T135 Comparison of nonlinear functions for describing the growth curve of Nile tilapia *Oreochromis niloticus* var. *chitralada* in a commercial production cycle. D. Rodriguez[1], C. Ariza-Nieto[2], A. Munoz[1], and G. Afanador*[1,2], [1]*Universidad Nacional de Colombia*, *Bogota, Colombia*, [2]*CORPOICA*, *Bogota, Colombia*.

Mathematical models in fish nutrition have proven indispensable in estimating growth and feed requirements. The aim of this study was to make a statistical comparison of the mathematical growth models in Nile tilapia. The data set used for this analysis was taken from a study that evaluated the effects of oregano essential oils (OEO) supplementation in Nile tilapia, *Oreochromis niloticus* (L.) (males) raised form 10 to 550 g of weight. Six nonlinear mathematical functions were compared: Gompertz, Logistic, Richard, Janoschek, Michaelis-Menden, and Bertalanffy which were fitted to the data using the NLIN procedure of SAS. Gauss-Newton method was used through this statistical procedure and the maximum number of iterations to converge was 11. A quantitative approach of statistical analysis was used to evaluate model adequacy and the residual variation for each prediction equation was partitioned into 3 components using means square prediction error (MSPE), analysis for comparing accuracy among models. The Gompertz, Richards and Janoscheck were shown to be the most appropriate models for *Oreochromis niloticus* (4597, 4591 and 4589 MSPE values, respectively). Parameters that allowed comparisons between general rates of body weight change (both absolute and relative) as derived by Gompertz model were: average lifetime absolute growth rate (AGR, 2.395 g/day), average lifetime absolute maturing rate, (AMR, 0.00278) and average lifetime relative growth rate (RGR, 0.0151 g/day).

Key Words: nonlinear functions, Nile tilapia, AGR, AMR, RGR

T136 In vivo measurement of body composition of chickens using quantitative magnetic resonance (QMR). A. D. Mitchell*[1], R. W. Rosebrough[1], G. Taicher[2], and I. Kovner[2], [1]*USDA-ARS*, *Beltsville, MD*, [2]*Echo Medical Systems*, *Houston, TX*.

QMR is a nuclear magnetic resonance based method for measuring the fat, lean and water content of the total body of the live animal. The purpose of this study was to evaluate the use of QMR for measuring the body composition of chickens while comparing QMR results to those obtained by dual x-ray absorptiometry (DXA) and chemical analysis (CA). A total of 144 birds, were scanned live (non-anesthetized) by QMR, killed, and then scanned by DXA. The birds were Ross 708 broiler chickens and ranged in weight from 768 to 2230 g. In addition, 32 of the carcasses were chemically analyzed for total body lipid, water and ash content. For the entire group of birds, the QMR and DXA measurements of total body water and total body lean mass were in good agreement, with no significant difference (1149 ± 202g vs. 1169 ± 183g and 1395 ± 246g vs. 1354 ± 226g, respectively, $P > 0.05$) and highly correlated ($R^2 = 0.96$ and 0.96, respectively). However, the QMR measurement of total body fat was significantly lower ($P < 0.05$) than that measured by DXA (94 ± 44g vs. 190 ± 43g, respectively) and poorly correlated ($R^2 = 0.40$). Compared with CA, QMR underestimated the percentage of total body fat by 37% while DXA overestimated the percentage of fat by 22% (9.7 ± 3.6 by CA vs. 6.1 ± 4.3 by QMR and 11.8 ± 3.0 by DXA, $P < 0.05$). Both QMR and DXA measurements of percentage total body fat were highly correlated with the CA measurement ($R^2 = 0.96$ and 0.82, respectively). Both QMR and DXA estimates of total body water were close to the CA measurement (1153 ± 232g by CA vs. 1199 ± 239g by QMR and 1202 ± 218g by DXA, $P > 0.05$), with R^2 values of 0.81 and 0.82, respectively. In conclusion, the results of this study demonstrate that QMR is a potentially useful method for measuring the body composition of chickens. Major advantages of this method are that no anesthesia is required and no other measurements are needed for the data input or analysis.

Key Words: chickens, body composition, quantitative magnetic resonance

T137 Estimation of direct and maternal heritability of body weights in Iranian native chickens using a multivariate animal model. H. Farhangfar*[1], M. E. Navidizadeh[2], and S. M. Hosseini[1], [1]*Birjand University*, *Birjand, Iran*, [2]*Agricultural Jihad Organisation*, *Mashhad, Iran*.

