However, more effort should be committed to developing guinea fowl-specific markers since those of chickens and quail may not be sufficient for studies in guinea fowl.

Key Words: Guinea Fowl, Microsatellite Markers, Polymorphisms

M37 Withdrawn by author. , .

M38 Dioxin-induced changes in chicken macrophage (HD11) gene expression. N. Puebla-Osorio*[1], K. S. Ramos[3], D. Abi-Ghanem[1], M. H. Falahatpisheh[3], and L. R. Berghman[1,2], [1]*Department of Poultry Science, Texas A&M University, College Station,* [2]*Department of Veterinary Pathobiology, Texas A&M University, College Station,* [3]*Center for Genetics and Molecular Medicine, University of Louisville Health Sciences Center, Louiville, KY.*

In this study, we used specific chicken immune cDNA arrays (constructed at the Fred Hutchinson Cancer Research Center) to identify the transcriptional profile induced by 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in chicken macrophages (HD11). The complete array contained 3,011 chicken lymphocyte cDNA spots representing 2,200 genes. Cultures of the chicken myelomonocytic line HD11, transformed by the myc-encoding MC29 virus, were exposed to two doses of TCDD (1 and 10 nM) for 6 and 12 h. Cells exposed to a similar amount of DMSO were used as the negative controls. Total RNAs were extracted using the Trizol method. The labeled cDNA samples (Cy3 and Cy5) were co-hybridized to an individual array. Scanning and image processing involved a GenePix 4000 scanner. The resulting images were analyzed using GenePix Pro 3.0. The Log2 values of the median of ratios were used. Upon filtering, a total of 217 genes showed significant up- or down regulation, and were further analyzed using hierarchical clustering (HCL) and tree formation, k-means clustering, and self-organizing maps (SOM). Nine clusters were formed using tree average linkage of genes with similar expression. Seven clusters were selected from the SOMs. K-means clustering produced 6 clusters. At least a 2-fold up-regulation after 6 h of exposure to TCDD (regardless of the dose) and subsequent down-regulation after 12 h of exposure, was observed in the following genes: mitochondrial cytochrome C, M phase inducer phosphatase 2, lysosomal transmembrane protein, alpha enolase, and HSP70 and HSP90. Consistently down-regulated genes included: inflammatory response-related MTMMP2 (matrix metalloproteinase 2), AKT1 (involved in TNF-related activation of NFkB), and oxidative-stress related neuronal NOS, among others. Specific primers will be designed for each of these genes and real-time PCR will be used for validation of the microarray data.

Key Words: Dioxin, Microarray, Macrophages

M39 The expression of genes related to egg production performance in the liver of Taiwanese country chickens. S. T. Ding*[1], Y. H. Ko[1], M. C. Huang[2], Y. P. Lee[2], and W. T. K. Cheng[1], [1]*Dept. of Animal Science, National Taiwan University, Taipei 106, Taiwan,* [2]*Dept. of Animal Science, National Chung Hsiung University, Taichung, Taiwan.*

The purpose of this study was to detect expression of genes related to egg production performance in Taiwanese country chickens by suppression subtraction hybridization (SSH). Liver samples from two Taiwanese country chicken breeds (L2 and B lines) with very distinct egg production rates were taken for mRNA extraction. The SSH procedure utilized a kit from Clontech (PCR Select). Two-way subtraction was performed and the differentially expressed gene fragments were cloned into pGEM-T Easy TA cloning vector (Promega). cDNA from the high egg production line (L2) was subtracted by the cDNA from the low egg production chickens (B). The resulted clones were selected for sequence analysis by a genetic analyzer (ABI 3730). We have select 288 clones for forward subtraction and 96 clones for the reverse subtraction. These genes were subjected to further differential screening to confirm the differential expression of genes between the two genetic breeds of chickens. We found that at least eight genes expressed greatly in the liver of L2. Among the genes were chicken apoVLDLII, liver basic fatty acid-binding protein, and two novel genes. We have also found that a glucose-regulated protein and chaperonin T-complex protein 1 were highly related to the poor egg production trait. The chicken apoVLDLII and liver basic fatty acid-binding protein in the liver involved in the egg yolk ingredient deposition. Greater expression of these genes assures more egg forming capacity in order to generate greater egg production rate. Specific functions of the other genes for egg production need to be further investigated.

