265 Calcium mobilization in the aging hen: II. Effect of the anti-estrogen, tamoxifen, on duodenal calcium absorption. K.K. Franzen1, M.M. Beck1, and L.G. Robeson1, 1University of Nebraska-Lincoln, Lincoln, NE.

Numerous studies have been conducted in an attempt to understand the estrogen/calcium relationship and its effect on optimizing egg production and shell quality. Calcium homeostasis in the laying hen is intimately tied to plasma estrogen profiles. Increases in plasma estrogen concentrations, either endogenous or exogenous, lead to increased calcium absorption and plasma Ca2+ (Sommerville et al., 1989; Qin & Klandorf, 1995; Elaroussi et al., 1993; Hansen, 1998). Two studies were conducted using a potent anti-estrogen, tamoxifen, in an effort to further elucidate the estrogen/calcium relationship in the hen and to determine whether estrogen’s effect on calcium metabolism is mediated through its receptor. HyLine W36 laying hens at peak production (PP; 33 wks of age, 93% production) and late stage production (L5; >85 wks of age, 80% production) were used in this study. Tamoxifen was dissolved in propylene glycol and administered i.m. 2-3 hours after oviposition and again 8 hours later. Hens were then euthanized by cervical dislocation and the duodenum was excised for in vitro calcium transport (CaT) determination. Tamoxifen treatment had no effect on plasma E2 or LH concentrations in either study. However, tamoxifen treatment resulted in a significant decrease in plasma P4 concentrations in PP hens (P<0.0455). There was a significant (P<0.05) increase in CaT in tamoxifen treated birds as compared to control birds in both studies. This observation suggests two possibilities: First, that tamoxifen may not be a “pure” antagonist in the chicken and second, that estrogen may act in a rapid, nongenomic fashion at the intestine. In the latter case, this finding would explain earlier findings that E2 implants caused a rapid, transient increase in CaT that occurs more rapidly than would be expected from an effect via the kidney.

Key Words: tamoxifen, calcium transport, age

267 Induced red discoloration in fully-cooked chicken or turkey breast meat. J.K. Northcutt1* and D.P. Smith1, 1USDA, ARS, Russell Research Center.

The present study was conducted to determine if red discoloration could be induced in fully-cooked chicken or turkey breast meat patties using bone marrow (fragments or water-soluble extracts). Five, 6 or 7 week old broilers (2 replications each) were slaughtered by cervical dislocation and femurs (n=20 femurs per replication and bird age) were removed. Primary spongosia from each end of the bone was pooled and blended (1:1 wt/vol) with 50 mM Tris (pH 7.5) for 30 s. This mixture was centrifuged (20,000 x g, 45 min at 4 C), and three distinct layers were noted: a supernatant, an intermediate paste layer, and bone pellet. Zero, 1, or 2 g of supernatant, paste, or bone pellet were mixed with 50 g of ground meat. Meat was formed into patties, vacuum-sealed in cooking bags, and cooked to internal temperature of 82.2 C (n=3 per treatment). Triplicate readings of internal and external color (CIE Lab) were measured on each patty. One g of chicken supernatant, paste or bone had little effect on interior and exterior patty color. Two g of supernatant extracted from 5 and 6 week old broiler femurs increased redness (a*) by 4.2 to 4.4 units, while extracts from 7 week old broiler femurs increased redness by 7 units. Comparable results were observed for bone and paste, with redness values increasing by 6 to 9 units for both treatments. The experiment was repeated using femurs from 16 week old tom turkeys, where only dialyzed supernatant (molecular weight cut-off of 12,000 dalton (MW12) or 25,000 dalton (MW25)) was used. Dialysis of turkey supernatant gave interior patty redness values of 9.1 and 2.8 for MW12 and MW25, respectively, as compared to the interior control patty redness of 3.8. These results indicate that red discoloration may be induced using water soluble bone marrow extracts from chicken or turkey femurs.

Key Words: red discoloration, chicken, turkey

268 Skin Pigmentation Evaluation in Broilers Reared Under Light and Dark Conditions and Fed Natural and Synthetic Pigments. M.P. Castañeda* and A.R. Sams, Texas A&M University, College Station, TX.

