

Monday, January 24
Physiology
Room: B315

S77 Effect of molting and pre- and post-molt diets high in omega-3 fatty acids on circulating insulin-like growth factor-1 in White Leghorns. H. Mazzucro^{*1,2}, J. P. McMurtry³, P. Y. Hester¹, ¹Purdue University, ²EMBRAPA, ³USDA.

The present study investigated changes in insulin-like growth factor-1 (IGF-1) of hens subjected to two distinct molting regimens and fed pre- and post-molt diets either high or low in omega-3 fatty acids (FA). From 62-76 wk of age, 45 hens (9 birds/treatment) were monitored for plasma IGF-1 at -7, 2 (or 54 h), 13, 21, 36, 43, and 64 d post-molt using an homologous RIA. The molting treatments consisted of 10 d fasting + cracked corn for 7 d + pullet developer diet for 10 d or a non-fasting molt (wheat-middlings based diet for 28 d). Five wk prior to and after either molt treatment, birds were fed one of two diets containing dietary omega-6/omega-3 FA ratios of 0.6 or 7.9. A non-molted control group of birds was fed a laying hen diet containing a dietary omega-6/omega-3 ratio of 8.0. A second experiment employed the same 5 treatment groups (5 birds/treatment) with blood sampling at -7, 25 and 64 d post-molt. Using treatment as the whole plot with repeated measurements, an analysis of covariance (62 wk IGF-1 as covariate) and an ANOVA were conducted for experiments 1 and 2, respectively. Induced molt affected IGF-1 in experiment 1 (treatment by age interaction, $P < 0.0001$) and the response was the same regardless of molting regimens. Induced molt initially caused a decrease in IGF-1 54 h post-molt; however, from 13-43 d post-molt, molted birds showed elevated IGF-1 as compared to controls. By 64 d post-molt, IGF-1 in molted hens was similar to controls. In experiment 2, significantly elevated IGF-1 were noted 25 d post-molt with a return to normal levels by 64 d post-molt in molted hens as compared to controls. Feeding diets high in omega-3 FA as compared to diets low in omega-3 FA 5 wk prior to or after molt did not consistently affect IGF-1 in molted hens. In conclusion, circulating IGF-1 in White Leghorns was affected by molting regimen but not by the dietary treatments varying in omega-3 FA. *Student sponsored by CNPQ-Brasilia-DF, Brazil.

Key Words: Insulin-like growth factor-1, Molt, Hens, Omega-3 fatty acids

S78 Gene expression in duodenum and breast muscle of broilers with low and high feed efficiency. C. Ojano-Dirain^{*1}, M. Toyomizu¹, T. Wing², M. Cooper², W. Bottje¹, ¹Center of Excellence for Poultry Science University of Arkansas, ²Cobb-Vantress Inc..

Increased hydrogen peroxide (H2O2) production was observed in breast muscle and duodenal mitochondria obtained from broilers with low feed efficiency (FE). As reactive oxygen species (ROS) such as H2O2 may alter or modulate expression of many genes, this study was conducted to evaluate messenger RNA (mRNA) expression of genes that are involved in energy metabolism and mitochondrial biogenesis: 1) avian adenine nucleotide translocase (avANT); 2) cytochrome oxidase III (COX III); 3) inducible nitric oxide synthase (iNOS); 4) peroxisome-proliferator-activated receptor-gamma co-activator 1-alpha (PGC1-a); and 5) peroxisome proliferator-activated receptor-gamma (PPAR-?) in breast muscle and duodenum. Avian uncoupling protein (avUCP; involve in adaptive thermogenesis) was also analyzed in breast muscle. Total RNA was extracted from snap-frozen tissues from male broiler breeders with low (0.55 ± 0.01 , $n = 8$) and high (0.72 ± 0.01 , $n = 8$) FE using RNeasy[®] Mini Kit. Aliquots of total RNA was reverse-transcribed using oligo(dT) and/or random primer and real-time reverse transcriptase-polymerase chain reaction (RT-PCR) was performed with ABI Prism[®] 7700. The mRNA expression of iNOS and PPAR-? in the duodenum was lower in the low FE broilers, with no differences in avANT, COX III and PGC1-a. In contrast, expression of avANT and COX III mRNA in breast muscle was lower in low FE broilers with no differences in iNOS, PPAR-?, and PGC1-a. The avUCP in breast muscle was not different between the groups ($P = 0.11$). The results of this study indicate that ROS induced differential gene expression in low and high FE broilers, as well as differences between duodenal and muscle tissues. The differential gene expres-