Key Words: Chicken, SSH, ApoVLDLII

M40 Withdrawn by author. , .

PSA-Processing and Products

M41 Preparation and characteristics of spent hen meat enzymatic hydrolysate. O. Sangthcrapitikul, Y.C. Chen*, and T.C. Chen*, *Mississippi State University, Mississippi State.*

Excessive expansion of egg industry resulted in abundant availability of spent hen. Meat from spent hens is generally tough and poor in functional properties. Due to the inherent qualitative differences between broiler and spent hen meat, the spent hen meat has created a difficulty in its effective disposal.

Spent layer carcasses were obtained from a commercial spent hen processing plant and breast meat was hand-deboned. Bromelain (B), trypsin (T), papain (P), and Aspergillus oryzae protease (A) were purchased from Sigma Chemical Co. (St. Louis, MO). Fine ground breast meat, water, and enzyme were mixed and hydrolyzed in a water bath at 50°C for four hours. For optimal hydrolyzing pH selection, the pH of the meat suspension were adjusted by adding either 1N HCl or 1N NaOH. The enzyme activity was terminated by placing the reaction bottles in boiling water for 15 min. Optimal hydrolyzing pH and concentration were determined for each enzyme and enzyme combinations. The sensory characteristics of enzymatic hydrosates were also investigated.

Data indicated that the optimal pH values for enzyme hydrolysis of spent hen breast meat suspension were: 5.0-7.0 for B, 6.0 for T, 5.0-7.0 for P, and 5.0-7.0 for A. One percent (w/w) of P and A based on raw meat weight showed the highest ($P<0.05$) hydrolysis efficacy, followed by 0.5% (w/w) and 0.1% (w/w). Considering the enzyme cost factor, the hydrolysates from A, P+A, P+B, and P+A+B were selected for sensory study. Undiluted enzymatic hydrolysates showed higher ($P<0.05$) scores in chickeny, meaty, mouth feeling, bitterness, and umami sensory attributes compared with the controls but there were no ($p<0.05$) difference on all sensory attributes among those enzyme hydrolysates. Generally, P+A showed the highest acceptability in sensory attributes among treatments followed by P+A+B, A, and P+B. Considering enzyme efficacy, cost, and sensory attributes, P+A and P+A+B were recommended for spent hen meat hydrolysate preparation.

Key Words: Spent Hen Meat, Enzyme, Hydrolysate

M42 Spent hen meat enzymatic hydrolysate as a flavoring base. O. Sangthcrapitikul, Y. C. Chen*, and T. C. Chen*, *Mississippi State University, Mississippi State.*

Due to the inherent qualitative differences between broiler and spent hen meat, the spent hen meat has created a difficulty in its effective disposal. The industry is actively seeking new and alternative uses for spent hens. Proteins are the best sources of flavor because of their amino acids, peptide, and nucleotide components. Protein hydrolysates are the main products derived from protein hydrolysis and have been used specially for flavoring purposes, as savory flavors or taste enhancers.
Fine ground spent hen breast meat and water (1:10 or 1:2) were blended and hydrolyzed with either Papain + Protease (P+A, 0.5% (w/w) of raw meat weight for each enzyme) or Papain + Protease + Bromelain (P+A+B. 0.33% (w/w) of raw meat weight for each enzyme) at their optimal hydrolyzing conditions in the water bath at 50°C for four hours. The enzyme activity was terminated by placing the reaction bottles in boiling water for 15 min. After cooling, either whole hydrolysates or

filtrates were used for product preparations. Freeze-drying and evaporation methods were used in preparing hydrolysate powders or paste accordingly. Yields and microbiological analyses of final products were measured.
Yields of white light and fine freeze-dried powders from P+A and P+A+B hydrolysate prepared at 1:10 (meat: water) filtrates were 22.8% (W/W) and 23.0% (W/W), respectively. Yields of freeze-dried whole hydrolysates were 26.0% and 24.8% for P+A and P+A+B, respectively. Meanwhile, freeze-dried powders from P+A and P+A+B hydrolysate prepared at 1:2 filtrates had 26.7% and 26.2% of yield, respectively, while the yields of concentrated paste from whole hydrolysates were 47.8% and 51.0% for P+A and P+A+B, accordingly. Both freeze-dried filtered hydrolysate and the freeze-dried hydrolysate products had a total aerobe plate count ranging from log 2.59 cfu/g to 2.97 cfu/g. Similar range of total aerobes (log 2.74 to 2.84 cfu/g) was obtained in concentrated paste products. No Salmonella and E. coli /Coliform were detected from the prepared products.

