

Processing and Products - Meat Quality and Student Competition

66 Variation in broiler breast meat tenderness due to sample location. R. K. Gundelly*, R. Xiong, J-F.C. Meullenet, and C. M. Owens, *University of Arkansas, Fayetteville, AR.*

Researchers and industry personnel often use instrumental methods to measure poultry meat tenderness. Although a variety of methods are used, typically no more than two samples are taken per fillet to obtain an average shear value to represent an entire for fillet and/or the individual broiler. There is limited information available on the variation of tenderness within and between broiler breast fillets. A new shear method was developed using a razor blade (8mm), and with this method, it is possible to make multiple measurements in order to obtain a more representative average of shear value. Therefore, this study was conducted to determine the effects of location within and between fillets on tenderness. Broilers (n=120) with uniform body weights were commercially processed in 3 replications, chilled and aged on ice until time of deboning. At either 3 or 6h postmortem (PM), breast fillets were deboned and aged on ice in plastic bags until cooking. All fillets were cooked and sheared using the razor blade shear method. Fillets (right and left sides) were sheared 8 times at predetermined locations, and maximum force (MF) and total energy (TE) values were obtained. At 3 h PM, significant variation in tenderness was observed within broiler fillets, but no significant differences were observed when comparing locations between fillets. At 6h PM, the variation within the left fillet decreased, but variation still existed in the right fillets. Slight differences in MF and TE between fillets at certain, but not all locations were observed. The differences in trends between 3 and 6h PM samples may be due to the aging process in the muscle. These data suggest that variation within fillets is more prominent early postmortem while variation between fillets is not a significant concern. However future studies are needed to determine variation within and between fillets deboned at various times postmortem.

Key Words: Tenderness, Broiler, Location, Shear

67 Plasma creatine kinase activity and postmortem pH decline in broilers fed supplemental tryptophan. M. E. MacKenzie*¹, J. L. MacIsaac², K. L. Budgell², and B. M. Rathgeber¹, ¹*Nova Scotia Agricultural College,* ²*Atlantic Poultry Research Institute.*

Tryptophan (TRP) supplementation in poultry rations has been shown to reduce levels of aggressive behaviour in broiler breeders and hysteria in laying hens. Reduction of stressful behavior in broiler flocks with TRP could potentially reduce stress related meat quality problems. The objectives of this study were to monitor levels of plasma creatine kinase (CK) (indicator of skeletal muscle damage) and breast muscle pH as a measure of stress induced postmortem changes to breast muscle of two commercial broiler strains fed supplemental TRP. Six pens were randomly assigned to each possible combination of sex and broiler strain for a total of 24 pens (47 birds/pen). Half the pens were given a corn/soybean meal-based control diet and the other pens were given control diets plus an additional 6g of TRP/kg of feed. Control diets were formulated to contain 0.25%, 0.22%, and 0.17% TRP in the starter, grower, and finisher respectively. On day 21, a blood sample was collected from 4 birds/pen at random. Blood plasma was analyzed for CK activity using Biotrol CK Monoreactif reagents. On day 37, two birds per pen were euthanized by cervical dislocation and a 5g breast muscle sample was removed at 15min postmortem. The pH of this sample was determined in the presence of iodoacetate in duplicate. Plasma CK was elevated in females compared to males (P<0.001) and TRP significantly increased levels of CK for both sexes (P<0.01). There was a significant interaction between tryptophan supplementation and sex (P<0.05). Supplementation with TRP reduced 15min breast muscle pH for females but increased it for males. Using increased plasma CK activity as a measure of muscle damage did not suggest that dietary TRP reduces stress related muscle damage.

Key Words: Tryptophan, Broiler, Creatine kinase, Breast muscle pH, Meat quality

68 Effect of in ovo injection of IGF-I on *Pectoralis* myofibers and post-hatch performance of broiler chickens. G. N. Scheuermann*^{1,2}, S. F. Bilgili¹, and D. R. Mulvaney¹, ¹*Auburn University, Auburn, AL,* ²*Embrapa, Brazil.*