The main objective of this research was to estimate direct and maternal heritability of body weights in Iranian native chickens. Generally, heritability is a key component for predicting breeding value of animals and few research have been so far undertaken in this respect for native chickens of Iran. To estimate genetic and environmental variance and covariance components for body weight traits, a multivariate animal model was applied. The traits were body weight at ages of 1 (W1) and 56 (W56) days. The data were provided by the breeding center of native chickens located in Khorasan Razavi province of Iran. The total number of records was 18,253 collected over 3 generations from 18,253 male and female chicks representing 315 sires and 2,141 dams. The average W1 and W56 were 33.8 g (SD = 3.27 gr) and 557 g (SD = 95.30 g), respectively. In the multivariate animal model, combined contemporary fixed effect of generation, hatch and sex (GHS), random effects of direct additive genetic, maternal additive genetic and maternal permanent were included. REML estimates of (co)variance components were obtained by DMU package. For W1, direct additive genetic, maternal additive genetic, maternal permanent environment and residual variance components were found to be 1.79, 0.68, 4.64 and 3.16 g^2, respectively. The corresponding figures for W56 were 2383, 823, 685 and 3553 g^2, respectively. Covariance components between direct and maternal additive genetic effects were −0.91 and −1398.8 g for W1 and W56, respectively. Direct heritabilities of W1 and W56 were 0.2 ($P < 0.05$) and 0.39 ($P < 0.05$), respectively. Maternal heritabilities of W1 and W56 were found to be 0.07 and 0.14, respectively. Correlation between direct and maternal additive genetic effects was −0.82 for W1 while it was approximately −1 for W56. The results also indicated that there is a significant additive genetic variation in the Iranian native chickens for W56 suggesting that genetic selection could be successfully practiced.

Key Words: Iranian native chicken, genetic parameters, body weight

T138 Maniçoba hay effects on the gastrointestinal tract of free-range birds. P. E. N. Givisiez*, G. S. G. Bach, J. H. V. Silva, F. G. P. Costa, C. J. B. Oliveira, and R. C. Lima Neto, *Universidade Federal da Paraiba*, *Areia, PB, Brazil*.

This study evaluated the effect of partial substitution of the diet by maniçoba hay (*Manihot pseudoglaziovii*) on gastrointestinal (GIT) morphology of free-range birds at 73 d of age. Eighty-four Paraiso Pedres birds were randomly distributed into 3 treatments and 4 repetitions of 7 birds each. Corn-soybean meal diet was substituted by maniçoba hay at 0, 10 and 20%. At 73 d of age, 2 birds per repetition were slaughtered and liver, gizzard, intestine and its segments were weighed and intestinal and segment lengths were measured. Weight and length were expressed

as percentages of the live weight (%PV). Fragments of duodenum and jejunum were collected from each bird and routinely processed for histological analysis. Villus height and crypt depth were assessed using a image analysis software and the villus:crypt ratio was calculated. Data were submitted to ANOVA in a completely randomized design, with 3 treatments and 8 repetitions for macroscopic parameters and different number of repetitions for microscopic parameters. Means were compared by Tukey's test at 5% probability. There were no significant differences ($P < 0.05$) between treatments for macroscopic results, except for the relative weight of gizzard, which increased in the treatments with maniçoba hay (1.82; 2.42 and 2.46% for 0, 10 and 20%, respectively). In the duodenum, villus height increased ($P < 0.05$) when 10% maniçoba was fed (789.18; 1110.3 and 698.90 μm for 0, 10 and 20%) and crypt depth decreased ($P < 0.05$) with 20% maniçoba (65.07; 68.7 and 44.71 μm for 0, 10 and 20%), but villus: crypt ratio was not affected ($P < 0.05$). No differences were seen in the jejunum. The increase in dietary fiber probably caused more extrusion of epithelial cells. Considering that high energy is necessary for GIT maintenance and that the inclusion of maniçoba hay decreases AME and AMEn, apparently recovery was possible in the 10% treatment, but not in the 20%. Maniçoba hay may be used up to the level of 10% without compromising the epithelium of duodenum and jejunum.

Key Words: free-range birds, intestinal morphology, dietary fiber

T139 Study on probiotic characteristics of three isolates of lactic acid bacteria in in vitro and in vivo condition in broilers. S. Ghyamyipour[1], S. Rahimi*[1], M. A. Karimi Torshizi[1], and N. Mojgani[2], [1]*Tarbiat Modares University*, *Tehran, Tehran, Iran*, [2]*Razi Vaccin and Serum Production Research Institute*, *Karaj, Tehran, Iran*.

The effect of administration of 3 lactic acid bacteria isolates on broiler performance and carcass characteristics were investigated. This study was done in 2 phases. In first phase the microbiological characteristics of these 3 isolates such as tolerance to low pH, growth in presence of bile salts, tolerance to some commercial antibiotics, hydrophobicity, ability to inhibit the growth of some pathogenic bacteria and their ability to release the hydrolase enzyme of bile salt were examined. Data from first phase indicated that the isolated bacteria were identified as lactobacilli. In the second phase, to determine whether probiotics improve broiler growth and carcass characteristics, 3 lactic acid bacterial isolates were added to drinking water. Day old chicks (n = 320) were distributed to 4 experimental groups with 4 replicates with 20 chicks in a completely randomized design. Control group (C) did not receive any probiotic culture in drinking water; groups A, B and D received one of the 3 lactic acid bacterial cultures at a concentration of 10.6 log cfu/mL in drinking water from 9 to 49 d of age. Data were analyzed by Duncan's multiple range test (SAS, 1990). Administration of B culture resulted the greater BW gain compared with the other groups on d 49 ($P < 0.05$). Lactic acid bacteria did not influence the feed intake, weight and length of internal organs and carcass characteristics of chicks and blood factors except spleen weight, jejunum length and total carcass weight.