Key Words: Spent Hen Meat, Enzymatic Hydrolysate, Flavoring Base

M43 *Listeria monocytogenes* prevalence and distribution within a poultry further processing plant over 12 months. M. E. Berrang*[1], R. J. Meinersmann[1], J. F. Frank[2], and D. P. Smith[1], [1]*USDA-ARS-Russell Research Center, Athens, GA,* [2]*University of Georgia, Food Science and Technology, University of Georgia, Athens.*

In light of recent outbreaks and FSIS directives, it is important for poultry further processors to define the potential for cross contamination or cooked product re-contamination with *Listeria monocytogenes*. The objective of this study was to determine the prevalence of *L. monocytogenes* in a commercial poultry further processing plant. Furthermore, the effect of production shift activities on the spread of the organism was examined. One line producing fully cooked product was sampled 9 times over the course of a year (approximately every 6 weeks). Environmental sites were sampled by sponge or swab between sanitation and start up of production (pre-op) and again after an entire 8 hour shift was completed (post-op). Sample sites on both the raw and cooked side of the line included drain pipes, drain covers and condensate drip tubes from overhead coolers. Further pre-op and post-op sampling was conducted on cooked product contact surfaces. During the course of the production shift, purge from each bin of raw meat used for product formulation was collected and variable additional samples (16 per sample day) were collected in an effort to hunt for the organism. All samples were cultured using the FSIS *L. monocytogenes* protocol of preenrichment in Listeria enrichment broth and selective enrichment in Fraser broth. Darkened Fraser broth was plated on modified oxford agar and isolates were confirmed as *L. monocytogenes* using the FSIS cultural confirmation protocol. In 7 of 9 samplings at least one drain on the raw side was positive before production began. Raw side drains were positive at post-op in 8 of 9 trips. *L. monocytogenes* was never detected in cooked side drains or on product contact surfaces at pre-op; however, in 5 of 9 samplings one floor drain was positive at post-op. Despite such drain contamination, *L. monocytogenes* was not detected on any cooked product contact surface. *L. monocytogenes* was detected in raw meat used for product formulation in 8 of 9 samplings suggesting a possible source of plant contamination.

Key Words: *Listeria*, Processing, Environment

M44 Antimicrobial susceptibility patterns of *Salmonella* from fresh whole chicken carcasses. S. R. Ladely*[1], M. E. Berrang[1], P. J. Fedorka-Cray[1], M. Simmons[2], and D. L. Fletcher[3], [1]*USDA-ARS-Russell Research Center, Athens, GA,* [2]*University of Georgia, Food Science and Technology, University of Georgia, Athens,* [3]*Poultry Science, University of Georgia, Athens.*

Salmonella is frequently reported as a cause of food-borne illness. The emergence of antimicrobial resistant *Salmonella* associated with food animals and their products has heightened concerns regarding antimicrobial use in food animal production. Eighty *Salmonella* isolates recovered from fresh whole chicken carcasses purchased at retail outlets were examined for susceptibility to 18 antimicrobials. Fifteen serotypes were identified; predominant serotypes included; *S.* Heidelberg (25%), *S.* Typhimurium var. copenhagen (18.75%), *S.* Kentucky (17.5%), *S.* Berta (11.25%), and *S.* Hadar (8.75%). Across all serotypes, 43.75% of the isolates were resistant to one or more antimicrobial. Fourteen resistance patterns were observed among the isolates. Among these isolates, 22.5% were resistant to 3 or fewer antimicrobials, 16.25% were resistant to 4-6 antimicrobials, and 5.0% were resistant to 7 or more antimicrobials. Across all serotypes, resistance was most commonly observed to tetracycline (25%), ampicillin (22.5%), streptomycin (21.25%) and cephalosporin derivatives (cephalothin 18.75%, ceftiofur 16.25%, and cefoxitin 15%). Resistance patterns tended to group by serotype, however, 3 resistance patterns were common among different serotypes. The prevalence of antimicrobial resistance varied by serotype, ranging from 20% for *S.* Heidelberg to 100% for *S.* Hadar. All 7 *S.* Hadar isolates were resistant to 1-2 antimicrobials, 4 of 20 *S.* Heidelberg isolates were resistant to 3 or fewer antimicrobials, 10 of 15 *S.* Typhimurium var. copenhagen isolates were resistant to 4-5 antimicrobials, 7 of 14 *S.* Kentucky isolates were resistant to 1-7 antimicrobials, and 3 of 9 *S.* Berta isolates expressed resistance to 9-11 antimicrobials. These data indicate that *Salmonella* recovered from retail poultry carcasses may be resistant to multiple antimicrobials, and that resistance among these isolates varies by serotype.