Xanthophylls are a class of carotenoids and are the most prominent source of pigmentation in poultry feeds. It has been reported that birds reared in outside pens were more orange and darker than birds reared in dark houses. This suggested that changes in pigmentation are influenced by light. Therefore, the purpose of this study was to determine the effect of light exposure in broilers fed natural and synthetic pigments at the levels commonly found in the Mexican market. Six hundred and ninety day-old chicks in two trials were obtained from a commercial hatchery and randomly distributed into six treatments (3 pigments classes x two lighting levels). The light pens were in a window house and were supplied with light from quartz halogen light sources. Dark houses had 0 - 3 foot candles of incandescent light. The feeding treatments were: Control group (without pigment); natural high levels of yellow and red; a blend (natural yellow and synthetic red). Body weight, feed consumption, skin color (Minolta CR-200 Chroma meter), and skin pigment levels were measured during growth and after processing. Final body weight and feed consumption were not significantly different among the treatments. No differences due to light level were observed in any parameter except skin yellowness. The effect of darkness was not as previously reported, possibly due to the higher levels of pigments used in this study that regulate growth and body composition.

Key Words: Natural Pigments, Light, Broiler Skin Color, Blood Pigments

266 Global gene expression profiling in liver of thyroid manipulated and/or growth hormone (GH) injected broiler chickens. X. Wang*, W. Carle, L. Rejto, and L.A. Cogburn, University of Delaware, Newark, DE.

DNA microarray analysis is a powerful tool for profiling gene expression on a genomic scale. We have developed a chicken liver cDNA microarray containing chicken ESTs (ESTs) that were sequenced from a normalized chicken liver cDNA library. The unique cDNA clones were PCR amplified and printed onto 8 x 12 cm nylon membranes. We have used 24 liver DNA microarrays for global gene expression profiling of hepatic genes in broiler chickens in response to thyroid manipulation and/or daily growth hormone injection. Four-week-old broiler chickens were fed 1.25 ppm T3, 0.6% propylthiouracil (PTU) or control diet (CF) for three weeks. Three additional treatment groups (4 birds/group) were included [buffer controls (BC), cGH (250 mg/kg), or T3+cGH]. Each total RNA sample, prepared from liver, was reverse transcribed with 3P-dCTP and hybridized to each microarray. A large number of known genes (and unknown ESTs) were up regulated by T3 treatment [C/EBP (CCAAT/enhancer binding protein), CCAAT displacement protein, SPOT 14 (thyroid hormone responsive hepatic protein), hydroxymethylglutaryl-CoA synthase, carboxypeptidase E (CPE), retinal synthase (Glns) and zinc finger protein, etc.]. Another group of genes (named and unknown ESTs) were down regulated by T3 [adipophilin, glutathione S-transferase (GST), cyclophilin, actin-CoA cyclosterltransferase 2 (ACAT2), 90kDa heat shock protein, etc.]. The expression of a small number of genes was affected by cGH (endolase-α, carboxypeptidase E, PPAR-γ, Vit.D binding protein, etc.). One unknown EST (pg11c.p5002.m22) was highly induced in PTU treated (slightly obese) chickens. This unknown liver-specific gene was previously identified by one of us (W.C.) as a fat-specific EST that has two single nucleotide polymorphism sites (SNPs), which respond to genetic selection for fat content. This initial study demonstrates the power of DNA microarray-based gene expression profiling to discover key regulatory genes in important metabolic pathways that regulate growth and body composition.

Key Words: DNA Microarrays, Gene Expression Profiling, Hormonal Manipulation, Single Nucleotide Polymorphism (SNP)
269 Incidence of red discoloration in fully-cooked retail chicken products. D. P. Smith* and J. K. Northcutt, USDA ARS, Russell Research Center, Athens, GA.