Key Words: lactic acid bacteria, performance, carcass

T140 Utilization of yeast extract and bacitracin for early intestinal maturation by broiler chicks obtained from breeder hens of different ages. Y. O. Fasina*, R. Thanissery, and S. J. Thomas, *Auburn University*, *Auburn, AL*.

The intestine of the newly hatched chick is immature at hatch and hatchlings from young breeder hens (YHC) typically demonstrate reduced livability compared with those from old breeder hens (OHC). Supplementing yeast extract (YE) into the diet may enhance intestinal development and growth of broiler chicks because, YE contains nucleotides that are essential for cellular functions and are also immunomodulatory. A 14-d experiment was conducted with day-old chicks from young (26–27 week old) and old (58 to 59 week old) breeder hens. Chicks (384) were randomly assigned to 8 dietary treatments. Treatment 1 (YH) consisted of YHC fed corn-soybean meal (SBM) diet without bacitracin methylene disalicylate (BMD) or YE added. Treatment 2 (YHB) consisted of YHC fed corn-SBM basal into which BMD was added at 0.055g/kg. Treatment 3 (YHE) consisted of YHC fed corn-SBM basal into which YE was added at 0.075% level. Treatment 4 (YHED) consisted of YHC fed corn-SBM basal into which YE was added at 0.15% level. Treatments 5 (OH), 6 (OHB), 7 (OHE), and 8 (OHED) consisted of OHC fed diets similar to those given to YHC in treatments 1, 2, 3, and 4, respectively. Intestinal jejunal tissue samples were analyzed for alkaline phosphatase (ALP) activity as an indicator of intestinal maturation on d 4 and 13 of experiment. Results showed that among YHC treatments, intestinal ALP activity was higher in YHB, YHE, and YHED treatments ($P < 0.05$; 1.85 to 2.61 IU/mg protein) compared with YH (1.06 IU/mg protein) on d 4 of experiment. Among OHC treatments, only OHB (2.14 IU/mg protein) had higher ALP activity than OH (0.89 IU/mg protein; $P < 0.05$). By d 13, ALP activity became similar for all treatments ($P > 0.05$). It was concluded that YE supplemented at 0.075% level of the diet performed similarly to BMD in enhancing early intestinal maturation in YHC, but had no effect in OHC.

Key Words: yeast extract, alkaline phosphatase activity, broiler chick intestine

T141 Growth and organogenesis of progeny chicks from dams fed different sources of trace minerals. Q. J. Sun*, S. Y. An, and Y. M. Guo, *State Key Lab of Animal Nutrition, College of Animal Science & Technology, China Agricultural University*, *Beijing, China*.

A study was conducted to evaluate growth and organogenesis of progeny chicks from broiler breeders fed diets supplemented with different sources of trace minerals. A total of 120 Cobb 48 broiler breeder females aged 31 wk were given 3 diets with organic or inorganic trace minerals at equal levels. The control (CON) was the basal diet supplemented with a combination of inorganic minerals ($CuSO_4$, $ZnSO_4$, $MnSO_4$ and Na_2SeO_3 separately, i.e., Cu 8 mg/kg, Zn 50 mg/kg, Mn 60 mg/kg and Se 0.3 mg/kg of diet). The second treatment (ZM) was basal diet supplemented with a combination of inorganic Cu, Mn and Se, and organic Zn from Mintrex-Zn. The third treatment (MIX) was basal diet supplemented with a combination of Mintrex-Cu Zn Mn (Novus Intl., USA) and yeast-selenium from Sel-Plex (Alltech Inc., USA). Diets were formulated based on NRC (1994). Trace minerals in basal diets were Cu 4.6 mg, Mn 30 mg and Zn 47 mg/kg diet based on actual analysis. All diets were iso-energetic, iso-nitrogenous and iso-methionine. After 8 wk, eggs laid during 39wk of age were incubated. Hatched chicks were raised for evaluation of growth performance and development of organs respectively. Broilers were fed with a common commercial ration with inorganic minerals (Cu 8 mg, Zn 50 mg, Mn 60 mg and Se 0.3 mg/kg diet). Results showed that minerals sources in broiler breeder hens diets did not influence the feed intake of their progeny. Supplementation of ZM and MIX in the diet increased body weight (BW) ($P = 0.121$), and decreased feed/gain ($P < 0.05$) of the chicks. No difference was observed in development of heart, however the liver weight (LW) and its relative weight (LW/BW) on d 1 and bursa weight (BAW) on d 11 were increased with ZM and decreased with MIX (LW, $P < 0.05$; LW/BW, $P < 0.10$; BAW, $P = 0.056$). Relative weight of bursa on d 11 was increased when breeders fed ZM ($P < 0.05$). On d 21, chicks fed

inorganic minerals obtained the greatest spleen weight (SW) and its relative weight (RSW) (SW, $P < 0.05$; RSW, $P < 0.10$). In conclusion, organic sources of minerals improved progeny growth performance and affected organogenesis.