Key Words: *Salmonella*, Antimicrobial Resistance, Chicken

M45 Influence of irradiation and storage on the quality of ready-to-eat turkey breast rolls. M. Zhu*, A. Mendonca, E. J. Lee, and D. Ahn, *Iowa State University, Ames.*

Influence of irradiation and storage on the quality of ready- to-eat (RTE) turkey breast rolls was investigated. Commercial oven roasted turkey breast rolls purchased from local stores were sliced and vacuum packaged. The sliced samples were randomly divided into three groups and irradiated at 0, 1.0, or 2.0 kGy using a Linear Accelerator. Color, 2-thiobarbituric acid reactive substances (TBARS), sensory characteristics and volatiles were measured at 0, 7 and 14 days of storage. Irradiation increased color a*-value of turkey breast rolls. TBARS values were not influenced by irradiation and storage. The production of acetaldehyde increased with storage time and irradiation dose. Irradiation also increased the production of 3-methyl butanal and 2- methyl butanal, which were suggested to be radiolytic product of leucine and isoleucine, respectively. However, there was no difference in hexanal content. Both 1.0 and 2.0 kGy irradiation greatly increased the amount of dimethyl disulfide. Irradiation also induced other sulfur compounds but at lower amounts. Irradiation of RTE turkey breast, especially at 2.0 kGy, significantly increased the production of benzene. The production of toluene in turkey breast was increased but to a less extent. Since both benzene and toluene have negative effects on health, their formation during irradiation warrants further studies to control the formation of these compounds. Sensory panelists pointed out that both sulfury odor and flavor of turkey breasts irradiated at 2.0 kGy were stronger than those of non-irradiated, but the sulfury odor and flavor of samples treated at 1.0 kGy were not significantly different from those of non-irradiated control. It was concluded that irradiation significantly influenced the odor and flavor of RTE turkey breast rolls under vacuum packaging conditions. Therefore, strategies to prevent negative changes in the quality of irradiated RTE turkey breast roll are needed.

Key Words: Ready-To-Eat Turkey Breast Roll, Irradiation, Volatiles and Sensory Characteristics

M46 Effects of extended storage on egg quality factors. D. R. Jones* and M. T. Musgrove, *Russell Research Center, Poultry Processing and Meat Quality Research Unit, USDA-ARS, Athens, GA.*

Eggs were collected from a single in-line processing facility once a week for three weeks (replicates). All eggs were stored at 4C and 80% RH for the 10 wk. Analyses began the day after collection and continued each week of storage. Two dozen eggs were examined for egg weight, albumen height, Haugh unit, shell strength, and vitelline membrane strength. Pooled egg yolks were analyzed for color values. Eggs from the second replicate were significantly ($P < 0.0001$) heavier than the other replicates by an average of 3 g. During storage, egg weight decreased ($P < 0.0001$) from approximately 61 g to 57 g after 10 wk of storage. Albumen height was approximately 2 mm higher for the eggs in replicate two compared to the other replicates ($P < 0.01$). On average, albumen height decreased with extended storage ($P < 0.0001$) from 7.05 mm to 4.85 mm. Haugh unit values decreased during cold storage from 82.59 to 67.43 ($P < 0.0001$). There were no differences between replicates for Haugh unit values. No differences were detected for shell strength

between replicates or during extended storage. A significant difference ($P < 0.05$) was found in detectable force required to break the vitelline membrane between treatments. This difference was less than 0.05 g. The elasticity of the vitelline membrane decreased during storage ($P < 0.01$) remaining low after 6 wk. Significant differences were detected for L*, a* and b* values. While numerically these differences existed, they were below the degree detectable by the human eye. Therefore, these differences would have no effect on consumer perceptions. Extended cold storage did lead to decreases in egg weight, albumen height and Haugh units. Average Haugh unit values were still within the range of A grade. Shell strength was not affected by the extended storage. Vitelline membrane elasticity also decreased which could lead to yolks more easily rupturing as consumers cracked the eggs.

