels of palmitic (20% without HSM, 25% with 20% HSM) and oleic acid (38% without HSM, 35% with 20% HSM) and higher levels of linoleic (15% without HSM, 22% with 20% HSM) and α-linolenic acid (0.2% without HSM, 1.2% with 20% HSM). The HSM provided useful amounts of energy and protein in layer diets and feeding it altered the fatty acid composition of eggs produced.

Key Words: Hempseed meal, Egg production, Egg quality

**172 Utilization of Different Soy Products Affected by Age in Chicks.** Amy Batal*1 and Carl Parsons2, 1 The University of Georgia, 2 University of Illinois.

Two experiments were conducted to evaluate the utilization of several different soy products at different ages in New Hampshire X Columbian male chicks. Six pens of eight chicks were fed dextrose-protein source diets (23% CP) containing one of 10 different protein sources from 0 to 21 d of age. Excreta were collected at 0-2, 3-4, 7, 14, and 21 d of age and apparent metabolizable energy (MEa) and amino acid (AA) digestibility were determined using acid insoluble ash as a marker. Protein sources evaluated were: Experiment 1 - casein, soybean meal (SBM), soy protein concentrate (SPC), and soy protein isolate (SPI); Experiment 2 - raw soyflakes, SBM, Williams 82 soybeans, heated Williams 82 soybeans, Kunitz-free soybeans, and lectin-free soybeans. In Experiment 1, chicks fed the dextrose-SBM diet had the highest (P<0.05) weight gains at the end of three wk. When comparing the MEa and AA digestibility values among diets at the same age, the ranking (from highest to lowest) of the four diets was: casein, SPI, SPC, SBM. The MEa values increased (P<0.05) with age for all four diets, with the increase being much smaller for the casein diet (3%) than the soy diets (mean increase 11%). In Experiment 2, the SBM diet yielded the highest (P<0.05) growth performance, MEa, and AA digestibility values. The MEa and AA digestibility values of the Williams 82 soybeans, Kunitz-free soybeans, and lectin-free soybeans were quite low. In general, the Kunitz and lectin-free soybeans yielded higher growth performance and MEa values than the Williams 82 soybeans, Kunitz-free soybeans, and lectin-free soybeans. The MEa values increased with age for most diets and AA digestibility increased with age for the soyflakes and Kunitz and lectin-free soybean diets. Our results suggest there may be some potential benefits of feeding SPC or SPI during the first 1 to 3 wk posthatching and that underprocessed (under heated) soybeans should definitely not be included in the diet of the very young chick.

Key Words: Age, Soybean meal, Soybeans, Amino Acid digestibility, Metabolizable energy

**173 Effect of soybean lectin on growth and nutrient digestibility in turkey poults.** Y.O. Fasina1, J.D. Garlich2, H.L. Classen1, H.E. Swaisgood2, P.R. Ferker3, G.B. Havenstein4, and J.L. Grimes1, 1 University of Saskatchewan, Saskatoon, Saskatchewan, Canada, 2 North Carolina State University, Raleigh, NC, USA.

Soybean meal is the major protein supplement in poultry diets. Levels of antinutrients such as lectins are reduced by the desolventization-toasting process during commercial meal production. However, Maenz et al. (1999) observed a considerable range of residual lectin activity (0.2 to 0.6 mg SBL/g meal) in commercially processed soybean meals. Because the meal is usually included at high levels (30 to 50 %) in young turkey diets, residual lectin levels in these diets may become high enough to cause antinutritional effects. Thus, an experiment was conducted to investigate the effect of soybean lectin (SBL) on performance characteristics and nutrient digestibility in turkey poults. Soybean lectin was purified by affinity chromatography, and incorporated into a casein-corn starch based semi-purified diet at 0.00 and 0.048 % level. The two semi-purified test diets were compared to a corn-soybean meal diet to make a total of three dietary treatments. All diets contained 0.5 % titanium dioxide as an indigestible marker. Each treatment was fed to 56 poults in four pens (14 poults per pen) from 0 to 14 days of age. Body weight gain, feed intake and feed efficiency (gain-to-feed ratio) of birds were recorded on days 7 and 14. Pecal samples were collected during days 5 to 7 and days 12 to 14 of the experiment. Weight gain and feed efficiency of poults fed the semi-purified diets were comparable to those of birds fed the corn-soybean meal diet. Soybean lectin had no effect (p>0.05) on weight gain, but improved feed efficiency (p<0.05). In addition, poults fed the lectin-containing purified diet absorbed more fat (p<0.05) and did not differ in starch digestibility, when compared to poults fed the lectin-free purified diet. It was concluded that the presence of SBL up to 0.048 % level of the diet is not harmful to turkey poults.

Key Words: Lectin, Soybean meal, Turkey poults

**174 Effect of Guarm Meal and Mannanase on Growth Performance and Intestinal Viscosity in Broiler Chickens.** J. T. Lee*, P. Zhang, C. A. Bailey, and A. L. Cartwright, 1 Texas A&M University System.

Guar meal contains high concentrations of protein and indigestible galactomannan polysaccharide. Two experiments examined effects of guar meal fractions (hull and germ) and beta-mannanase enzyme (Hemicell®) on growth performance and intestinal viscosity in broiler chickens. In Experiment 1, 360 day-old birds were randomly assigned to six six-bird replicates per treatment group fed diets containing 0, 2.5, 5.0, 7.5 and 10% of either guar fraction. At 20 days, three birds from each replicate were weighed, and liver, gizzard, bursa, pancreas, spleen, and intestines removed. Each organ and intestinal segment, duodenum, jejunum, ileum,