Key Words: broiler breeder, progeny, mineral

T142 Effect of dietary probiotic and prebiotic on bone characteristic of Ross broiler chickens. H. Ziaie[1], G. H. Hadarbadi*[1], A. Zeinali[2], M. A. Karimi Torshizi[4], M. Bashtani[3], and H. Farhangfar[3], [1]*Agriculture and Natural Resources Research Center*, *Birjand, South Khorasan, Iran*, [2]*Ferdowsi University*, *Mashhad, Iran*, [3]*Birjand University*, *Birjand, South Khorasan, Iran*, [4]*Tarbiat Moddares University*, *Tehran, Iran*.

Weak bones result in breaking during processing and lower meat grade. Also, weak legs often result in reduced feed intake thus affecting weight gain and feed conversion ratio. Therefore, the objective of the present study was to determine the effect of dietary probiotic and prebiotic on bone characteristic and Breaking Strength of Ross broiler chickens. In this study, 240 day-old male broiler chickens (Ross strain) were allocated to 4 treatments in pens (120 × 100 × 90 cm) with 4 replicates (15 birds / pen) in a block completely randomized design. Experimental diets were fed: T1 = Control diet based corn and soybean meal without supplementation, T2 = Control diet + antibiotic (Virginiamycin) 15 ppm, T3 = Control diet + probiotic (commercial mixture of lactobacillus, Protexin) 150g/ton diet and T4 = Control diet + prebiotic (commercial mixture, Immnuwall) 450g/ton diet).). At the end of the experiment (42 d), 2 birds from each replicate were randomly selected and killed to evaluate the tibia bone characteristic (modulus of elasticity, yield stress and percentage of ash, calcium and phosphorous). Bone breaking strength analysis was conducted using an Instron Materials Tester (Model 4411, Instron Corp., Canton, MA) with Automated Materials Test System software version 8.09. The results of the present study indicated that mechanical parameters, ash percentage, Ca and P contents were significantly improved by the supplementation antibiotic and their alternatives ($P < 0.05$) but, the difference between antibiotic diet and treatments 3 and 4 was not significant ($P > 0.05$). In finally, with the prophylactic use of antibiotic (as growth promoters) in animal feeds probiotic and prebiotic resulted in increase resistance to stress fracture of broiler bones and as a suitable replacement can be proposed.

Key Words: broiler, antibiotic alternative, bone characteristic

T143 Improved hatchability and post-hatch performance in turkey poults receiving iodinated casein in ovo. W. G. Bottje*[1], A. Wolfenden[1], L. Ding[2], M. Morgan[1], N. Pumford[1], R. Wolfenden[1], G. Duncan[3], T. Smith[3], T. Slagel[3], K. Lassiter[1], and B. Hargis[1], [1]*Dept. of Poultry Science, Center of Excellence for Poultry Science, Univ. of Arkansas*, *Fayetteville,* [2]*Dept. of Animal Nutrition, College of Animal Science and Technology, China Agriculture University*, *Beijing, China*, [3]*Cargill Turkey Division*, *Springdale, AR*.

Iodinated casein has been shown to have thyroid hormone-like properties, and thyroid hormone has been shown to improve turkey embryo hatchability. Thus, studies were conducted to investigate the effect of iodinated casein injected in ovo at 25 d of incubation on hatchability, hatch weight, and growth (6 or 7 d post-hatch) in turkey poults. Two experiments were conducted with a commercial turkey hatchery using a commercial egg injection system. In Exp. 1, 3900 turkey eggs (1300 per group) were injected at 25 d of incubation with 200 µL of solution containing either 10 mg/mL of gentamicin (Control) or ones containing 75 µg/mL or 375 µg/mL of iodinated casein (IC75 and IC375, respectively) in a dextrin solution mixture of maltodextrin and potato starch dextrin (~28%). Two hundred poults each from the Control, IC75 and IC375 groups were neck tagged, placed in a commercial turkey house within a single brooder ring, and weighed 7 d later. In Exp. 2, 5200 eggs (2600 per group) were injected with the Control or the IC75 solution. A total of 600 poults (300 per group) were neck-tagged and placed in a single brooder ring in a commercial house and weighed on d 6 post-hatch. Eggs in Exp. 1 and 2 were obtained from hen flocks that were 33 and 5 wk into the laying cycle, respectively. In Exp. 1, the IC75 injection resulted in a 1.8% increase ($P = 0.03$) in hatch weight and numerically higher hatchability and 7 d BW compared with Controls. In Exp. 2, the IC75 treatment resulted in a 2.4% increase in hatchability ($P = 0.01$), a 4.3% increase in hatch weight ($P < 0.001$), and a 1.8% increase in 6 d poult weights ($P < 0.03$) compared with Controls. The results of this study indicate that a solution containing 75 µg/mL iodinated casein in a dextrin solution injected into turkey eggs at 25 d of incubation may be used to improve hatchability and early poult weights in commercial turkey production.

