decreased in SC diets. In conclusion, the results of this experiment indicated that Supercede corn may have the potential to replace the energy source in broiler diets.

Key Words: Supercede corn, Broiler, Performance, Digestibility, Fatty acids

331 Identification of differentially expressed genes in broilers fed different levels of phosphorus and calcium. M. Kelly*, F. Yan and Y. Zhang and are trying to trigger an acute response to heat stress. This study was conducted to identify genes involved in the absorption of calcium (Ca) and P in the intestine of broilers.

Excess phosphorus (P) in poultry litter is an increasing concern and the development of novel strategies for producers to meet new environmental regulations is imperative. This study was conducted to identify genes involved in the absorption of calcium (Ca) and P in the intestine of broilers.

Key Words: Broilers, Phosphorus, Calcium, Gene expression

Physiology A

332 Endocrine and metabolite adaptations in the thermoconditioned chicken in response to high ambient temperature. J McMurry*, S Yahy, D Brocht, C Ashwell, R Rosebrough, S Kahn, and R Leach. Prior research has shown that early in life thermoconditioning (TC) results in improvements in performance and thermotolerance. This study was conducted to assess the endocrine and metabolite response to high ambient temperature by TC chickens. On day 3 post hatch, TC was induced by exposing male broiler chicks to an ambient temperature of 37.5 °C for 24 hours. Control (C) chicks were maintained at 32 °C. Blood samples were taken at the end of TC and 21 days of age. At 42 days of age both groups were exposed to an ambient temperature of 36.5 °C (challenge phase). Blood samples were drawn prior to and at intervals during the challenge phase. All blood samples were analyzed for various hormones and metabolites. Prior to the experiment, access to feed and water was provided. Overall, exposure to elevated ambient temperature increased plasma corticosterone, glucagon, IGF-I, and leptin, while triiodothyronine and insulin were decreased. However, the extent of the hormonal response was significantly different between the TC and C groups, with the response being suppressed in the TC birds compared to the C group. Plasma IGF-I and thyroxine were unaffected by heat challenge. In TC chickens, hepatic deiodinase activity remained unchanged during the challenge phase, whereas in the C group, activity was significantly increased. Plasma free fatty acids were increased in both groups by heat challenge. Uric acid was increased in C birds, but remained unchanged in the TC chickens. Mortality was reduced by 50% in the TC groups compared to that in the C group. It is evident from this study that the physiological and biochemical response to heat stress is ameliorated in TC chicks, and that this change imparts some ability to adapt to elevated ambient temperatures. However, it remains to be determined how and where the control mechanisms are changed to enable the TC chicken to adapt to heat stress.

Key Words: Heat Tolerance, Stress, Hormones


Intravenously injected micro-particles become trapped within the pulmonary vasculature where they increase the resistance to blood flow and trigger pulmonary hypertension. We tested the hypothesis that i.v. micro-particle injections can be used to trigger acute (24 to 48 h) post-injection mortality in broilers having the most limited pulmonary vascular capacity, or ascs in broilers whose marginal cardio-pulmonary capacity renders them susceptible to pulmonary hypertension syndrome (PHS). Progressive inflammation-associated responses were initiated within the lung parenchyma by 30 to 80 um diameter dextran polymer (Sephadex) and 30 um diameter cellulose micro-particles, leading to the scavenging of Sephadex micro-particles from the pulmonary vasculature by 5 d post-injection, whereas the cellulose micro-particles persisted for 7 d post-injection. The persistence and size of the cellulose apparently facilitated chronic occlusion of blood flow through precapillary arterioles, thereby triggering appreciable post-injection mortality and PHS at relatively low injection volumes (0.3 to 0.6 mL at 0.02 g/mL). In contrast, the small size of the polystyrene microspheres (15 um), and the lack of persistence of the Sephadex micro-particles, apparently precluded the reliable occurrence of post-injection mortality or PHS until higher volumes (greater than 0.8 mL at 0.02 g/mL) were injected. Values for the total post-injection mortality (TPI) (24 to 48 h post-injection mortality + PHS mortality) following cellulose injections were higher for broilers reared at cool than at thermoneutral temperatures. The incidences of PHS induced by exposing broilers from different genetic lines to constant cool temperatures qualitatively paralleled the respective post-injection mortalities elicited by injecting the cellulose micro-particle suspension into the same lines. These observations indicate the micro-particle injection methodology potentially can replace unilateral pulmonary artery...

Cold exposure climates or induced cold exposure in environmental chambers have been implicated as the cause of the development of pulmonary hypertension or pulmonary hypertension syndrome (PHS). This study was performed to investigate the effects of a nitric oxide (NO) donor, diethylentetramine/nitric oxide complex (DETA/NO), on the incidence of pulmonary hypertension syndrome and/or PHS. One-day-old broilers were reared in environmental chambers at 32°C for 1 week. Beginning the second week, 1 environmental chamber was changed to 25°C and the other 2 environmental chambers were changed to cold exposure (10°C). At 2 weeks old, the broilers were divided into 2 groups: a treatment group gavaged with 0.25 mg of DETA/NO in 0.5 ml of doubled distilled water (ddH2O), and a control group receiving only 0.5 ml of ddH2O. All broilers were gavaged every other day within each environmental chamber and were maintained until the broilers were 4 weeks old. Body weights (BW), hematocrit (HCT), the ratio of right to total ventricular weight (hypertrophy index) and NO concentration in plasma (determination of total nitrate and nitrite reported as a good indicator of NO production) were measured. COX I and II in the DETA/NO treatment group had a significantly (P<0.05) greater BW and lower mortality, HCT, and hypertrophy index in the 10°C environment compared with the 10°C control group. Plasma levels of NO were significantly increased (P<0.05) in all broilers receiving the DETA/NO treatment (25°C and 10°C) compared to the control. These data suggest that DETA/NO imparts a protective effect to broilers by increasing plasma levels of NO and thus preventing pulmonary hypertension and/or PHS in response to cold exposure.