Insulin-like Growth Factor I (IGF-I) has been shown to increase myoblast proliferation and differentiation *in vitro*. Myofiber numbers relate

to extent of muscularity in many species. Given the great economic importance of breast muscle, the objective of this study was to evaluate the effects of in ovo injection of IGF-I on *Pectoralis* muscle fiber number, post-hatch body weight, and breast yield of broiler chickens. Three hundred fertile eggs, obtained commercially, were incubated for three days, and then randomly assigned to one of three treatments: 1) control, vehicle injection (0.1 g BSA/100 ml); 2) injection of 100 ng IGF-I; and 3) injection of 200 ng IGF-I. Egg surfaces were cleaned with 70% ethanol, perforated at the blunt end with a 20-gauge needle, and injected with a 26-gauge needle directly into the albumen. At hatch, chicks were placed in batteries and raised to 21 days. Water and a common commercial broiler feed were provided *ad libitum*. Body weight, breast weight and breast yield were assessed at 14 and 21 d by sampling 30 birds/treatment. At 14 d of age, one side of the breast was removed for the estimation of breast cross-sectional area (BCA), sectioned and stained for estimation of myofiber density (MFD; number of myofibers in a given cross-sectional area) and total apparent myofiber number (MFN). Statistical analysis was performed using GLM procedure of SAS, with sex and treatment as main effects. Injection of 100 ng IGF-I increased BW (P<.01), breast weight (P<.01) and BCA (P<.05) at 14 and 21 d post-hatch, while improvement (P<.05) in breast yield was observed only at 21 d. In general, no differences were observed between the control and 200 ng IGF-I treatments. As expected, males showed higher BW, breast weight and BCA than females, whereas, no sex effect was detected for breast yield. MFN was higher in males (P<.05) compared to females, but no significant treatment effect was observed. This study demonstrated a positive effect of exogenous IGF-I on post-hatch growth and muscularity of broiler chickens that is under further investigation.

Key Words: Broiler chickens, *Pectoralis*, Myofiber, IGF-I

69 High oleic acid corn in turkey diets: carcass fatty acid composition. T. Ergul*, S. L. Noll, P. B. Addis, and G. A. Reineccius, *University of Minnesota.*

Fatty acid composition of poultry meat and fat are influenced by diet. Male market turkeys (Large white, Nicholas strain) were evaluated to determine the effect of feeding high oleic acid corn (HOAC) on carcass fatty acid composition. Poults were randomly assigned to 45 pens at day of age and fed one of five different dietary treatments (TRT) varying in source of corn to 20 wks of age. TRT 1 (control) diets contained a conventional corn hybrid. TRTs 2, 3, 4 and 5 had 25, 50, 75 and 100% of the control corn replaced with HOAC, respectively. Diets were isocaloric and formulated based on NRC (1994) requirements. The experimental design was a randomized complete block design. At 20 wks, two birds per pen were selected and processed. Samples of corn (conventional and HOAC), breast (pectoralis muscle), and thigh (sartorius and biceps muscle) were subjected to determination of fatty acid composition. Fatty acid methyl esters were separated by gas chromatography following *in situ* transesterification, and were identified by comparison of retention times with reference standards. As a percentage of total methyl esters, oleic acid (OA) content for the conventional and HOAC corn was 29.6 and 67.1%, respectively. For breast meat, as the dietary % of HOAC increased, OA increased from 27.7% to 43.7%. In thigh meat, OA increased from 26.7 to 39.5%. Changes in the proportion of other fatty acids such as stearic and linoleic acid also occurred. The results indicate that the fatty acid composition of turkey meat was modified by feeding HOAC. That oleic acid was increased in the meat helps support previously reported data regarding inhibition of rancidity development in meat from turkeys fed high oleic acid corn (Ergul et al., 2000).

Key Words: Turkey, Meat, Corn, Oleic acid, Fatty acid

70 Poultry collagen coatings as flavor protection for pet foods made with rendered poultry fat. D. M. Greene*¹, K. M. Waterman¹, S. F. O'Keefe¹, C. Z. Alvarado², and S. E. Duncan¹, ¹*VPI&SU, Blacksburg, VA, USA,* ²*Texas Tech University, Lubbock, TX, USA.*