Key Words: poult hatchability, iodinated casein, in ovo injection

T144 Effect of daily lithium chloride (LiCl) administration on bone quality and strength in growing broiler chickens. B. M. Harvey*[1], M. Eschbach[2], E. Ackell[1], S. Kotha[2], M. Darre[1], N. Francis[1], D. J. Adams[3], R. Ramanathan[1], R. Mancini[1], and K. E. Govoni[1], [1]*Department of Animal Science, University of Connecticut*, *Storrs,* [2]*Department of Mechanical Engineering, University of Connecticut*, *Storrs,* [3]*Orthopedic Surgery, University of Connecticut Health Center*, *Farmington*.

Bone fractures and deformities are a serious problem for the broiler industry; therefore, identification of mechanisms to improve bone quality and strength would be beneficial. The wnt/β-catenin pathway plays a critical role in the bone formation process and this pathway can be stimulated by oral LiCl supplementation in mice. We hypothesized that oral supplementation of LiCl would increase bone strength and quality in broiler chickens. 144 broilers were divided into LiCl, control (C) and pair-fed (PF) groups. Beginning at 1 or 3 weeks (wk) of age, chickens were administered LiCl (20 mg/kg BW) or water daily by oral gavage. At 6 wk of age, chickens were killed and blood, bone and muscle samples were collected. A 24h LiCl (20 mg/kg BW) challenge determined that serum LiCl increased within 2h and cleared the system within 24h, thus demonstrating the effectiveness of our oral gavage to deliver LiCl. We did not observe any differences in BW ($P \geq 0.53$) or feed intake ($P \geq 0.19$) between all treatment groups, demonstrating that LiCl treatment did not negatively affect growth in these broilers. To evaluate bone composition, we performed morphometric analysis on the tibiae of C and LiCl groups using microCT imaging. We did not observe a difference in cortical or trabecular bone volume, trabecular thickness, number, or spacing ($P \geq 0.52$). To determine bone strength, we performed 3-point bending on the femora and tibiae of C and LiCl birds from the 1 wk group. We did not measure a difference in bone length or ultimate load ($P \geq 0.60$). However, we did observe a 23% reduction in stiffness ($P = 0.02$) in the femora and 34% reduction in fracture energy ($P = 0.11$) in the tibiae of the LiCl treated birds, thus suggesting reduced bone quality in the LiCl birds. We did not observe any effect of LiCl treatment on pectoralis muscle color or lipid oxidation ($P > 0.05$). In conclusion, LiCl treatment in broilers did not affect growth or meat quality. Surprisingly, we measured a reduction in bone stiffness with LiCl treatment which may be due to the dose of LiCl utilized or a species difference in response to LiCl treatment on bone formation.

Key Words: poultry, bone, broiler

T145 The bi-allelic expression of *delta-like 1 homolog* (*Dlk1*) in avian species. S. Shin* and K. Lee, *The Ohio State University*, *Columbus*.

Delta-like 1 homolog (*Dlk1*) is known as an important gene in the regulation of adipose and muscle differentiation and development. This gene is also known as an imprinted gene usually expressed only from the paternal allele in mammals. To determine the properties of the *Dlk1* genes of the avian species, *Dlk1* genes for chicken, quail and turkey were cloned and characterized for cDNA and amino acid sequences, alternative splicing, and genetic distances from other species. In addition, the structure of genomic DNA containing the cluster of genes including *Dlk1* was investigated in the chicken and compared with the human. The allelic expression pattern of the avian *Dlk1* gene was also determined here. The coding sequences of the quail and turkey *Dlk1* were the same as chicken *Dlk1* in their numbers of nucleotides (1,161 bp) and amino acids (386 a.a.). The similarities in DNA and amino acid sequence were more than 96% among the poultry species. The chicken and turkey *Dlk1* were closer than the quail in the phylogenetic analysis. The domains, such as one signal sequence, 6 *epidermal growth factor* (*EGF*)-like domains and a transmembrane domain were predicted in DLK1. There was no alternative splicing of *Dlk1* transcripts as in the chicken. Like in mammals, *Yy1*, *Wars*, *Wdr25*, *Begain*, *Dlk1*, *Dio3*, and *Ppp2r5c* were found as a syntenic gene cluster in chicken genome. However, *Meg3*, *Rtl1*, and *Meg8* genes located between *Dlk1* and *Dio3* were not found in the cluster of the chicken genome. There were several single nucleotide polymorphisms (SNPs) in the fifth exon of *Dlk1* genes in chickens and quail, and the heterozygous SNPs of *Dlk1* transcripts were observed in the adipose and muscle, indicating the bi-allelic expression of *Dlk1* in the avian species. The data confirmed avian *Dlk1* is not imprinted in poultry and might be regulated in a different manner from mammals.

Key Words: avian Dlk1, genomic imprinting, biallelic expression

T146 Expression of myosin heavy chain isoforms during muscle development in Leghorns and broilers. A. Lee*, Y. Suh, and K. Lee, *The Ohio State University*, *Columbus*.