Key Words: broiler, cold stress, pulmonary hypertension, nitric oxide


We reported that muscle mitochondria obtained from broiler breeder males with lower FE exhibited increased hydrogen peroxide production, lower respiratory chain coupling, and lower activities of Complex I and II of the respiratory chain (Bottje et al., 2002, Poultry Sci., 81(5): 95). Based on these findings, the major objectives of the present study were to determine if differences in protein oxidation, an additional measure of oxidative stress, could be observed in mitochondria isolated from broilers with low and high FE. Breast muscle mitochondria were isolated by differential centrifugation from male breeder birds raised in a single genetic line with high (0.83 ± 0.01, n = 7) and low (0.64 ± 0.01, n = 7) FE. Protein carbonyl levels (P<0.05) were higher in low FE compared to high FE breast mitochondria. Using SDS-polyacrylamide gel electrophoresis, it was fortuitously observed that a protein band (47 kDa) was present in higher amounts (P<0.05) in low FE than in high FE muscle mitochondria, and was negatively correlated (r^2 = 0.45) with feed efficiency. These findings: a) indicate lower feed efficiency was associated with increased protein oxidation in breast muscle mitochondria, b) that potential differences in protein expression exist (either inherent or due to post-translational modification) in muscle mitochondria from broilers with high and low FE, and c) provide further insight into cellular mechanisms associated with the phenotypic expression of feed efficiency.

Key Words: Mitochondria, Muscle, Broiler, Proteins

Identification and characterization of two mRNAs produced by alternative splicing of transcripts from the chicken proglucagon gene. S. M. Poch and M. P. Richards. USDA, ARS, ANRI, GBL, Beltsville, MD.

In mammals, the proglucagon gene produces a single identical mRNA transcript in pancreas, intestine and brain tissue. This transcript encodes glucagon and two glucagon-like peptide hormones (GLP-1 and GLP-2), each of which plays an important role in the regulation of nutrient metabolism. Previously, two distinct mRNA transcripts have been identified in chickens, one in pancreas that encodes glucagon and GLP-1 but not GLP-2, and one in intestine that encodes glucagon and both...
GLPs. It was suggested that tissue-specific expression of these two mRNAs could contribute, in part, to the localized production of glucagon, GLP-1 and GLP-2 resulting from proteolytic processing of the prohormones. We now report that two mRNAs are expressed in pancreas, duodenum, brain and liver of chickens. Using RT-PCR in conjunction with 5'- and 3'-RACE, we have identified, amplified, and sequenced cDNAs corresponding to both mRNAs (designated A and B) and found that the two share common sequence including a 5'- untranslated region and a portion of the coding region that includes glucagon and GLP-1. The A mRNA lacks a portion of the coding region that includes GLP-2, whereas the B mRNA contains a larger open reading frame that includes GLP-2. Both mRNAs have unique 3'- untranslated regions that differ in size and sequence. Specific RT-PCR assays were developed to determine the levels of A and B mRNAs in different tissues. While no tissue specificity was observed with respect to the presence of the two glucagon-like mRNAs, the levels of A and B mRNA relative to 18S rRNA did differ among tissues. Pancreas was found to preferentially express the A form of the mRNA, whereas, duodenum appeared to express more of the B form. A portion of the chicken proglucagon gene that gives rise to the two mRNAs has been identified and partially characterized. We conclude that the differences in the A and B transcripts arise from alternative splicing of sequence following the common GLP-1 encoding region that results in the formation of unique 3'- ends of both mRNAs.

Key Words: Proglucagon, Glucagon, GLP-1, GLP-2

340 The effect of the ovulatory cycle on bone mineral density and content in live White Leghorns as assessed by densitometry. M.A. Schreweis*, J.I. Orban2, M.C. Ledur3, and P.Y. Hester1, 1Purdue University, West Lafayette, IN, 2Southern University, Shreveport, LA, 3Embrapa Swine and Poultry Research Center, Cordoba, SC, Brazil.

Densitometry is being validated in our laboratory for use as a noninvasive tool to evaluate live birds for osteoporosis, a noninfectious disease resulting in mineral loss from bones. The objective of the current study was to determine if there are detectable changes in bone mineral density and content which could be reflected by densitometry readings during the 24-hour ovulatory cycle in sexually mature birds. Implications from this study will depict the time of day scans will be conducted for future experiments. Densitometric scans were conducted on live, unanesthetized hens at 0, 5, 15, and 20 hr post oviposition at 24, 30, and 40 wk of age using a Norland pDexa X-ray bone densitometer (Model No. 476D01).Bone mineral density (BMD) and bone mineral content (BMC) of the left leg (tibia and fibula) and wing (humerus) were determined in 6 to 7 control-fed birds at each age, all undergoing active egg formation. The first bone scan at 0 h was performed immediately following oviposition. The second scan reflected the BMD and BMC immediately after the egg entered the uterus. The third scan at 15 h was performed during active egg calcification, and the final scan at 24 h was done near the end of calcification prior to oviposition. Results showed no detectible changes in either the BMD or BMC of the tibia and humerus as the egg was being formed in the reproductive tract for any of the ages observed. As expected, the medullary tibia had a greater BMD and BMC than the tibial BMD which increased from 24 to 40 wk of age in contrast to humeral BMD which decreased between 24 and 40 wk of age, resulting in an age by bone interaction (P < 0.02). These results suggest that densitometric scans may be conducted in live birds at any time during the day, irrespective of the egg cycle. Research supported by NRI Competitive Grants Program No. 2001-02426 and SCRP-USDA No. PL 95-113.