Turkey skins and rendered poultry fat are by-products that are produced in excess amounts in rendering plants. The use of low value by-products such as poultry collagen and fat to improve flavor and quality in dry petfood could be economically attractive. The objective of this study was to use a collagen coating as a preventative barrier against oxidation in dry petfood made with rendered poultry fat. Collagen was extracted

from turkey skins, dissolved in an acidic solution, applied to dry cat food and dried to form a surface collagen film. Four treatments were examined: kibble, rendered poultry fat-coated kibble, fat-coated kibble with a single layer of collagen film, and fat-coated kibble with a double layer of collagen film. Oxidation and water activity were measured on samples stored in 'jungle conditions' of 42C, 85% relative humidity for an eight-day period. There were significant differences in water activity measurements with the collagen coated samples having a lower water activity compared to the non-coated samples. Also, the collagen coated samples had a lower oxidation than the non-coated kibbles. Therefore, collagen coating can be used in cat food kibbles to decrease oxidation and extend the shelf-life.

Key Words: Poultry collagen, Poultry fat, Oxidation, Cat food

71 Improving PSE and normal broiler breast meat quality with poultry collagen in a chunked and formed deli roll. S. P. Daigle*¹, M. W. Schilling¹, C. Z. Alvarado², and N. G. Marriott¹, ¹VPI&SU, Blacksburg, VA, USA, ²Texas Tech University, Lubbock, TX, USA.

Value-added products made with pale, soft, and exudative (PSE) broiler meat have poor bind ability, pale color, and low water holding capacity. Collagen has been used in further processed meat products to improve protein functionality and increase binding strength. This study was designed to determine the effects of chicken collagen on chunked and formed deli rolls made with PSE and normal broiler breast meat. Treatments consisted of 100% PSE meat, 100% PSE meat + 1.5% chicken collagen, 100% Normal meat, and 100% Normal meat + 1.5% chicken collagen. Color (L*,a*,b*), cook loss, expressible moisture, purge loss, total moisture, and bind were determined on the samples. A Randomized Complete Design was used to test the treatment effects and means were separated using Duncan's Multiple Range Test when significant differences occurred. Addition of 1.5% collagen decreased ($p < 0.05$) cook loss demonstrating its potential to increase water holding capacity in both PSE and normal broiler meat. The addition of collagen increased bind ability in PSE deli rolls to that of the normal deli rolls. There were no significant differences ($p < 0.05$) in purge loss, L * value, a * value, expressible moisture, and total moisture in PSE or normal treatments with added collagen compared to the controls. This research demonstrates that quality of broiler breast rolls made with PSE meat could be improved with the addition of 1.5% poultry collagen. An increase in water holding capacity and protein binding can add value to PSE meat while increasing yield for processors.

Key Words: Broiler meat, Meat quality, Poultry collagen

72 Detection of *Campylobacter* spp., from chicken rinse samples with electrochemiluminescence. D. E. Cosby*, J. S. Bailey, N. A. Cox, L. J. Richardson, and M. T. Musgrove, U.S. Dept. of Agriculture, Agricultural Research Service, Russell Research Center, Athens, Georgia.

Processed chicken carcasses were purchased from local grocery stores and sampled for *Campylobacter* using the FSIS cultural procedures or by the IGEN PATHIGEN[®] *Campylobacter* electrochemiluminescence procedure. Three replicates of 15 birds each were sampled by each method to compare the two methods. Briefly, the PATHIGEN[®] *Campylobacter* test uses a sandwich immunoassay format in which a polyclonal antibody specific for *Campylobacter* binds the organism to a paramagnetic micro particle and a second polyclonal antibody specific for *Campylobacter* is labeled with a compound, which becomes excited at the surface of an electrode and emits light when *Campylobacter* is present. The PATHIGEN[®] *Campylobacter* takes about two hours to run after an enrichment process of 44 to 48 hours as compared to the standard FSIS method, which requires four days for a positive identification of *Campylobacter*. The PATHIGEN[®] *Campylobacter* assay found 12 out of 15 positive in Rep 1 compared to 8 out of 15 positive for the FSIS method. In Rep 2, the PATHIGEN[®] *Campylobacter* assay found 14 out of 15 positive compared to 12 out of 15 for the FSIS method. And in Rep 3, the PATHIGEN[®] *Campylobacter* assay found 15 out of 15 positive, compared to 15 out of 15 for the FSIS method. The agreement for each rep was 66.7 %, 85.7 %, and 100 % for the three Reps, respectively. The overall agreement was 85.4 %, with no false negatives detected with PATHIGEN[®] *Campylobacter* and a total of six false positives (as compared to standard cultural procedures) over the three trials. The PATHIGEN[®] *Campylobacter* assay is easy to run and detected *Campylobacter* on six samples that the

conventional procedure missed. This system is an effective alternative to the tedious standard cultural procedure.