Three chicken products (bone-in) were selected at a supermarket to determine incidence and severity of red discoloration in fully-cooked retail items. Four containers each of fully-cooked frozen boxed chicken, fully-cooked fillets of rotisserie chicken (retail), and fully-cooked rotisserie breasts were obtained from a local supermarket on three different dates (n=214). The breasts, drums, and thighs were weighed, muscle removed from bone, and internal discolored areas measured using both a subjective scale of 1 (none or slight) to 4 (unacceptable), and with a colorimeter (CIE L*, a*, and b*). Subjective scores showed: a higher percentage of rotis. breasts with moderate discoloration (33%) than frozen or fried breasts (15 and 10%, respectively); a higher percentage of moderate and severe discoloration in frozen drums (79%) than fried or rotisserie drums (47% and 50%, respectively); and, more severe discoloration in rotis. thighs (37%) than frozen (19%) or fried (0%) thighs. Across products, discolored area L* values were significantly higher for breasts (64.8) than drums or thighs (51.7 and 53.6, respectively). Breasts had lower a* values (5.2) than drums (7.7) or thighs (9.1). All products and parts displayed some subjective discoloration, although rotis. breasts, rotis. thighs, and frozen drums showed a higher percentage of discoloration than other product parts. Discoloration in the breast was lighter and less red than drum or thigh discoloration.

Key Words: Red discoloration, Retail chicken products


This study was conducted to evaluate a new shearing method for the determination of poultry meat tenderness. Three replications consisting of 270 broilers were commercially processed to evaluate meat tenderness. Breast fillets were deboned at 0.25, 1.25, 2.0, 2.5, 3.0, 3.5, 4.0, 6.0, and 24.0 h postmortem (PM). At 24.0 h PM, samples were collected from the right thigh for sarcomere length determination. All fillets were cooked to 76 C, cooled, and then analyzed for tissue texture using either Allo-Kramer (AK) (10 blade) or razor blade shear (8 mm width) methods. The AK test was performed on a strip of muscle (40mm X 20mm X 7mm) while the razor blade shear was performed on intact muscle. All samples were sheared perpendicular to the muscle fibers. A trained sensory panel was used to evaluate samples for attributes including initial hardness (IH) and chewdown hardness (CH). Means for all parameters measured exhibited significant differences over time, indicating a decline in toughness from 0.25 h to 24.0 h PM. Sarcomere length exhibited the highest correlation to sensory attributes than the AK method suggesting that the new razor blade shear method is superior in predicting poultry meat tenderness to the standard AK shear method. Further, the total energy value obtained in this test is more useful in predicting tenderness than maximum force. This new method not only has a more predictive value, but also has less sample preparation involved as it is conducted on intact fillets.

Key Words: Poultry meat, Texture analysis and Sensory, Tenderness

271 Subjective and objective characteristics of a restructured turkey breast product formulated with a Fibrin cold-set binding system. M. S. Hussain, S. R. Williams, and R. L. West, University of Florida.

The objectives of this research were to 1) manufacture a restructured turkey breast product utilizing the Fibrinex® Fibrin cold-set binding system (a combination of fibrinogen and thrombin) and 2) determine the effect(s) of the fibrin, sodium diacetate (NaD) and/or sodium lactate (NaL) on sensory, chemical and physical characteristics of the restructured turkey product. Whole turkey breasts were cut into 5 cm thick strips, treated with either 1.5% NaL, 2.0% NaL, 1.5% NaL + 0.1% NaD, 2.0% NaL + 0.1% NaD, 0.1% NaD, or no additives (control), mixed with the fibrin ingredients, stuffed into 12 cm diameter by 94 cm length casings, and stored at -30°C for 0, 1, 2, and 3 mo. After each storage period, chubs were removed from the freezer and sliced into 1 cm thick steaks. The steaks were packaged in a retail styrofoam tray and overwrap film and stored at 0°C for 8 d. Triplicate samples were analyzed for each treatment at 2 d intervals for binding integrity, binding strength, sensory characteristics (i.e., juiciness, turkey flavor intensity and off-flavor), proximate composition and onset of rancidity. Although steaks treated with NaD and/or NaL had lower binding strength (P < 0.05), binding integrity was retained in all steaks. There were no significant differences (P > 0.05) in cooking yield, fat, moisture, protein, and juiciness among the treatments. Ash content was higher for steaks with NaL (P < 0.05). At months 1, 2, and 3, steaks formulated with NaL only or combined with NaD had lower than less control or steaks formulated with only NaD (P < 0.05). The TBA values for all steaks formulated with NaD and/or NaL were higher than control steaks (P < 0.05). This study revealed that the NaD and/or NaL treatments had no adverse effects on the Fibrin binding system used to manufacture the restructured turkey breast product.