Key Words: Bone mineral density, Ovulatory cycle

341 The chicken follicle-stimulating hormone beta subunit gene. Jingying Yang1*, Jorge Vizzcarra2, Ronald Okimoto3, and John Kirby1, 1Department of Poultry Science, University of Arkansas, Fayetteville, AR, 2Dept. of Animal Science and Food Technologies, Texas Tech University, Lubbock, TX.

Follicle-stimulating hormone (FSH) plays an important role in regulation of reproduction in animals. It is composed of two glycoprotein subunits, alpha and beta. The alpha unit is common subunit among FSH, luteinizing hormone, and thyroid-stimulating hormone. The beta subunit determines the hormonal specificity. The genomic sequence of about 4kb was obtained from Red Jungle Fowl and White Leghorn by using the vectorette PCR technique. The Japanese quail cDNA sequence of the FSH beta subunit was used to design PCR primers. This fragment includes 5'-flanking region, FSH beta gene, and 3'-flanking region. The FSH beta gene has three exons and two introns. Using RLM-RACE method, the full length (2443 bp) of the FSH beta gene was obtained. It includes 5'-untranslated region, open reading frame and 3'-untranslated region. Northern blot and RT-PCR analysis revealed that FSH beta gene is expressed in the pituitary gland. This gene is mapped to chromosome 5 by using East Lansing White Leghorn reference population.

Key Words: chicken, FSH, mapping, PCR

342 Comparison of production parameters and egg quality between laying hens indigenous naked neck (Na) and commercial Babcock B-380. M.T. Alvarez1*, M.C. Carrocco1, P. Tato1, and G. Tellez2, 1Universidad Michoacana de San Miguel de Hidalgo, 2Facultad de Medicina Veterinaria y Zootecnia, UNAM, Mexico, 3Facultad de Medicina, UNAM, Mexico.

The indigenous naked neck laying hen has exhibited natural resistance to extreme fluctuations in temperature while maintaining body temperature, growth rate and egg production. The aim of this study was to determine the effect of the naked neck gene (Na) on egg production and quality in homoygotic (Na/Na) and heterozygotic (Na/na) laying hens when compared to the wild type (na/na) or to a commercial egg line (B-380) over the 60 wk production cycle. Groups of 20 laying hens of each genotype were placed at an experimental farm located in the State of Michoacan at an altitude of 1882 meters, average temperature of 22°C, and 60% humidity. All hens were provided a commercial diet that met NRC requirements. Egg weight, egg production and livability were recorded daily. Egg quality (Haugh units, albumin height, and shell thickness) was measured every 8 weeks. Eggs mass, egg weight, feed intake, and feed efficiency were recorded weekly. The commercial line, B-380, had greater egg production and egg weight (P < 0.01) compared with indigenous laying hens. Feed conversion was 2.11 in B-380, 2.42 in na/na, 1.84 in Na/Na, and 1.92 for Na/Na hens. Specific gravity, Haugh units, albumin height, and shell thickness were significantly better in Na/na genotype (P < 0.05) compared with B-380, Na/Na and na/na hens. Similar results were observed with yolk pigment (P < 0.05). Livability was 95% for B-380 and Na/Na hens and 90% for Na/Na and na/na hens. Additionally, Na/Na and Na/na hens had better growth rates (P < 0.05) than B-380 and na/na hens.

Key Words: Production, Egg quality, Naked neck, laying hens

343 Effect of broody hen in the immune response against Newcastle disease (NVD) vaccine between indigenious naked neck (Na) and normally feathered laying hens. M. Tato1*, G. Tellez2, and P. Tato1, 1Universidad Michoacana de San Nicolas de Hidalgo, Morelia, Michoacan, Mexico, 2Facultad de Medicina Veterinaria y Zootecnia, UNAM, Mexico, 3Facultad de Medicina, UNAM, Mexico.

Broodiness, the hen’s natural tendency to cease laying and incubate a clutch of eggs, can be a challenge for the conservation and preservation of many species of birds. During this period, hens are more susceptible to infections. The aim of this study was to determine the effect of broodiness in caged hens to the NVD vaccine (La Sota strain). Cellular and humoral responses to the NVD vaccine were measured in homozygotic (Na/Na), heterozygotic (Na/na) and wild type (na/na) laying hens. Ten broody lines of each genotype were vaccinated orally with the NVD vaccine. Non-broody hens were also vaccinated and used as the Control group. Specific antibodies in serum were measured by ELISA. Cellular immune response to NVD and ConA were evaluated by peripheral blood proliferation assay. In all broody laying hen groups, the cellular response to ConA was decreased (P < 0.05) and the tritiated thymidine incorporation stimulated by NVD was also decreased (P < 0.01) when compared to the Control. The humoral response of antibody titer against NVD was higher in the Control group than all of the broody groups (P < 0.01). Within the broody hen groups, the heterozygous hens (Na/na) had better cellular and humoral responses than either of the homozygous groups. The dominant group had the lowest response of all groups studied.

Key Words: Broody hens, Newcastle Disease Vaccine, Naked neck, Laying hen, Immune response
344 Feed deprivation induces similar changes in the gene expression of chicken skeletal and cardiac muscle lipoprotein lipase (LPL) and skeletal muscle uncoupling protein (UCP). C. M. Evoke-Clover, S. M. Poch, M. P. Richards, C. M. Ashwell, and J. P. McMurtry, USDA - ARS, GBL, Beltsville, MD.