Myosin heavy chain (MyHC), one of the major components in the contractile machinery of skeletal muscle fibers is found in several isoforms during myogenesis. During chicken development embryonic, neonatal, and adult MyHC isoforms are expressed. Broiler chickens have been selected for fast and large muscle growth while Leghorn chickens have been selected for egg laying capabilities. This has led to an obvious difference in muscle growth and development with broilers being much larger than Leghorns. The objective of this study was to determine if differences in muscle growth and development of Leghorns and broilers are associated with differences in temporal expression of MyHC isoforms in skeletal muscle between the 2 breeds. Pectoralis major muscle was collected from Leghorns and broilers at embryonic d 15, and 17 and d 1, 5, 11, 20, 27, and 33 d post hatch with n = 3 samples per time point and breed. Western blotting using 3 monoclonal antibodies (EB165, 2E9, and AB8) was performed to compare the expression patterns of embryonic/adult, neonatal, and adult isoforms of MyHC, respectively, for all time points in both Leghorn and broiler chickens. Pectoralis major tissue from broiler chickens expressed the adult MyHC isoform as early as d20 whereas the Leghorn chickens began expressing the adult isoform later. Both broiler and Leghorn chickens began expressing the neonatal MyHC isoform on d5 however Leghorn chickens expressed the neonatal isoform much longer than broilers. Leghorn chickens had sustained expression of the neonatal MyHC isoform through d27 whereas in broiler chickens the neonatal isoform was not expressed at d20. The differences in the expression of both adult and neonatal MyHC isoforms in broilers and Leghorns are consistent with the faster maturation and growth of broilers relative to Leghorns. Further study of other MyHC isoforms is needed to determine their association with differences in muscle growth and development of broiler and Leghorn chickens.

Key Words: muscle development, myosin heavy chain, chicken

T147 Growth of internal organs in quail embryo (*Coturnix japonica*) as a function of age. K. L. Arora*, *Fort Valley State University*, *Fort Valley, GA*.

The Japanese quail embryo is a very valuable model for experimental studies in developmental biology, toxicology, virology, teratology, endocrinology and drug testing. Various reports in the literature have focused on embryonic growth, weight, and developmental defects as a function of age. However, it is important to know the progressive changes in the growth of different organs which make up the total organism for complete pathological analysis. Eggs of uniform size and weight (10–11g) were collected, between 3 to 6 p.m., from 56d old birds weighing 130–135g. The birds were housed in cages under 14L: 10D lighting system and fed commercial turkey starter. Eggs were incubated at 37.8°C and 65–70 R.H. At the end of 10, 12, 14, and 16 d of incubation, a group of 15 eggs each were removed from the incubator and opened into Petri-dishes containing lukewarm saline solution. The embryos which were devoid of extra-embryonic tissues and spare yolk, were washed again, blotted with paper towel, organs dissected and removed and weighed individually using analytical balance. Day old chicks were killed with CO_2 and handled in a similar fashion. The following organs were collected: brain, liver, heart, gizzard, proventriculus, lungs, eyes and kidneys. Embryonic mass increased rapidly from 1.44 ± 0.01g at d 10 to 5.38 ± 0.14g at d 16, the time to hatch ($P < 0.01$). By d16, the embryonic mass had reached 91.7%, liver 88.2% heart 98%, kidney 100%, brain 100%, gizzards 89.6%, proventriculus 87.6%, lungs 95.2% and eyes 99.4% of the weight of day-old chick (100%). The embryonic growth accelerated during d10 and 12 and d14 and 16 with the organs growing at different rates ($P < 0.01$). The larger and faster growing organs in order of growth were: eyes, brain, gizzard and liver. The smaller and slower growing organs were ranked similarly in order of growth: proventriculus, heart, lungs and kidneys. The importance of the relationship between the growth of internal organs, age and stage of development will be discussed.

Key Words: Japanese quail, internal organ, embryo

T148 Growth after an innate immune challenge is different between broiler strains. L. Xu*[1], M. deBeer[2], M. Einstein[1], A. Schinckel[1], and T. J. Applegate[1], [1]*Purdue University*, *W. Lafayette, IN,* [2]*Aviagen, Inc.*, *Huntsville, AL*.

The acute phase response (APR) is defined as the early set of innate immune reactions induced by unfamiliar infectious agents or tissue injury. Lipopolysaccharide (LPS)-induced APR is associated with depressed growth and appetite loss. However, the question remains if there is a difference in the recovery after an APR between broiler strains. Therefore, a 40d feeding study was conducted with 2 broiler strains that were challenged between 7 to14 d with LPS. The experiment was designed with 3 treatments per strain (n = 8 cages/treatment; 6 birds/cage) starting at 7 d of age: an unchallenged positive control, LPS-challenged negative control (LPS-NC), and an unchallenged treatment that was pair-fed to LPS-NC. The LPS was injected i.p. Four times at 48-h intervals (1 mg/kg of BW). Body weight was recorded individually at 7, 14, 27, and 40 d of age. The LPS challenge depressed BW gain from 7 to 14 d of age by 10% and 12% for strains 1 and 2,