Key Words: Fibrin binding system, Turkey product, Sodium lactate and Sodium diacetate


This study was conducted to determine consumer acceptability of chicken deli rolls made from meat marinated with non-meat ingredients. A total of 153 breast fillets were collected from a commercial poultry processing plant. The fillets were cubed and tumbled (30 min, 4 C) with a 20% marinade (based on meat weight) using water plus NaCl (0.6%, final concentration), sodium tripolyphosphate (STP) (0.3%) and either a soy protein isolate (SPI), whey protein isolate (WPI), or modified food starch (MFS) (2%) in two replications. Meat was stored at 4 C overnight, and then formed into two deli rolls (per treatment per replication) and cooled to 74 C. Cook loss and total moisture were determined for each roll made. A 60 member consumer sensory panel was used to evaluate the samples for overall impression, appearance, flavor, and texture using a 9 point hEDonic scale. Additionally, a 5 point just about right scale was used to evaluate juiciness. All treatment marinades improved water holding capacity (WHC) compared to the NaCl/STP (control); however, the WPI and MFS improved WHC to a greater extent indicated by significantly lower cook losses and total moisture compared to SPI and control. The juiciness of the WPI and MFS rolls was considered just about right by consumers whereas the juiciness was considered slightly too dry for SPI and control. There were no significant differences in acceptance (P > 0.05) among control, SPI or MFS rolls of all other sensory attributes; however, means of sensory attributes from WPI rolls were significantly lower indicating lower acceptance of the product. Furthermore, the rolls made with WPI marinated chicken exhibited no binding when cooked in a roll form. These results indicate that using non-meat marinades including modified food starch and soy protein isolate can significantly improve water-holding capacity of cooked poultry deli rolls or fillets without negatively affecting consumer acceptance.

Key Words: Poultry meat and Water holding capacity, Sensory, Marinade

273 Use of double-packaging and antioxidant combinations to improve color, lipid oxidation, and volatiles of irradiated raw and cooked turkey breast patties. D. U. Ahn* and K. C. Nam1, 1Iowa State University.

Although irradiation is the best method to ensure the microbiological safety of poultry meat, it accelerates lipid oxidation, produces characteristic off-color, and develops a pink color. Some antioxidants can significantly reduce oxidative quality deterioration of irradiated meat by quenching free radicals. Packaging is a critical factor influencing the quality of irradiated meat and proper combinations of vacuum and aerobic packaging during storage can be effective in minimizing quality changes in irradiated meat. The objective of this study was to determine the effects of double packaging and antioxidant combinations on color, lipid oxidation, and volatiles of irradiated raw and cooked turkey breast patties stored at different temperatures for 6 months. Ground turkey meat at 3 kg was vacuum packaged (all meat) and stored at 0°C for 10 d. Three packaging methods were used: vacuum alone, vacuum and overwrap, and vacuum and overwrap with antioxidants. Each package was stored at 0°C for 10 d and then at 4°C for 6 months. At each storage period, color (L, a, b), color stability (CIE L*, a*, b*), lipid oxidation value (TBA), thiobarbituric acid (TBARS), and volatiles (headspace) were measured. The results indicated that the combination of vacuum packaging and antioxidant treatments effectively minimized quality changes in irradiated turkey breast patties.
Key Words: Antioxidant, Double-packaging, Irradiation

274 Double packaging is effective in reducing lipid oxidation and off-odor volatiles of irradiated raw turkey meat. K. C. Nam1, B. R. Min1, and D. U. Ahn1, 1Iowa State University.