sion between tissues follows our earlier results in terms of protein expression and may reflect the inherent metabolic and gene regulation differences between tissues.

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Key Words: Feed efficiency, Gene expression, Duodenum, Breast muscle, H2O2 production

S79 Effect of a growth-promoting probiotic on selected serum chemistry values and heterophil to lymphocyte ratios in poults. J. P. Higgins^{*1}, A. Torres-Rodriguez¹, A. M. Donoghue², G. Tellez¹, B. M. Hargis¹, W. Bottje¹, ¹University of Arkansas, ²PP&PSRU, ARS, USDA.

A commercially available *Lactobacillus* probiotic (FloraMax B11) in combination with dietary lactose (0.1%) significantly increased body weight gain in commercial turkeys in several studies. Presently, 7d of age turkey poults were placed in pens ($n=20$, 4 replicates/treatment) with individual water and feed source within a commercial turkey house. Poults received either standard starter rations and plain water (controls) or the same ration supplemented with lactose (7-35d) and probiotic in the drinking water from 7-9d of age according to label directions. At 35d of age, treatment with the probiotic-lactose combination caused an 18% ($p < 0.0001$) increase in body weight ($1107g \pm 19$) as compared to control ($938g \pm 14$). Lower ($p < 0.009$) heterophil to lymphocyte ratios were observed in the treated poults (0.505 ± 0.040) as compared to controls (0.955 ± 0.151). Circulating glucose level was modestly elevated (11%; $p < 0.004$) in treated poults while, treatment caused significantly ($p < 0.05$) lower serum aspartate aminotransferase (AST), uric acid, iron, creatine kinase (CK), and lactate dehydrogenase (LDH) levels as compared to controls. Lower AST levels may indicate a lower degree of liver damage in treated poults as compared to controls. CK and LDH, associated with muscle cell damage, may indicate diminished muscle damage in treated poults for unknown reasons. The reduced liver and muscle enzyme levels in treated vs. control poults, coupled with the reduced heterophil to lymphocyte ratio in treated poults, may suggest that the probiotic treatment may be reducing low level inflammatory disease or other stressors that directly affect physiological functions in these poults under commercial conditions. The causative relationship of these physiological changes and the observed marked increase in body weight gain (18%) are speculative.

Key Words: *Lactobacillus*, Lactose, Probiotic, Stress, Disease

S80 Effects of supplemental L-carnitine in broiler breeder diets on various organ moisture and lipid concentrations in embryo progeny. J. Tanksley¹, E. Peebles^{*1}, M. Kidd¹, C. McDaniel¹, J. Woodworth², S. Whitmarsh¹, H. Parker¹, P. Gerard¹, ¹Mississippi State University, ²Lonza Incorporated.