LPL gene expression was characterized under conditions of feed deprivation and/or leptin administration in pectoralis, iliobibialis and heart muscles, and in abdominal adipose tissue. In the initial experiment, 3-week-old male broilers were deprived of feed for 24 or 48 hrs. Half of each treatment group was killed while half were refed for an additional 24 hrs. LPL mRNA levels in pectoralis and iliobibialis muscle were unchanged with treatment. Feed deprivation increased LPL mRNA in heart by 85% at 24 and 48 hrs, while in adipose tissue LPL gene expression was decreased by 34% at 24 hrs and 53% at 48 hrs. Refeeding normalized LPL mRNA levels in heart and adipose tissue. In a follow-up experiment, 3-week-old male birds were feed-deprived for 48 hrs with or without leptin administration. Plasma was collected to determine hormone and metabolite concentrations. Feed deprivation increased LPL gene expression 52% in pectoralis muscle, 315% in iliobibialis muscle, and 60% in heart, while decreasing it by 68% in adipose tissue. Leptin had no effect on LPL mRNA levels. Changes in LPL expression in all four tissues were highly correlated with each other and with skeletal muscle UCP mRNA levels. Changes in LPL and UCP gene expression over treatment were highly correlated with plasma concentrations of triglyceride, free fatty acid, insulin-like growth factor-I (IGF-I) and IGF-II. Pectoralis muscle LPL and UCP mRNA levels were highly correlated with IGF-I and IGF-I receptor mRNA levels. These data suggest that LPL and UCP are up-regulated during feed deprivation in skeletal muscle and are highly correlated with fatty acid oxidation. The IGFs may play a role in regulating lipid metabolism in poultry. Leptin administration was without effect on LPL or UCP gene expression in this experiment. However, longer exposure times or higher dosages may be needed for observable differences to occur.

Key Words: Feed deprivation, Lipoprotein lipase, Uncoupling protein, Insulin-like growth factors


The effects of selection for egg production and body weight on weight, length and tissue components of gastrointestinal organs of hatch d1 turkeys were determined. Hatching Wild turkeys (WT) were compared to lines selected for egg production, Egg Line (EL), and growth, British United Turkey (BUT). Twenty eggs per line were incubated and hatched. Settings were staggered for each line due to egg availability. At hatch, pouls were weighed, decapitated and the liver, pancreas, small intestine, and colon were removed. The small intestine was divided into the duodenum (stomach/pyloric valve to bile duct), jejunum (bile duct to yolk stalk) and ileum (yolk stalk to cecal sate). Each intestinal section was rinsed in 0.9% saline, blotted dry, weighed, and the unstretched length was recorded. A two cm portion was removed from the midsection of duodenum, jejunum and ileum, cut open, and the mucosa was separated from the serosa with a glass slide and the serosal and mucosal wet weights were recorded. After drying at 80°C for 48h, serosal and mucosal dry weights were recorded. Hatch weights for BUT, EL and WT were different (p < 0.0001; 72.60g, 68.29g and 49.98g, respectively). Liver weight/kg BW of WT pouls were greater (p = 0.01) than that of BUT pouls. Pancreatic weight/kg BW of WT pouls were greater than (p<0.01) BUT. Colon weight/kg BW was greater (p<0.01) for WT pouls compared to EL pouls. No differences were noted for intestinal segment weights/kg BW between lines. Duodenal, ileal and jejunal lengths/kg BW were greater (p<0.05) in WT pouls than EL or BUT. Duodenal, jejunal and ileal density (wt wet, g/length, cm) were greater (p<0.001) for EL and BUT pouls than WT. The jejunal serosal dry weight was greater (p<0.01) while mucosal dry weight as a percentage of whole intestinal dry weight was less (p>0.01) for WT pouls compared to EL and BUT. These data suggest that genotype and modern selection practices significantly influence liver and pancreatic weights as well as gastrointestinal structure and, hence, energy metabolism in hatching turkeys. These changes are likely to have negative effects on survivability and efficiency of energy utilization in turkeys.

Key Words: Gastrointestinal, Turkey, Pouls, Genotypes, Allometry

346 Pulmonary vascular capacity and resistance to cyclic heat stress in broilers. R. F. Wideman, M. E. Chapman*, and W. Wang, Department of Poultry Science, Univ.of Arkansas, Fayetteville, AR.

The intravenous micro-particle injection technique provides an efficient methodology for eliminating broilers having a marginal pulmonary vascular capacity. The survivors of micro-particle injections possess a robust pulmonary vasculature that confers resistance to pulmonary hypertension syndrome. Resistance to cyclic heat stress theoretically also should improve if broilers having a robust pulmonary vasculature can more readily accommodate the increment in cardiac output needed for heat dissipation. The present study was designed to evaluate the livability and growth responses of broilers that survived an initial micro-particle injection challenge and then were subjected to cyclic heat stress. Male broilers were brooded at normal temperatures in environmental chambers. At 18 d of age they were injected i.v. with heparinized saline (Saline Controls), or heparinized saline containing micro-granular cellulose (30 mm) at a dosage suitable for achieving 50% mortality within 24 h post-injection. The resistant survivors (Cellulose Survivors) and Saline Controls were reared in alternating chamber halves at 24°C through 35 d of age. Immune-mediated mechanisms clear cellulose micro-particles from the vasculature within 14 d post-injection, thereby restoring pulmonary functionality by Day 35. Individual body weights were recorded on Day 36, and feed was weighed-in by chamber half. The cyclic heat stress change initiated on Day 36 included, 1° at 35°C, 2° at 23°C, and 2 h/d of transitional temperatures. Birds that died were weighed and necropsied to determine the cause of death. All survivors were euthanized with CO2 gas, weighed, and necropsied on Day 57. The total body weight gain and net feed consumption were calculated during the heat stress challenge (D36-57 BW Gain; D36-57 Net Feed). When compared with the Saline Control group, the Cellulose Survivors had a lower BW on D36, but thereafter they exhibited an improved resistance to heat stress as indicated by an improved livability, a higher growth rate and net body weight gain, and a lower feed:gain ratio.