Key Words: *Campylobacter* spp., Detection methods, Broiler carcasses

73 Recovery of salmonellae post-chill and after storage for one week from TSP treated and control carcasses. D. V. Bourassa*¹, D. L. Fletcher¹, M. E. Berrang², R. J. Buhr², and J. A. Cason², ¹The University of Georgia, Athens, GA, ²USDA-ARS Russell Research Center, Athens, GA.

The application of trisodium phosphate (TSP) to poultry carcasses is used as an antimicrobial wash to reduce salmonellae during broiler processing. Experiments were conducted to determine the effectiveness of TSP on salmonellae detection immediately after chilling and following 1 wk of refrigerated storage at 2-4 C. All carcasses were sampled using whole carcass enrichment for 24 h at 37 C. For each of two trials, 40 carcasses were obtained from a commercial processing line immediately after the mechanical bird washer (pre-chill) and transported to a pilot processing plant. In each of 5 replicate batches, four carcasses were re-washed in a mechanical bird washer and either subjected to a 5 s TSP dip (Treatment; specific gravity 1.045 to 1.055, temperature 23.3 to 25.6 C), or not dipped (Control). Treatment and control groups were chilled in separate pilot scale ice and water immersion paddle chill tanks for 45 min and allowed to drip for 5 min before bagging. Half of each treatment group were sampled immediately and half following 1 wk storage. For the two trials combined, the control group had 17 out of 20 carcasses salmonellae positive on Day 0 and 15 of 20 positive 1 wk later. The TSP treated group resulted in 9 of 20 salmonellae positives on Day 0 and 7 of 20 positive at 1 wk. The TSP treatment also resulted in an increased chill water pH from 7.0 to 9.4. These results are not conclusive regarding the effectiveness of TSP and further work is needed to determine if the results obtained thus far are due to the TSP dip or the longer term effects of TSP on water pH during chilling.

Key Words: salmonellae, TSP, broilers, whole carcass enrichment

74 Effect of storage time on the growth of *Salmonella Enteritidis* in egg components. Z. R. Howard*¹, R. W. Moore¹, I. B. Zabala-Diaz¹, K. L. Medvedev¹, M. M. Kundinger¹, S. G. Birkhold¹, S. C. Ricke¹, L. F. Kubena², J. A. Byrd², and D. J. Nisbet², ¹Texas A&M University, Poultry Science Department, ²USDA Southern Plains Research Center.

Salmonella Enteritidis (SE) accounts for over 24% of all food borne Salmonellosis cases. Since the 1970's, infections of this pathogen have been on the rise domestically and in other countries, especially the United Kingdom. Grade A shell eggs are the most common vehicle for the transmission of SE. Eggs were collected from a commercial laying facility at one-week intervals for eight weeks, and stored at refrigeration temperature. After storage, eggs were dipped in ethanol, cracked aseptically and separated into yolk and albumen samples. *Salmonella* Enteritidis resistant to novobiocin and nalidixic acid were inoculated on to the surface of the yolk membrane at a concentration of approximately 10^6 CFU/mL. Yolks were then covered with albumen and incubated for 24 hours at 25C. After incubation, eggs were separated into component parts. Samples were removed from yolk, albumen and yolk membrane and diluted 10-fold in sterile phosphate buffered saline. CFU/ml of SE were then enumerated on Difco's Brilliant Green Agar supplemented with novobiocin and nalidixic acid. Over the course of storage time, albumen counts were significantly higher by seven weeks than those of fresh eggs. *Salmonella* counts in the albumen of fresh eggs were enumerated at 10^5 CFU/mL. After seven weeks of storage counts were observed at approximately 10^9 CFU/mL.

Key Words: *Salmonella* Enteritidis, Vitelline membrane, Yolk membrane, Eggs

75 The effects of storage time on vitelline membrane protein banding patterns and interior egg quality of eggs from molted hens. A. J. Kelley* and S. G. Birkhold, ¹Texas A&M University, Dept of Poultry Science.