The effects of supplemental L-carnitine in broiler breeder diets on various organ moisture and lipid concentrations in embryo progeny were investigated in this study. Beginning at 21 wk of age, hens were fed diets supplemented with either 0 (control) or 25 ppm L-carnitine (treated) through 40 wk of age. In each of 16 breeder floor pens, 20 hens were housed, with 8 replicate pens assigned to each of two treatment groups. At 27, 32, and 38 wk of age, 15 eggs from each replicate pen were set at random according to treatment in a single incubator. In fresh eggs, percentage yolk moisture, total lipid, and fatty acid concentrations were determined. At 18 d of incubation: relative embryo (% of set EW) weight; relative yolk sac (% of set EW) weight; relative liver (% of embryo weight) weight; percentage embryo moisture content; percentage liver moisture and lipid concentrations; and percentage yolk sac moisture, total lipid, and fatty acid concentrations were determined. Breeder hen age significantly affected relative embryo, liver, and yolk sac weight; percentage embryo, liver, egg yolk, and yolk sac moisture content; and percentage liver and yolk sac lipid concentration. Yolk free L-carnitine levels of fresh eggs from treated birds at 38 wk were 49% higher than those from control birds. However, dietary treat-

ment did not significantly affect any of the aforementioned parameters. In this study, 25 ppm supplemental L-carnitine in breeder hen diets did not impact subsequent egg yolk moisture or lipid content, or relative weight or moisture and lipid contents of the body, liver, or yolk sac of embryos at 18 d of incubation between 25 and 38 wk of breeder hen age.

Key Words: Broiler breeder, Carnitine, Embryo, Lipid, Moisture

S81 Does sexual maturity alter the clearance of creatine kinase from female chicken plasma? M. A. Mitchell*, D. A. Sandercock, R. R. Hunter, A. Muthukrishnan, *Roslin Institute*.

Previous studies in this laboratory have demonstrated an apparent myoprotective effect of estrogen in female chickens both at normal sexual maturity and following administration of exogenous steroid. This action is characterized by a marked decrease in the plasma activity of the muscle enzyme creatine kinase (CK) although the precise mechanism remains to be elucidated. It has been suggested that alterations in the elimination of the enzyme from the circulation may contribute to this phenomenon. The present study examined this hypothesis. Two groups of female chickens of an Institute-bred brown leghorn line (J-line) were used. One group was designated immature (16-18 weeks of age) and the other mature (26-30 weeks of age) and were in lay. Birds were anaesthetized with urethane and a cannula was inserted in to the brachial vein and baseline blood samples were obtained. Birds from each age group received a 0.5ml bolus of a semi-purified preparation of skeletal muscle CK of known enzyme activity. Control birds received an equal volume of the Tris-EDTA muscle homogenization buffer. Serial blood samples were taken over a total period of 6 hours and plasma activity of CK was determined by spectrophotometry. Sexual maturity and associated elevated circulating estrogen was confirmed by measurement of plasma concentrations of triglyceride (TG), zinc (Zn) and calcium (Ca). Use of an appropriate model allowed calculation of total volume of distribution (V_d) of CK, the half-life of elimination ($t_{1/2}$) and the plasma clearance (C_{CK}). Sexually mature females had reduced plasma CK activity and elevated plasma TG, Zn and Ca compared to immature birds. The V_d for CK was 75ml in immature and 88ml in mature birds. The corresponding $t_{1/2}$ values were 233 and 252 minutes with C_{CK} values of 11ml/kg/hr and 10ml/kg/hr. There were no significant differences in these parameters between groups. It

is concluded that estrogen induced decreases in plasma CK activity are primarily a consequence of reduced release from muscle tissue and not from alterations in elimination or clearance.

Key Words: Myopathy, Creatine kinase, Estrogen, Broiler

S82 Thermoregulatory and metabolic heat production responses during acute heat stress in genetically improved broiler chickens. M. A. Mitchell*, D. A. Sandercock, M. G. MacLeod, R. R. Hunter, *Roslin Institute*.