Key Words: Livability, growth, feed:gain

347 Molecular cloning of a vasotocin receptor expressed in the pituitary gland of the domestic chicken: avian homolog of the mammalian V1B-vasopressin receptor. L. E. Cornett**, N. Alii, D. A. Bayeans*, J. C. Ellison, P. R. Ingle*, M. D. Crew, J. A. Vizzarre*, and J. Kirby*, School of Veterinary Medicine, Little Rock, AR, 2 University of Arkansas, Little Rock, AR, 3 University of Arkansas, Fayetteville, AR, 4 Dept. of Animal Science and Food Technologies, Texas Tech University, Lubbock, TX.

The neurohypophysial hormone arginine vasotocin (AVT) stimulates adrenocorticotropic hormone (ACTH) secretion from the avian pituitary gland resulting in increased adrenal secretion of corticosterone in response to stress. Here, we report molecular cloning and functional characterization of a gene encoding an AVT receptor subtype, designated the VT2 receptor, that may mediate the stimulatory effect of AVT on ACTH secretion in birds. The open reading frame predicts a 428 amino acid polypeptide that includes 7 segments of 20 to 25 hydrophobic amino acids, typical of guanine nucleotide-protein coupled receptors. Phylogenetic analysis revealed that the VT2 receptor shares highest identity (63%) with the mammalian V1B-vasopressin receptor subtype. Expressed VT2 receptors in COS7 cells mediate AVT-induced calcium mobilization as assessed with Fura-2. By Northern blot analysis, expression of VT2 receptor gene transcripts is limited to the pituitary gland. Based on similarities in sequence, site of expression and coupled signal transduction pathways, we conclude that the VT2 receptor is the avian homolog of the mammalian V1B-vasopressin receptor, and therefore may play an important role in the avian stress response. (Supported by NSF IBN9727915, NSF MCB9728171 and USDA/NRI 98-35208-6597)

Key Words: Pituitary gland, Stress, Vasotocin, Vasotocin receptor
348 Effect of proteolytic enzyme, IVRI, from \textit{Cucumis pubescens} on the lipid profile of meat from culled, desi and broiler chicken. R. P. Sinku\textsuperscript{1}, R. L. Prasad\textsuperscript{1}, A. K. Pal\textsuperscript{1,2}, and S. B. Jadhao\textsuperscript{1,2}, \textsuperscript{1}Ranchi Veterinary College, Ranchi 834 007, India. \textsuperscript{2}ARS, Central Institute of Fisheries Education, 7 Bunglows, Versova, Mumbai 400 061, India.

Proteolytic enzymes are used for meat tenderization, an important process with regard to consumer preference. The proteolytic enzyme, IVRI, was isolated from the plant \textit{Cucumis pubescens}. Fifty-grain meat of thigh and breast from culled, desi and broiler were treated with IVRI containing 32 mg enzyme protein at 60 °C for 20 min and lipid profile of the meat was studied. The total lipid concentration in thigh and breast muscle of desi was lower (p<0.01) than broiler and culled birds, latter being similar in this respect. The cholesterol content was lower (p<0.01) in breast than thigh muscle, in broiler than desi and culled and in IVRI treated than untreated meat samples. The phospholipid concentration was unaffected by IVRI. Broiler and culled birds exhibited more phospholipid content than desi birds.

Key Words: Proteolytic enzyme, chicken meat, lipid profile


Bacterial contamination of raw processed poultry continues to be of concern to consumers, as well as regulatory and health officials. For the past 40 yr scientists have been working on suitable and acceptable decontamination methods to reduce or eliminate spoilage organisms and human enteropathogens from raw processed meat and poultry products. Safe\textsubscript{2}TM-Poultry Wash, a highly acidic calcium sulfate solution, was evaluated as a final wash before chilling for its ability to reduce total aerobic plate counts and enteric pathogens on chilled broiler carcasses. Fifty-four carcasses were picked up from a local processor prior to final wash. On arrival back at the research facility all carcasses were inoculated with one mL of a cocktail containing 3 \textsuperscript{Log}, CFU/mL of \textit{Salmonella typhimurium} and \textit{Listeria monocytogenes}. After a 30 min attachment time, six plant run control carcasses (PRC) were immediately subjected to a whole carcass rinse (WCR). The remaining carcasses were subjected to a 4 sec in/out spray with either 1.5 L de-ionized water or Safe\textsubscript{2}TM-Poultry Wash, hung for 3 min, then chilled for 45 min. After chill, a WCR was performed on all carcasses. Microbiological analyses were conducted on the rinsates for total aerobes, \textit{E. coli}, \textit{Campylobacter}, \textit{S. typhimurium}, and \textit{L. monocytogenes}. All bacterial counts \textsuperscript{Log}, CFU/mL were lowered by the water spray treatment and lowered further by the Safe\textsubscript{2}TM-Poultry Wash spray treatment. Total aerobic plate counts and \textit{E. coli} counts from PRC were 4.56 and 3.34, from \textit{Safe}TM-Poultry Wash were 4.04 and 2.72, and from Safe\textsubscript{2}TM treated carcasses 3.39 and 1.60, respectively. \textsuperscript{Log}, \textit{Campylobacter} counts were 2.18 for the PRC, 1.47 for the water spray treatment and 0.55 for the Safe\textsubscript{2}TM-Poultry Wash. \textit{S. typhimurium} were significantly reduced by the water spray treatment from 1.57 to 0.28, and no \textit{S. typhimurium} were recovered from the carcasses treated with the Safe\textsubscript{2}TM-Poultry Wash. \textsuperscript{Log}, \textit{Salmonella} counts were 2.56 for the PRC, 1.68 for the water spray, and 0.95 for the Safe\textsubscript{2}TM-Poultry Wash. Acceptance and use of the Safe\textsubscript{2}TM-Poultry Wash at the final in/out wash in commercial poultry processing plants could lead to a microbiologically safer product for consumers here and abroad.