Key Words: Egg, Storage, Quality

M47 Chemical analyses of commercial shell egg wash water collected from three different operations. J. K. Northcutt*, M. T. Musgrove, and D. R. Jones, *USDA, Agricultural Research Service, Russell Research Center, Athens, GA.*

A study was conducted to evaluate egg wash water from in-line shell egg processing facilities (Plants X, Y and Z). Water samples were collected from the tap, washer 1 (W1) and washer 2 (W2) in each facility. Samples were evaluated for chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), total suspended solids (TSS), total dissolved solids (TDS), pH, temperature, chlorine and soluble iron. Values for COD, TKN, pH, temperature and chlorine varied significantly among the facilities ($P < 0.05$). Sample (tap, W1 or W2) had a significant effect on COD, TKN, TSS, TDS, pH, temperature, chlorine and soluble iron ($P < 0.05$). COD values for both W1 and W2 followed the order of: Plant Z > Plant X > Plant Y. Wash water had COD values that ranged from 7300 mg/L to 1765 mg/L. TKN values for the wash water ranged from 302 mg/L to 81 mg/L. Highest values for TSS and TDS occurred in W1 (601 mg/L and 5287 mg/L, respectively) as compared to W2 (401 mg/L and 3087 mg/L, respectively). Wash water pH varied from pH 11.4 (W1, Plant Z) to pH 10.0 (W2, Plant X). No difference was found in the pH of tap water which averaged from pH 6.1 to 6.7. Wash water temperature ranged from 44.1 $\pm$ 0.1°C to 39.7 $\pm$ 0.3°C, and was generally highest in W2 samples from all three plants. Chlorine levels in the wash water for Plant Y (0.89 mg/L, W1; 0.91 mg/L, W2) were significantly lower ($P < 0.05$) than the levels for Plant X (2.72 mg/L, W1; 2.62 mg/L, W2) or Plant Z (4.5 mg/L, W1; 2.35 mg/L, W2). Chlorine levels in the tap water were similar among the facilities and ranged from 0 to 0.15 mg/L ($P < 0.05$). Average values of soluble iron (ferrous) in the egg wash water were 0.29 $\pm$ 0.02 mg/L to 1.60 $\pm$ 0.29 mg/L; however, iron levels were found to be above the 2.0 mg/L guideline in W1 for Plant X during one of the sample collections. Data provided by the present study may be useful for identifying process deficiencies and minimizing organic and inorganic discharge loads in the waste stream.

Key Words: Shell Eggs, Egg Processing Water, Chemical Analyses

M48 Evaluation of carcasses obtained from broilers fed with ostrich oil and/or soybean oil as energy source. W. Martinez, E. Posadas, E. Avila, and M. P. Castañeda*, *Universidad Nacional Autonoma de Mexico, Salvador Diaz Miron s/n, Col Zapotitlan, México D.F..*