respectively. However, 67 and 74% of growth depression for strains 1 and 2, respectively, was attributable to factors other than feed intake reduction when compared with the pair-fed treatment. No BW differences between strains were apparent at the end of the challenge period (14 d; $P > 0.05$); whereas Strain 1 was 5.4% heavier (153.9 g) at 40 d of age ($P < 0.0001$). When 7 to 14 d of age BW gain was used as a covariate, average daily gain was affected by treatment within strain 1 but not strain 2. In other words, birds given the LPS treatment for strain 1 demonstrated compensatory growth; whereas those for strain 2 did not. Additionally, the coefficient of variation for 40d BW of strain 1 was 1.3% versus that for strain 2 which was 1.6%. Thus, growth recovery after an APR is different between broiler strains.

Key Words: broiler strain, innate immune response, lipopolysaccharide

T149 Influence of gender and initial body weight uniformity on growth performance and carcass quality of pigs slaughtered at 130 kg BW. L. Cámara*[1], M. P. Serrano[1], D. G. Valencia[2], A. Fuentetaja[3], and G. G. Mateos[1], [1]*Universidad Politécnica de Madrid*, *Madrid, Spain*, [2]*Nutral S.A.*, *Madrid, Spain*, [3]*Copese S.A.*, *segovia, Spain*.

A trial was conducted to study the influence of gender (castrated female, CF vs. castrated male, CM) and initial pen uniformity (BW ± SD, 7.5 ± 0.6 kg vs. 7.5 ± 1.2 kg BW) on performance and carcass quality of crossbreds pigs resulting from Landrace * Duroc × Large White dams mated to Duroc sires pig. Males were castrated at 5 ± 2.0 d of age (2.5 ± 0.57 kg BW) and females at 69 ± 2.6 d of age (22.3 ± 0.83 kg BW). Each treatment was replicated 4 times and the experimental unit was a pen with 30 piglets from 7.5 to 27.3 kg BW and a pen with 14 pigs from 27.1 to 130.4 kg BW for productive traits. For carcass quality traits, 10 carcasses of the same pen constituted the experimental unit. From 7.5 to 27.3 kg BW, CF had lower ADFI ($P < 0.05$) and ADG ($P < 0.001$) and poorer FCR ($P < 0.001$) than CM. Also in this period, uniform pigs tended to be less efficient than less uniform pigs ($P < 0.10$). From 27.1 to 130.4 kg BW, CF tended to eat less feed and to have better FCR than CM but pen uniformity did not affect performance. Castrated females had more ($P < 0.05$) fat thickness at P_2 and tended to have more ($P < 0.10$) fat at *gluteus medius* muscle than CM. Trimmed shoulder yield ($P < 0.001$) and trimmed primal cut yield ($P < 0.01$) were higher for CM than for CF. Gender did not affect carcass, ham, and loin yields or shrink loss. Pen uniformity had little effect on carcass quality; the only effect detected was that uniform pigs tended to have more trimmed primal cut yield than the less uniform pigs. It is concluded that castrated females, had higher carcass fat content than castrated males. Therefore, castrated females are a good alternative to castrated males for the production of pigs destined to the dry-cured industry. On the other hand, the distribution of the pigs to improve pen uniformity does not provide any advantage in growth performance or carcass quality.

Key Words: castration and gender, heavy pig productivity and quality, uniformity

T150 Sow and litter productivity as affected by sow age. L. Cámara[1], M. P. Serrano*[1], D. G. Valencia[2], A. Fuentetaja[3], and G. G. Mateos[1], [1]*Universidad Politécnica de Madrid*, *Madrid, Spain*, [2]*Nutral S.A.*, *Madrid, Spain*, [3]*Copese S.A.*, *Segovia, Spain*.

A total of 180 sows (crossbred of Landrace × Duroc × Large White) was used to study the effect of parity (primiparous, PRI, vs. multiparous in the 3rd and 4th reproductive cycle, MUL) on productive performance and posterior fertility. Each treatment was replicated 5 times and the experimental unit was a room with 16 sows housed individually. Feed and water intake were controlled daily and BW and backfat at P_2 were measured at farrowing and at weaning. Total number of piglets born alive, death, and mummified, and piglet mortality during lactation were recorded per litter. Also, piglet body weight was recorded at birth, and at 3, 14, 21, and at 28 d of age. In addition, the interval weaning to first estrous and the percentage of sows that did not make next farrowing were recorded. Multiparous sows ate more feed (5.64 vs. 4.25 kg/d; $P < 0.001$) and drank more water (28.63 vs. 23.07 l/d; $P < 0.05$) than PRI sows but feed:water ratio was not affected. Body weight change from farrowing to weaning was similar for both groups. Multiparous sows had more piglets born alive (11.4 vs. 10.2; $P < 0.05$) than PRI sows. Piglets from MUL sows were heavier ($P < 0.05$) at birth (1.73 vs. 1.53 kg), 3 (2.14 vs. 1.89 kg; $P < 0.01$), 14 (4.73 vs. 4.26 kg), 21 (6.45 vs. 5.84 kg), and 28 (8.61 vs. 7.58 kg) days of age than piglets from PRI sows. Consequently, from 1 to 28 d of age, piglets from MUL sows had higher ADG than piglets from PRI sows (260 vs. 229 g/d; $P < 0.05$). Mortality of piglets during lactation and of sows between farrowings was not affected by sow parity. The interval weaning to positive gestation was similar for both groups of sows. Sow parity did not affect the number of piglets born alive or death in the following parity. It is concluded that multiparous sows had higher voluntary feed intake and produce more piglets per litter, which are heavier, than primiparous sows.