Key Words: \textit{Salmonella}, \textit{Campylobacter}, \textit{Listeria}, Microbiology, Broilers

350 Recovery of \textit{Campylobacter jejuni} in the feces, ceca, and semen from broiler breeder roosters following three routes of inoculation. R. J. Buhr\textsuperscript{a}, J. L. Wilson\textsuperscript{1}, N. A. Cox\textsuperscript{1}, M. T. Musgrove\textsuperscript{1}, and L. J. Richardson\textsuperscript{2}, \textsuperscript{1}USDA-ARS, Russell Research Center, \textsuperscript{2}The University of Georgia.

We previously reported the recovery of \textit{Campylobacter} (naturally colonized) from the ductus deferens of 5/101 roosters at 65 wk of age, and that 4 of those 5 positive roosters had previously produced \textit{Campylobacter}-positive semen samples. These results prompted further evaluation with more refined sampling techniques. Individual caged roosters, that had been confirmed to be feces and semen-negative for \textit{Campylobacter}, were challenged with a marker strain of \textit{Campylobacter jejuni} either orally (1.0 mL suspension 4.7x10\textsuperscript{8}) by dropping 0.1 mL (suspension 4.7x10\textsuperscript{7}) on the everted phallicus (immediately after semen collection), or by dip coating a 1-cm diameter ultrasound probe (dip suspension 4.7x10\textsuperscript{7}) that was inserted into the cloaca 12 cm beyond the lips of the vent. Five days postinoculation individual feces and semen samples were again collected and cultured. On Day 7, roosters were electrocuted and exsanguinated while suspended by their feet in a processing shackle, and then externally sprayed with 70% ethanol. The abdominal and breast skin-and-feathers were removed toward the head, the rib cage separated at the sternal-vertebral rib junctions, and the breast pulled toward the head exposing the abdominal viscera. One cecum was aseptically collected. A testis was encircled with a suture loop, tied at the hilus, and then lifted out of the abdominal cavity while cutting loose the ductus deferens from the overlying peritoneum. The cut ends of the ductus and testes were ligated, flamed, the external surface sanitized, and then the sample was suspended 1:3 (wt/vol) in Bolton’s enrichment broth for the culture of \textit{Campylobacter}. For all 15 roosters, \textit{Campylobacter} was recovered after challenge from feces (log\textsubscript{10} 5.3 cfu / g sample), semen (log\textsubscript{10} 3.3 cfu / mL) and a cecum (log\textsubscript{10} 6.6 cfu / g sample). \textit{Campylobacter} was not isolated from any testis samples and from only one ductus deferens sample (log\textsubscript{10} 0.7 cfu / mL sample volume). \textit{Campylobacter} adminis-
tered orally, on the phallus, or by ultrasound probe readily colonized the cecum and resulted in positive semen and feces samples from challenged roosters. Although \textit{Campylobacter} did not colonize the ductus deferens and testes, the production of \textit{Campylobacter}-positive semen could enable transmission from the rooster to the hen.

Key Words: \textit{Campylobacter}, Broiler breeder roosters, Ceca, Semen, Ductus deferens

351 Functional Properties of Pale Broiler Breast Meat. M. Bianchi\textsuperscript{2}, D. L. Fletcher\textsuperscript{1}, and D. P. Smith\textsuperscript{3}, \textsuperscript{1}University of Georgia, Athens, GA, \textsuperscript{2}University of Bologna, Bologna, ITALY, \textsuperscript{3}USDA, Agricultural Research Service, Athens, GA.

Four replicate trials were conducted to determine the functional and physical properties of pale whole and ground broiler breast meat. A total of 50 normal and 40 white boneless, skinless, 24h post-mortem whole breast fillets (right and left sides, n=180) were collected from the deboning line of two commercial processing plants. Breast fillets were selected based on lightness (L\textsuperscript{*}) values as follows: pale fillets, L\textsuperscript{*} > 53, and normal fillets, 46 < L\textsuperscript{*} < 53. Lightness (L\textsuperscript{*}), redness (a\textsuperscript{*}) and yellowness (b\textsuperscript{*}) were determined on the medial surface and pH was determined on a meat sample removed from cranial section of each filet. The left filet of each whole breast was ground and used to determine cook loss, ground meat shear, moisture uptake, and cook yield. The pH of the ground samples from pale fillets was subsequently adjusted to the pH of the normal fillets and used to determine moisture uptake and cook yield after pH modification. The right filet was kept intact and was used to determine expressive moisture (EM), cook loss and shear. As expected, pale fillets exhibited higher L\textsuperscript{*} (58.9 vs 50.9) and a lower ultimate pH (pH 5.67 vs 5.94) compared to the normal fillets, respectively. The pale fillets exhibited a significantly higher EM, a lower moisture uptake and cook yield, a higher cook loss of both whole and ground fillets, as well as a higher shear for the whole muscle. Adjusting the pH of the ground pale meat resulted in a higher moisture uptake and cook yield, indicating a partial restoration of protein functionality. Cook yield for the normal ground meat was 88.2% compared to pale fillets (75.3%) and pH adjusted meat (79.9%). Significant correlations were found between L\textsuperscript{*} and pH (r=-.84) and between L\textsuperscript{*}, pH, and the other measurements for assessing meat functional properties and texture. These results confirm the strong relationship between meat lightness and pH, and indicate that wide differences in raw broiler breast meat color results in variations in the functional properties of the meat.