Vitelline membrane strength plays a role in preventing contamination of albumen by yolk during separation and is important to food safety. This experiment was conducted to determine if a relationship exists between vitelline membrane protein banding patterns, interior egg quality,

and vitelline membrane rupture strength. Eggs were gathered from a 72-week-old commercial flock post molt. Twenty-one eggs were gathered and stored (4C). Three eggs were evaluated on days 1, 7, 14, 21, 28, 35, and 42 for changes in SDS-PAGE protein banding patterns. The yolk from each egg was isolated and rolled on a wet paper towel to remove adhering albumen. The yolk was emptied and washed. The whole membrane was placed into double deionized water and divided into two sections. The first section was the whole membrane sample and the other was separated by forceps into inner and outer membrane samples. The three sections were dissolved in 1% SDS/70 mM Tris/HCl, pH 6.8. Protein concentration was determined using the Lowry method and proteins separated on 4-20% gel gradient by SDS-PAGE. Protein banding patterns were analyzed using the Bio-Rad Multi-Analyst Densitometer. Reductions of VMO I and GP II occurred along with reductions in the protein bands between 45 to 66 kDa. An additional one hundred forty eggs were gathered at the same time from the same flock and stored (4C). Twenty eggs were evaluated on days 1, 7, 14, 21, 28, 35, and 42 for quality. Yolk index, albumen height, albumen pH, and yolk pH were determined. Vitelline membrane strength was determined using a compression anvil. Two different treatments were used on the yolk when evaluating rupture strength: 10 egg yolks with inner thin albumen layer, and 10 egg yolks rolled on wet paper towel to remove inner thin albumen layer. Interior egg quality and vitelline membrane strength declined during storage.

Key Words: Vitelline membrane, Interior egg quality, Yolk rupture strength, Molting

76 Quantitative assessment of the inhibitory activity of HabaGUARD® conveyor belting materials against *Campylobacter jejuni* and *Escherichia coli* O157:H7. B. W. Sheldon* and S. A. Hale, *North Carolina State University.*

To reduce the risk of product cross-contamination during further processing of poultry products, conveyor belting materials containing microbial inhibitors have been developed and marketed. The objective of this study was to quantitatively estimate the efficacy of HabaGUARD® conveyor belt materials in inhibiting *Campylobacter jejuni* and *Escherichia coli* O157:H7. Using a modified seed layer test, multiple type culture or environmental strains of each pathogen were cultured in Brucella broth or Brain Heart Infusion broth, respectively, harvested by centrifugation and resuspended in 0.1 percent peptone water. The suspensions of each test strain were combined, diluted as needed and 1 ml added to the appropriate culture medium as previously described. Twenty mls of the cell suspension were transferred to triplicate 10cm dia. templates positioned on top of treated and corresponding control (without inhibitor) HabaGUARD® conveyor belt samples (12 cm dia.). The samples were incubated at either 41C for 96h for *C. jejuni* or 37C for 1, 3, 5, 7, or 24h for *E. coli*. For the *E. coli* test strain, the belting material was subsequently removed at the above designated sampling times and the seeded BHI agar incubated for an additional 24 to 48h. Colonies were then counted and log reductions calculated between the treated and control samples. Two treated and two corresponding control belt types were tested across three trials. For *C. jejuni*, no detectable colonies were observed on the Brucella agar in contact with the two treated HabaGUARD® belt types. In contrast, the corresponding control HabaGUARD® belt types yielded populations averaging log 5.3 after 96h or a 5.3 log reduction in population attributed to the treated belts. For *E. coli* O157:H7, minimal population reductions (less than 1 log) were detected within the first 7 hours of exposure to the treated belting materials. However, after 24 h of exposure, no detectable organisms were recovered (9 log reduction). These results indicate that the two treated HabaGUARD® belt types completely inhibited both bacterial pathogens after 24 hours of exposure. Moreover, the inhibition was not particularly rapid but developed over a 24 hour period.