Key Words: multiparous, primiparous, piglet productivity

T151 Effects of L-arginine supplementation to suckling piglets on plasma metabolites and skeletal muscle properties at weaning. D. Loesel*, S. Goers, and C. Rehfeldt, *Leibniz Institute for Farm Animal Biology (FBN)*, *Dummerstorf, Germany*.

Piglets of low birth weight exhibit a lower total number of skeletal myofibers at birth and throughout life compared with piglets of middle and heavy birth weight, which is associated with impaired (lean) growth, carcass and meat quality at market weight. To investigate, whether L-arginine is effective in stimulating the early postnatal increase in the number of myofibers, piglets of low birth weight (≤1.22 kg) from 5 German Landrace sows received 0.48 g L-arginine-HCl/kg body weight/day (n = 12) or an isonitrogenous amount of L-alanine (control; n = 12) from d 7 to 28 of age. Piglets were weaned and slaughtered at d 28 of age. Supplementation with arginine or alanine increased blood plasma concentrations of arginine and alanine, respectively ($P < 0.001$). Live weight gain, final body weight, and body composition by dissection and chemical analysis were not affected by arginine, except for a reduction in relative liver weight ($P = 0.05$). Plasma concentrations of glucose and free fatty acids remained unchanged, whereas urea concentration tended to be smaller in response to arginine supplementation ($P = 0.12$). The total number of semitendinosus (ST) myofibers was not affected by treatment ($P = 0.80$). Likewise, fiber area and metabolic fiber type composition by red, intermediate, and white fibers were not influenced. Protein and DNA concentrations remained unchanged, whereas total DNA amount tended to be greater in ST muscle of arginine-supplemented piglets ($P = 0.12$). Specific activities of CK ($P < 0.01$) and LDH ($P = 0.05$) increased 1.06-fold and 1.08-fold, respectively, in response to arginine, whereas ICDH activity was unchanged. The results suggest that arginine slightly stimulated muscle differentiation and metabolic maturation, but not muscle protein accretion and myofiber formation. It remains to be investigated whether modifications in the dosage or period of arginine supplementation would be more efficient in affecting skeletal muscle growth and metabolism of suckling piglets.

Key Words: body composition, enzyme, pig

T152 Finishing growth and carcass characteristics following reciprocal embryo transfer between Meishan and White crossbred pigs. J. R. Miles*, J. L. Vallet, B. F. Freking, J. J. Ford, S. D. Shackelford, and T. L. Wheeler, *USDA-ARS, US Meat Animal Research Center*, *Clay Center, NE*.

Crossbreeding studies between Meishan (MS) and contemporary White crossbred (WC) pigs have shown that increased lean, finishing growth of WC pigs is affected by the direct genotype of the piglet. The objective of the current study was to determine the contributions of the piglet and maternal genotypes and their interactions on finishing growth and carcass characteristics following reciprocal embryo transfers between MS and WC gilts. Twenty-five pregnancies were produced in 2 farrowing seasons that represented all piglet and maternal genotype combinations; MS × MS (n = 4 litters), WC × WC (n = 7 litters), MS × WC (n = 7 litters), and WC × MS (n = 7 litters). Starting at d 105 of age, gilts (n = 50) and barrows (n = 40) were weighed and backfat was recorded every 3 weeks. At d 165 of age, pigs were slaughtered and hot carcass weights were recorded. Within 3 d of slaughter, leaf fat was weighed and loin eye color, marbling, and area were determined. All data were analyzed using MIXED model procedures. There were piglet breed effects ($P < 0.01$) for body weight. As a result, average daily gain during grow-finish was greater ($P < 0.001$) in WC pigs. In contrast, average back fat measurements were greater ($P < 0.001$) in MS pigs. At slaughter, a piglet breed effect ($P < 0.001$) was observed in hot carcass weight in favor of WC pigs. Conversely, there was a direct breed effect ($P < 0.05$) of leaf fat weight in favor of MS pigs. No significant genotypic effects were observed for loin eye marbling between the breeds. However, loin eye color was darker ($P < 0.01$) in the MS pig. Furthermore, there was a piglet breed effect ($P < 0.001$) for loin eye area in favor of WC pigs. This study detected no significant interactions between the piglet and maternal genotypes of MS and WC pigs on finishing growth and carcass characteristics, and supports crossbreeding studies illustrating that differences in finishing growth are attributed to the genotype of the piglet.

Key Words: finishing growth, carcass characteristics, pigs