Key Words: Broiler, Meat color, pH, Functional properties


Bacterial contamination of raw processed poultry continues to be of concern to consumers, as well as regulatory and health officials. For many years wings were considered a low value product; therefore, shelf life of...
and transported to Texas A&M University. Shell strength was determined using an Instron machine to assess shell crackability. Yolk color was assessed using a Minolta Colorimeter. Albumen and yolk heights were measured using a micrometer. Egg weights and lengths were also determined using a balance and a caliper. The eggs were also sampled by consumer (untrained) sensory panels that assessed the desirability of the eggs' color and flavor/texture. Eggs laid by hens molted by alfalfa had a significantly higher (p<0.05) level of redness (a*) as determined by Minolta colorimetry. Eggs laid by hens molted with alfalfa also exhibited significantly higher yolk heights (p<0.05) egg weights and lengths. In consumer sensory panels, there were no significant differences in color or flavor/texture measurements in eggs from either feed deprived or alfalfa molted hens. Therefore, using alfalfa as an alternative to feed deprivation for the induction of molt does not appear to deleteriously affect consumer acceptability.

Key Words: Alfalfa, Egg quality, Sensory panel, Molt

355 The Effect of Dietary Natural Pigment on Egg Yolk Color

J.C. Na1, S.J. Lee1, B.S. Kang1, S.H. Kim2, O.S. Seo1, H.K. Kim3, T.H. Kim3, D.J. Yu1, B.G. Jang1, and B.D. Lee2, 1National Livestock Research Institute, Rural Development Administration, Daejeon, 2Division of Animal Science and Resources, Chungnam National University, Daejeon, Republic of Korea.

This study was conducted to investigate the effect of natural red or yellow pigment sources added to the commercial layer diet on the egg yolk color diversity. The experiments were randomly allocated to ISA brown layers at 14 weeks of age, collect eggs by way of treatment every week for analysis on egg yolk color which was analyzed by method of QCM+(TSS Co, LTD. England) and to use commercial layer diet including 2,800 kcal ME and 16% CP as experimental diet. The experiment 1: Its supplementary amount was fixed as no supplement(C), 0.05%(R 0.05), 0.1%(R 0.1), 0.2%(R 0.2) and 0.3%(R 0.3) to five treatments in order to examine the effect of supplement of natural red pigment on yolk color. Fed experiment diet to 225 hens(3 replicates in each treatment, 15 hens in each replicate) raised in cage for 6 weeks. The experiment 2: Its supplementary amount was fixed as no supplement(C), 0.05%(Y 0.05), 0.1%(Y 0.1), 0.2%(Y 0.2) and 0.3%(Y 0.3) to five treatments in order to examine the effect of supplement of natural yellow pigment on yolk color. The other condition was set like the experiment 1. The result from above work showed that in the experiment 1, All treatments increased yolk color significantly compared to those of control(P<0.05) during whole experiment period. The more levels of supplement of natural red pigment was and the longer period of feeding was, the thicker density was as the yolk color turned red, which means unsuitable state in visual aspect. In experiment 2, there is significant difference to control group(p<0.05) in each case of feeding experiment diet as Y0.2, Y0.1 and Y0.05 for 1 week, 2 weeks and 3 weeks, respectively. Conclusively, supplement of natural red pigment was more effective to improve yolk color than natural yellow pigment. Moreover, supplement of natural red pigment in level of 0.05% for 1 week made yolk color be very clear.

Key Words: natural yellow pigment, natural red pigment, yolk color, ISA brown

356 Sensory profiles and physical characteristics of cooked breeder hen breast meat deboned at 2, 4, and 24 hours post-mortem.

B. G. Lyon1, C. E. Lyon2, and E. M. Savage3, USDA-ARS-Russell Research Center, Athens, GA.

Commercially processed breeder hen breast fillets were evaluated for effects of deboning (DB) times (2, 4, 8, 24 h) on sensory and physical characteristics of the cooked meat. Right and left fillets were individually packaged in heat-seal bags, labeled, and frozen. After thawing, bags were immersed in 85°C water for 25–30 min (80°C internal temperature). Raw and cooked weights were used to calculate yield. Minolta CIE L* a* b* color values were measured on raw and cooked samples. Strips cut from the breast samples were used for panel test samples and for instrumental texture using the Warner-Bratzler (WB) shear blade attached to a Texture Analyzer (TA-HD). Peak force, work, and area under the curve were obtained. Texture Profile Analysis (TPA) was also obtained on cores using a 2-bitte, 70% compression to obtain peak force, peak2 area, hardness, cohesiveness, springiness and chewiness. A trained descriptive panel (n=8) evaluated samples for 18 flavor and texture attributes. Raw samples from 2- and 4-h DB had significantly higher (p<0.05) L values (lighter) than the 24-h DB samples, which were significantly more yellow (higher b* values) than other samples. After cooking,
only the α values indicated differences due to debone time. Samples at 4-h DB were significantly more red (higher α values) than 2- or 8-h DB. The 2- and 8-h DB samples had significantly higher cooked yield than the 24-h samples. Cooked yield of the 4-h DB samples was not different from other samples. Instrumentally, the 2-h DB samples required significantly more force to compress. Instrumental chewiness of the 2-h DB samples was significantly higher than 8- or 24-h DB samples but not 4-h DB samples. WB shears of 4-h DB samples (8.1 kg) were significantly (p<0.05) higher than 2, 8, or 24-h (6.7, 5.9, and 4.7 kg, respectively). There were no significant differences in sensory taste attributes (brothy, chickeny, cardboard, etc). However, sensory texture attributes of springiness, cohesiveness, hardness, bolus size and chewiness were significantly higher for samples from the 2- and 4-h DB times compared to samples from the 24-h DB time. This study provides a profile of the sensory and physical characteristics of cooked breeder hen fillets based on effects of DB time.

Key Words: Hens, Sensory, Debone, Texture, Yield

357 Comparison of Methods and Testing Temperature For Internal Egg Quality Measurement

T. C. McAvoys, J.B. Tharrington*, K. M. Keener1, P.A. Curtis2, and K.E. Anderson3,
1North Carolina State University, Raleigh, NC 27695, 2Auburn University, Auburn, AL 36849.