Key Words: *Campylobacter jejuni*, *E. coli* O157:H7, Inhibitory conveyor belts

77 The survival of *Salmonella typhimurium* and psychrotrophic bacteria on commercial chicken breast meat treated with high energy electron beam irradiation and stored at 4°C for 14 days. K. C. Sarjeant¹, S. K. Williams*¹, A. Hinton, Jr.², and G. E. Rodrick¹, ¹*University of Florida*, ²*Richard B. Russell Research Center, USDA ARS.*

The antimicrobial effect of high energy electron beam irradiation on the survival of *Salmonella typhimurium* and psychrotrophic bacteria in commercial chicken breast meat was evaluated. Fresh chicken breast meat was purchased from a local poultry processor, inoculated with *Salmonella typhimurium* to yield 8 log₁₀ cfu/gm, packaged in Styrofoam trays and over wrapped with a polyvinyl chloride film, and subjected to either 0, 1, 2 or 3 kilogray (kGy) dosages of irradiation. The packaged samples were stored at 4C and analyzed for *Salmonella typhimurium* and psychrotrophic organisms at 0, 2, 4, 6, 8, 10, 12 and 14-day storage intervals. Direct plating and enrichment methods were employed for *Salmonella typhimurium* analyses. All uninoculated samples were negative for *Salmonella typhimurium* before and after irradiation. The direct plating method revealed 90%, 95% and 95% reduction in *Salmonella* for chicken breasts inoculated and treated with 1, 2 and 3 kGy of irradiation, respectively, when compared to the unirradiated, inoculated control chicken breasts. The enrichment method revealed 3, 52 and 84% reduction in *Salmonella typhimurium* for chicken breasts inoculated and treated with 1, 2 and 3 kilograys of irradiation, respectively, when compared to the unirradiated, inoculated control chicken breasts. Psychrotrophic counts decreased significantly (P < 0.05) as the irradiation dosage increased.

Key Words: Irradiation, Microbiology, *Salmonella typhimurium*

78 Modified atmosphere gas effects on bacterial growth at different depths in ground poultry meat. R. Dhanayajan, I. Han, J. Acton, and P. Dawson*, *Clemson University.*

High oxygen and high carbon dioxide gas atmospheres were used to package ground turkey meat. The meat was packaged in conventional trays and a low permeability lid was heat sealed to the tray and stored at 4 C for up to 9 days. In separate experiments meat was inoculated with naladixic acid resistant *Salmonella Typhimurium* or not inoculated prior to packaging and storage. The top, middle, and bottom layers of the ground meat patty were sampled for bacterial growth during storage. In carbon dioxide atmosphere, bacterial growth was inhibited to a greater extent in the top layer than the middle and bottom layers. This held for both *Salmonella Typhimurium* and for total bacterial growth. Bacteria numbers increased at a faster rate in the high oxygen atmosphere compared to the high carbon dioxide but this difference was only evident in the top layer of the ground meat. Color of the ground meat remained redder in the high carbon dioxide atmosphere compared to the high oxygen atmosphere. Therefore, the inhibitory effect of carbon dioxide in MAP of ground meat is a surface phenomenon and limited by the solubility of the gas in the meat.

Key Words: MAP, Ground turkey, *S. Typhimurium*, Carbon dioxide, Meat depth

79 Fillet L* from a broiler population: Correlations with preceding production-processing and changes to representative extremes after refrigeration and freeze-thaw. J. Galobart*, A. Corzo, and E. T. Moran, Jr, *Poultry Science Department, Auburn University.*

Broiler males (800 Ross x 308) were grown to 56 days (grand mean=4344g live wt, SEM=23.9) then processed under common terms while maintaining individual identity. Front halves were deboned 24 hours later to obtain fillets (grand mean=768g total wt, SEM=25.2), and CIE light reflectance was immediately measured on the skin side of each right fillet (grand mean=63.8, SEM=0.13). Population L* values were correlated with live weight at 42 days of age (r=0.11) and gain from 21 to 42 days (r=0.13) but not with weight at 56 days nor interim gain. L* was also correlated with the percentage carcass yield from live and absolute weight of total fillets (r=0.16 and 0.11, respectively). All fillets on which measurements were performed were held overnight at 4C, and 60 total samples having a range corresponding to the highest (76.4-71.1), median (64.0-63.7), and lowest (57.5-47.3) ranges were trimmed of tissues other than the *P. major*. CIE re-measurement indicated a decreased L* solely associated with the highest values (72.4 to 65.4). Immediately, fillet weights

and dimensions were measured on "as is" raw basis with one half of each L* category which was repeated after freezing (4 days at -20C) and thawing (3 days at 4C). L* of the freeze-thawed fillets decreased from the fresh-raw state which equivalently occurred with each category. Absolute raw weights of representatives from each class were equivalent; however, the weight losses associated with thawing progressively increased with L* at the time of deboning and correlated with their decrease in dimensions ($r=0.587, 0.403, 0.372$, for length, width and depth, respectively). Fil-

lets with the highest L* values from a common population originate with broilers having most favorable growth early in development and as a proportion of live weight at 56 days when marketed. Ultimately, these fillets experience the greatest changes in L* values with subsequent handling as well as weight loss and alteration in dimensions.