One of the best emerging technologies to ensure microbiological safety of meat is irradiation. The main concern of irradiating meat, however, is the organoleptic quality changes that occur. The objective of this study was to determine the effect of double packaging (the combinational use of vacuum and aerobic packaging conditions) on the quality changes of irradiated raw turkey meat. Sliced raw turkey breast or thigh muscle samples were vacuum packaged, aerobically packaged, or double packaged (individually packaged in oxygen permeable zipper bags and then a few of them were vacuum-packaged in a larger oxygen impermeable bag). The samples were electron beam-irradiated at 0 or 2.5 kGy and stored for 10 d at 4°C. The outer vacuum bag of the double-packaged samples was removed after 5, 7, or 9 d of storage to expose the meats to aerobic conditions during the rest of the storage time. Lipid oxidation, volatile compounds, and color of the samples were determined after 10 d of storage. Irradiation and aerobic packaging increased TBARS and promoted the production of aldehydes and S-compounds than aerobic or vacuum packaging alone. Color a* values of double-packaged meats were lower than that of the vacuum-packaged meats, but were not significant. Thus, the use of double-packaging alone was not enough to reduce the pink color of irradiated raw turkey meat. When both lipid oxidation and irradiation off-odor should be minimized without any additional additives, however, double packaging is an excellent method to be used for turkey meats.

Key Words: Double packaging, Irradiation, Off-odor

275 Effect of antioxidants on the production of off-odor volatiles and lipid oxidation in irradiated turkey breast meat and meat homogenates. E. J. Lee1, H. Yan1, and D. U. Ahn1, 1Iowa State University.

Irradiation is the best-known method to control the oxidative changes of irradiated raw and cooked turkey breast. Preventing primary infection will require pre-screening of potential employees, restricting access to installations and securing live-bird units, feed mills, hatcheries and common service centers. The use of electronic alarm and surveillance systems and the presence of trained employees and contractors should serve as a deterrent. Preventing dissemination of infection will depend on early detection of a clinical abnormality characterized by rapidly ascending morbidity and mortality. Future action will be predicated on a rapid and accurate diagnosis. Appropriate pre-determined procedures will be required to limit the spread of pathogens by restricting and controlling movement of flocks, personnel, equipment, and especially feed delivery vehicles. Contingency plans will have to be activated on suspicion of any emergence of a disease. The success of a coordinated program to defend against agro-terrorism will depend on the intensity of planning and the ability to implement response options as indicated by a structured risk assessment. Commitment of management

Key Words: Antioxidant, Irradiation, Off-odor

276 Lipid oxidation in chicken doner kebab: anti-oxidative and pro-oxidative factors. B Kilic1 and M.P. Richards2, 1University of Wisconsin-Madison, 1Ataturk University.

The effect of mechanically separated turkey (MST), sodium ascorbate, a combination of MST and sodium ascorbate, and vacuum packaging on rates of lipid oxidation in cooked, chicken dner kebab during storage at 4°C or -20°C was investigated. Samples were analyzed for thiobarbituric acid reactive substances (TBARS) and lipid hydroperoxides. MST and MST with added ascorbate accelerated lipid oxidation during storage regardless of storage temperature compared to control kebab (P < 0.05). Ascorbate had a pro-oxidant effect when combined with MST. However, sodium ascorbate without MST inhibited lipid oxidation in chicken dner kebab (P < 0.05). Lipid oxidation was inhibited more effectively by ascorbate than vacuum packaging during 4°C storage (P < 0.05). Freshly prepared MST contained much greater levels of lipid hydroperoxides compared to freshly prepared minced, chicken leg muscle. The anti-oxidative effect of ascorbate in the absence of MST that was converted to a pro-oxidative effect in the presence of MST suggests that the excess lipid hydroperoxides and non-heme iron in the MST could each be activated as a lipid oxidation catalyst by ascorbate to overwhelm the ability of ascorbate to inhibit lipid oxidation at lower concentrations of hemoglobin, iron and peroxides. The ability of an ascorbate-low molecular weight iron chelate to generate hydrogen peroxide reactant in the presence of oxygen is discussed.

Key Words: Mechanically separated turkey, Ascorbate, Heme proteins