Ostrich oil is a waste product from the production of leather and meat on Mexican ranches. The objective of this study was to evaluate carcass yield, breast, leg and thigh yields, pigmentation, and fatty acid profiles in meat obtained from broilers fed with ostrich oil and/or soybean oil. Four hundred twenty broiler chickens (Ross x Ross) were randomly distributed in four treatments with five trials of 21 chickens each. The treatments were as follows: T1 (5% soybean oil in both feeding phases), T2 (5% ostrich oil in both feeding phases), T3 (5% soybean oil in starter feed and 5% ostrich oil in finisher feed) and T4 (5% ostrich oil in starter feed and 5% soybean oil in finisher feed). At 49 days, the birds were processed under commercial conditions and pigmentation, carcass yield, breast, leg and thigh yield, and fatty acid profile (Folch's method) were determined. There were no statistical differences among treatments ($P<0.05$) for the weight of the carcass, weight of carcass with vicera, carcass yield and breast, leg and thigh yield, and yellowness value. The redness value was not significantly different after picking; however, after chilling T1 (7.79) was only significantly higher than T2 (4.962). The lightness value following chilling indicated T4 (71.79) was significantly higher than T1 (69.16). The results from the fatty acids profile indicated T3 and T4 had the highest content of lipids and saturated fatty acids in breast, leg and thigh. T4 had the highest content of monounsaturated fatty acids in breast and the T3 the highest in leg and thigh compared to the remaining treatments. The content of omega-3, omega-6 indicated that T4 had the highest concentrations in the breast and leg-thigh meat samples compared to the remaining treatments. T4 was significantly higher in omega-9 in the breast meat and T3 was significantly higher in omega-9 in the leg-thigh meat samples compared to the remaining treatments. The results obtained in the present study suggest that ostrich oil and soybean oil increased the polyunsaturated fatty acids levels without affect the yield and pigmentation levels. The ostrich oil is a viable option in the broiler feed as energy source.

Key Words: Ostrich Oil, Soybean Oil, Carcass

M49 Effects of post-defeathering electrical stimulation on moisture retention characteristics of broiler carcasses and phosphate-marinated breast fillets. L. L. Young*[1], D. P. Smith[1], J. A. Cason[1], R. J. Buhr[1], and J. M. Walker[2], [1]*USDA, Athens, GA,* [2]*Stork-Gamco, Inc., Gainesville, GA.*

Processing technologies sometimes interact in a way that alters their individual functionalities. The objective of this study was to evaluate effects of simultaneous application of two such technologies, electrical stimulation (ES) of broiler carcasses immediately post-defeathering to improve texture of early harvested breast fillets and marination of breast fillets in sodium tripolyphosphate (STPP) solution to enhance moisture absorption and retention. Mixed-sex broiler chickens were conventionally slaughtered. Half were stimulated by pulsed electrical current (220 VAC, 2 s on, 1 s off) for 90 s immediately after defeathering and prior to evisceration and half remained unstimulated. After chilling, breast fillets were excised. Half the fillets from each stimulation treatment were marinated in STPP and half without STPP. Chiller water absorption by intact carcasses and pH and moisture absorption and retention by marinated fillets were observed. ES slightly depressed chiller water absorption by the carcasses (4.0% v. 4.6%), but its effect on breast fillets was much greater. ES improved marinade absorption by fillets (11.1% v. 9.6%) but did not affect cooking loss. Although the STPP increased fillet pH somewhat (6.28 v. 6.22), it had little effect on marinade absorption (10.1% v. 10.6%); however, fillets marinated without STPP lost more moisture in cooking than those marinated without STPP (17.6% v. 12.4%). No significant statistical interactions between ES- and STPP-treatments were observed in this study. These results suggest that ES affects chiller water absorption by broiler carcasses only slightly and has little effect on the efficacy of STPP in enhancing moisture absorption and retention by marinated breast fillets.

Key Words: Electrical Stimulation, Polyphosphate, Meat

Meat Science and Muscle Biology

M50 DFD-like (dark, firm, dry) meat in a broiler commercial plant. J. Schneider[2,3], S. H. I. Oda[1], A. L. Soares[1], E. I. Ida*[1], P. D. Guarnieri[2], R. Olivo[3], and M. Shimokomaki[1,2], [1]*Department of Food and Drug Technology, Londrina State University, Londrina, PR, Brazil,* [2]*Food Science Graduate Program, Faculty of Pharmaceutical Sciences, São Paulo University, São Paulo, Brazil,* [3]*Globalfood Advanced Food Technology, Alberto Sampaio, São Paulo, S, Brazil.*

It has been established there is occurrence of PSE (Pale, Soft, Exudative) chicken meat in commercial plants in Brazil. Attempts to control its development are currently applied and one of them consists on the use of water shower spray to lower the chicken body temperature. This manouvre has been shown to be successful but it seems to be one cause of the appearance of DFD-like meat. The objective of this work was to evaluate the occurrence of DFD-like poultry meat and its functional properties in a commercial plant. Commercial Ross chickens were divided into two groups: Untreated Group (UG) (n=811) and Treated Group (TG) (n=425), without and with water shower treatments, respectively. Carcasses were refrigerated through water chiller and af-