Key Words: Breast meat, Broiler processing, Fillet quality

Environment and Management - Meat Bird Production

80 Influence of lighting program, light intensity and feed energy level on live performance, carcass fat and parts yields of female broilers. R. J. Lien^{*1}, J. B. Hess¹, K. M. Downs², S. F. Bilgili¹, and W. A. Dozier III³, ¹Auburn University, Auburn, AL, ²Middle Tennessee State University, Murfreesboro, TN, ³University of Georgia, Athens, GA.

To determine effects on growth, carcass fat and processing yields, broilers were grown with either long or step-up lighting programs, either bright or dim light intensities, and either high or low feed energy levels in a 2X2X2 factorial arrangement. A total of 1680 day-old female broilers (Ross 508) were placed in twelve light tight rooms which were each divided into two pens (70 chicks/pen). Three rooms were provided 23L:1D (long) with intensity of 2 FC (bright). Three rooms were provided long lighting with intensity of 1 FC during wk 1, 0.5 FC during wk 2, and 0.25 FC during wk 3-8 (dim). Three rooms were provided step-up lighting (23L:1D during wk 1, 12L:12D during wk 2, 14L:10D during wk 3, 16L:8D during wk 4, 18L:6D during wk 5, 20L:4D during wk 6, and 23L:1D during wk 7-8) with bright intensity. Three rooms were provided step-up lighting with dim intensity. One pen per room was provided starter (22% CP), grower (20% CP), finisher (18% CP), and withdrawal (16.5% CP) feeds containing 1400, 1417, 1433, and 1450 kcal ME/lb (low) while the other was provided feeds containing 1450, 1467, 1483, and 1500 kcal ME/lb (high), respectively. Relative to long days, step-up lighting reduced both BW and cumulative consumption from 7-2% from 2-5 wk. However, final BW (7.53 vs 7.46 lb) and consumption (15.84 vs 15.65 lb) of step-up birds were numerically greater while feed conversion was unaffected (2.10). Compared to bright, dim light increased BW from 4-3% from 2-5 wk and cumulative consumption from 5-1% from 2-8 wk. However, feed conversion was unaffected. Feed energy did not affect BW. However, in relation to high, low energy increased both cumulative consumption and feed conversion by about 2% at 6 and 8 wk, and 7 and 8 wk, respectively. Mortality averaged 3.2% and was unaffected by treatment. Uniformity was unaffected by treatment at 1 and 5 wk. However, relative to low, high energy decreased uniformity at 7 wk. Carcass fat was unaffected by treatment. Parts weight and yield data indicated step-up and dim lighting may decrease breast meat in favor of less desirable parts.

Key Words: Broiler, Lighting program, Light intensity, Feed energy

81 Lighting program effects on broiler performance and heat production. A. Beker^{*1}, A. Beker¹, S. L. Vanhooser², and R. G. Teeter¹, ¹Department of Animal Science, Oklahoma State University, ²Oklahoma Animal Disease Diagnostic Laboratory, Oklahoma State University.