Internal egg quality relates to the functional and aesthetic characteristics of an egg. The effect of testing device and temperature on the quality measurements has not been fully investigated. The objective of this study was to determine the effect testing device and temperature on quality measurements. The quality measurements evaluated included egg weight, albumen height, albumen width, albumen index, Haugh units, yolk index, yolk width, yolk height and percent thin albumen. In addition, three Haugh unit methods (calculated using the height of the albumen using a standard tripod micrometer, the height determined using the electronic micrometer and a Haugh unit conversion micrometer) were compared. A 2x2x3 experimental design was selected. The eggs were collected, washed, sorted for size then transported to the laboratory within 48h after being laid. Grade A large eggs from two diverse strains of laying hens were used. Two testing periods at time zero and 7 weeks were selected. Eggs were stored at 5 C during the seven weeks of storage. At each testing period 12 eggs from each treatment combination were measured for each test. Eggs were equilibrated at three temperatures of 5C, 13C and 23C prior to testing. Testing temperature had a significant effect (p<0.05) on albumen height, Haugh units, albumen width, yolk width, yolk height, yolk index and albumen index. As testing temperature increased Haugh units decreased and coefficient of variation increased. The Haugh units measured using the electronic micrometer at 5C was the most precise measurement (coefficient of variation 12.29%).

Key Words: Egg Quality, Haugh Unit, Testing Temperature

358 Optimization of Nisin-Based Disinfectant Formulations for Maximum Bactericidal Activity

S.M. Shefet1, A. Joyner* and W. B. Sheldon2, 1Goodmark Foods Inc., Garner, NC, 2North Carolina State University, Raleigh, NC.

The statistical design of experiments to optimize the inhibitory activity of a complex multiple ingredient disinfectant can be approached in several ways. Traditional techniques generally require more experimentation because they adjust the concentration of only one variable at a time while all other variables are held constant. Alternatively, designed experimentation is a systematic approach whereby several ingredients and their interactions are examined simultaneously, allowing the researcher to derive the greatest amount of meaningful data from the fewest number of experiments. The objective of this study was to maximize the bactericidal activity of nisin-based formulations against Salmonella Typhimurium-contaminated broiler drumstick skin by varying the pH and the components of the formulation. A systematic statistical approach based on a simplex algorithm program was used for optimizing the formulations. Treatments conditions included a constant nisin concentration (100 micrograms per ml) with varying solution pH (5.5-4.5), citric acid (CA, 3.0-3.45%), EDTA (4.52-7.45 mM), and Tween 20 (T20, 0.5-0.68%) concentrations. After completion of testing, the most efficacious formulations were identified and further compared in broiler skin decontamination studies. Of nine formulations compared, four yielded significantly greater bactericidal activity (3.12-4.86 log reduction) and were composed of 100 micrograms per ml of nisin and: 3.1% CA, 7.45 mM EDTA (pH 3.8); 3.1% CA, 5.4 mM EDTA, 0.68% T20 (pH 3.7); 3.27% CA, 0.61% T20 (pH 3.5); 3% CA, 5 mM EDTA, and 0.5% T20 (pH 3.5). These results demonstrate the utility of applying a systematic approach to maximize the biocidal activity of a multiple component nisin-based formulation.

Key Words: Nisin, Bactericidal Activity, Disinfection Optimization

359 Mineral components of feed grade egg products

R.D. Gaylean1, F.B. Wardlaw1, and S. Phimiphail1, 1Clemson University.

Feed grade egg product (FGEp) is a by-product of egg production and processing industries, utilized primarily as a high quality ingredient in animal feed. Little information is available regarding chemical and nutritional characteristics of FEGP. This study examines the mineral composition of FEGP derived from hatcheries, retailer graders/packers, egg breakers, and blends of these sources. Ash content of three production lots of FEGP from each of the above sources were determined, then selected individual minerals within the ash content were determined. Differences were noted in ash content and mineral content in FEGP from differing companies and differing sources of product. This study provides information that may allow normalization of FEGP products in the egg processing industry.

Key Words: Feed grade, Inedible, Egg product, Processed egg

Pathology

360 Campylobacter jejuni colonization assessment and drug resistance in broiler chickens. A. Joyner* and W. Willis, Department of Animal Sciences, North Carolina A&T State University.

Two hundred day-old commercial female broiler chicks were used in a completely randomized design to study the colonization inhibition of Campylobacter jejuni. Chicks were divided into four treatment groups, replicated twice with 25 chicks per replicate pen. Treatments utilized were: (1) control-tap H2O(2; green tea; (3) green tea + terramycinTM and (4) terramycinTM. All treatments were administered orally via water for seven weeks. Broilers (10) were wing-banded, and cloacally swabbed weekly to assess the presence of C. jejuni shedding and ceca presence at seven weeks of age. Antibiotic sensitivity and resistant to C. jejuni were determined when samples tested positive. Weight gained, feed conversion and mortality were measured when chicks reached seven weeks of age. Antibiotic sensitivity and resistant to various drugs and the ability of terramycinTM to inhibit C. jejuni colonization in broiler chickens.

Key Words: Campylobacter jejuni, Broilers, Resistance

361 Cardiac phospholipid fatty acid composition and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. R.K. Selvaraj1, D. Wilson2, and G. Cherian1, 1Department of Animal Sciences, Oregon State University, Corvallis, Oregon, 2College of Veterinary Medicine, Oregon State University, Corvallis, Oregon.

The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids. The ventricular tissue (VT) fatty acid profile and electrocardiography of broilers fed diets containing trans saturated, n-3 or n-6 polyunsaturated fatty acids.