It has been proposed that artificial genetic selection for improved production traits in modern broiler lines is associated with both pathology and reduced effectiveness of some homeostatic systems. The high metabolic rate of rapidly growing birds may reduce their resistance to high ambient temperatures. The present study has compared the effects of acute heat stress upon deep body temperature regulation, metabolic heat production and some physiological indices of thermoregulatory effort in a fast growing broiler line (FG) and a slower growing genetic predecessor (SG). The metabolic heat production (MHP) responses to a 2 hour exposure to a temperature of 32°C + 70% relative humidity were determined in birds from the two lines at identical body weights by indirect calorimetry. Deep body temperatures were also recorded and venous blood samples obtained for determination of pCO₂ and pH before and after heat stress. Exposure to high thermal load induced a profound hyperthermia in both lines, rectal temperature increasing 2.6°C and 4.8°C in SG and FG birds. During heat stress mean heat production increased by approximately 20% (p<0.05) in both groups, the absolute increase being 55% greater in the FG birds. The peak changes in MHP during heat stress were 57% (p<0.005) and 35% (p<0.01) in the FG and SG groups respectively. There was no evidence of a greater thermoregulatory effort in the FG birds as the degree of hypocapnic alkalosis induced in the two lines was similar. It is suggested that fast growing broiler chickens may exhibit inappropriately elevated MHP responses during heat stress and that the heat loss mechanisms to dissipate the imposed heat load are inadequate. It is concluded genetic selection for improved growth in broiler chickens has detrimental effects upon thermo-tolerance through regulation of MHP and heat loss and that this may compromise their productivity and welfare by limiting their capacity to respond to thermal challenge.

Key Words: Broilers, Heat production, Thermoregulation, Heat stress

Tuesday, January 25 SCAD (Avian Diseases) Room: B312

S83 Transmission of blackhead disease (*Histomonas meleagridis*) from bird to bird by exposure to contaminated litter. P. Armstrong*, L. McDougald, *Department of Poultry Science, University of Georgia*.

Previous studies have shown that blackhead disease (histomoniasis) can spread from inoculated turkey poults to uninoculated poults in litter-floored pens and cages without the aid of invertebrate vectors. Other studies showed that birds could acquire histomoniasis by cloacal drinking after contact with liquid cultures. The exact mechanism by which birds acquire the infection under practical conditions is not known. The present series of experiments was designed to determine whether poults could acquire blackhead infections from contact with contaminated litter in the absence of infected birds. Groups of 8 2-wk-old poults were given the following treatments: 1) Uninfected, unexposed; 2) All birds inoculated; 3) 2 birds/cage inoculated with 100,000-300,000 histomonads from culture; or 4) no birds inoculated, but birds in these cages were switched repeatedly with birds in Treatment 2 so they would come in contact with contaminated litter. The experiment was repeated 3 times. Typically, most of the directly inoculated birds contracted blackhead and died or had severe lesions at necropsy. Some of the inoculated birds in Treatment 3 developed severe blackhead as a result of exposure to the directly inoculated birds in the cage. Of the birds exposed only to contaminated litter (Treatment 4), 4 birds in experi-

ment 1, 2 birds in experiment 2 and 2 birds in experiment 3 had lesions of histomoniasis in the ceca or were positive for histomonads by microscopy. These results suggest that it is possible for turkeys to become infected with blackhead through contact with contaminated litter. However most of the lesions seen were very mild (1 or 2) or were only positive by microscopy. Thus, further work will be needed to determine whether contact with contaminated litter is a significant factor in transmission of blackhead within a flock.

Key Words: Histomonas, Turkey, Blackhead disease, Epidemiology, Contamination

S84 In vivo persistence of *Mycoplasma gallisepticum* vaccine strain 6/85 singly and following challenge by *Mycoplasma gallisepticum* F-strain. J. D. Evans*¹, S. D. Collier¹, G. T. Pharr², S. L. Branton¹, ¹USDA-ARS South Central Poultry Research Unit, ²College of Veterinary Medicine, Mississippi State University.

Within the layer industry, commercially available attenuated strains of *Mycoplasma gallisepticum* (MG) are commonly used to control MG-induced mycoplasmosis. Strain 6/85 is a commonly utilized vaccine strain which has