An experiment was conducted to evaluate influences of three lighting programs A (23L:1D), B (12L:12D) and C (1L:1D) on broiler performance and heat production (HP) throughout the growth cycle. Birds were reared on standard poultry diets in metabolic chambers with controlled lighting starting at seven days of age until they were 49 days old. Indirect calorimetry was utilized to measure HP. There was no significant difference ($P < 0.05$) in feed consumed (g), gain (g) or feed conversion ratio at three weeks of age (starter phase). In the grower phase (3-5 weeks of age) there was a lower ($P < 0.05$) body weight gain (908 g) for the birds on C than those on the A (940 g) or B (964 g) lighting programs. Feed conversion ratio was lower ($P < 0.05$) for the B (1.52) lighting schedule than the A or C programs (1.60 and 1.65). In the finisher phase (5-7 weeks of age) birds on B consumed more feed (2363 g) and gained more weight (1189g) than A or C at 2193 and 2168 g feed and 1028 and 976 g, respectively. Accordingly, overall feed conversion ratio (FCR) at 7 weeks of age for birds on the 12L:12D lighting program (2.03) was significantly lower ($p < 0.05$) than that for A and C lighting schedules (2.17 and 2.30). Final bird body weight was 2613, 2423, and

2290 g for the 12L:12D, 23L:1D, and 1L:1D respectively. Bird heat production was reduced ($P < .01$) during the dark phase and was related to FCR. Results suggest that lighting cycles significantly influence broiler performance and energetic efficiency.

Key Words: Energy, Feed efficiency, Lighting

82 Effect of heat stress on growth and organ enzyme activities of broiler chickens. H. Y. Tabiri^{*1}, K. Sato², K. Takahashi², M. Toyomizu², and Y. Akiba², ¹Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Canada, ²Graduate School of Agricultural Sciences, Tohoku University, Sendai, Japan.

A study was conducted to determine the effect of chronic heat stress on growth performance and enzyme activities in plasma, liver and kidney of broiler chickens. Two-week-old male broiler chickens (Ross strain) were reared at of 24 C (control group) and 36 C (heat stress). A third group was kept at 24 C and fed on the same amount of feed consumed by the heat stress group (pair-fed). Birds were fed ad libitum on semi-purified diet containing 200g CP/kg and 13.39MJ ME/kg. Twelve birds (6 replicates with two birds per cage) were assigned to each treatment room. At the end of the 2 weeks experimental period, blood was drawn from the birds by cardiac puncture for plasma GOT and GPT analysis. They were then killed; liver and kidney were removed for the determination of glutamate pyruvate transaminase (GPT) and glutamate oxaloacetate transaminase activities (GOT). Heat stress significantly reduced body weight gain, feed intake and feed conversion efficiency compared with the control group but there was no difference between the heat stress and the pair-fed groups. Plasma GOT was significantly increased compared with both the control and pair-fed groups. In the organs heat stress decreased liver GPT and increased GOT significantly. On the other hand, in the kidney, heat stress significantly increased GPT and decreased GOT compared with the pair-fed group. Results of the present study shows that heat stress per se did not impact growth rate of two to four weeks old broiler chickens but it altered the biochemical functions of the liver and kidney. This may imply that between two and four weeks of age plasma and organ GPT and GOT of broiler chickens are more sensitive to heat stress per se than growth performance.

Key Words: Heat stress, Broilers, Organ, GPT, GOT

83 Reduction of heat stress in broiler chickens exposed to high ambient air temperatures by means of convective cooling. M. A. Mitchell^{*1}, P. J. Kettlewell², R. R. Hunter¹, and D. A. Sandercock¹, ¹Roslin Institute, Roslin, Midlothian UK EH25 9PS, ²Silsoe Research Institute, Silsoe, Beds, UK MK45 4HS.

During road transportation broiler chickens are exposed to a number of concurrent stressors the major threat to productive efficiency and welfare being attributable to thermal stress. Recent studies have suggested mechanical ventilation of commercial vehicles might reduce the risk of heat stress by both removal of heat and water vapour and by direct convective cooling of the birds. The present study has therefore examined the effects of defined air movement (0 and 1.0 ms^{-1}) upon thermoregulatory responses and deep body temperature control at a range of air temperatures ($T_a = 24-40^\circ\text{C}$ and RH = 50-70%) in broilers ($n=6$ in each group) during an exposure period of 1 hour in a controlled climate, wind tunnel calorimeter. Respiratory frequency (f) was measured by thorax plethysmography and respiratory evaporative water loss (REWL) by gravimetric analysis. Rectal temperature (T_b) was recorded throughout. REWL was linearly related to T_a ($p < 0.01$). Significant linear relationships were also demonstrated between REWL and T_b and f ($p < 0.01$). An air velocity of 1.0 ms^{-1} significantly reduced ($p < 0.05$) the proportional increases in f and REWL in response to increasing T_a in comparison with still air.