

Processing and Products

223 Carcass characteristics of different marketing weight standards in South Korea chicken grading system design. H. S. Chae^{*1}, C. N. Ahn¹, Y. M. Yoo¹, S. H. Cho¹, J. M. Lee¹, and Y. I. Choi², ¹National Livestock Research Institute, RDA, ²Dept. of Animal Science, Chungbuk National University.

The purpose of this study was to investigate the carcass characteristics of different marketing weight standards in the South Korea chicken grading system. Nine-hundred and forty broiler chickens were slaughtered. The carcasses were divided 13 groups(5ho-13ho) by carcasses weight(451g-1,750g). Remaining feathers, fine feathers, wound, the major axis length of discoloration, clots of blood, fracture, appearance, and pollution of bile were recorded. Feathers(<1cm) remaining under two were detected 95% in 5ho and 17ho chickens and 98% in 7ho to 15ho chickens. The remaining feather contents were higher in 5ho, 6ho and 17 ho chickens than 7ho to 16ho chickens. Chickens in 5ho(5.0%) and 7ho(7.5%) had excess fine feathers more than the other chicken groups, also 8ho to 10ho(2.5%); however they decreased as chicken weight increased. The small exposure of flesh(<2cm) on breast and leg parts were higher in 5ho(7.5%) and 17ho(5.0%) than the other chickens and the of big exposure flesh(>2cm) above 2cm were detected 1.3% to 2.5% in 5ho to 13ho chickens which having relatively a small weight. The major axes of discoloration(1.5-2.5cm) were not detected in 8ho to 14ho chickens, but were detected 1.3% to 3.8% in 5ho to 7ho chickens and 15ho and 16ho chickens in especially on breast and leg parts. Bone fractures were higher in 17ho chickens(10%) than the other chicken groups. Bone fractures were detected by 2.5% in 5ho, 9ho and 15ho groups. Damage of appearance were higher in 10ho(8.8%), 13ho(7.6%) and 17ho(10%) than the other chickens. The frequency rates for incomplete removal of intestine, a bromchus or blood contaminated chickens were evenly distributed in all chicken groups(1.3%-3.85%).

Key words: Chicken grading system, Weight standard, Carcass characteristics

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361 Influence of irradiation and storage on the quality of ready-to-eat turkey breast rolls. M. J. Zhu^{*1}, H. A. Ismail¹, A. Mendonca², and D. U. Ahn¹, ¹Animal Science, Iowa State Univ., ²Food Science and Human Nutrition, Iowa State Univ..

Influence of irradiation and storage on the quality of ready-to-eat turkey breast rolls was investigated. Commercial oven roasted turkey breast rolls purchased from local stores were sliced and re-vacuum-packaged. The sliced samples were randomly separated into three groups and irradiated at 0, 1 or 2 kGy using a Linear Accelerator. Color, Thiobarbituric acid reactive substances (TBARs), sensory characteristics, volatiles and total plate counts were measured at 0, 7 and 14 days of storage. Irradiation significantly increased color a* value of turkey breast rolls. TBARS values were not influenced by irradiation and storage. Both volatiles analysis and sensory evaluation showed that irradiation significantly increased sulfur like flavor, which could be related to the dramatic increase in sulfur compounds in volatiles of irradiated samples. Irradiation also increased acetylaldehyde content in volatiles. The contents of 2-methyl butanal and 3-methyl butanal in 2.0 kGy irradiated samples were significantly higher than those in 0 and 1.0 kGy treated samples. The irradiation also increased the amounts of benzene and toluene. Aerobic plate counts showed that irradiation is very effective in eliminating the microorganisms in meats. There were more than 2 and 4 Log10 reductions following irradiation at 1.0 and 2.0 kGy irradiation. However, the survived or injured microorganisms recovered to grow during the refrigerated storage. Thus, to extend the shelf-life of ready-to-eat products, additional hurdles may need to inhibit the growth of micro-organisms in ready-to-eat products following low-dose irradiation.

Key Words: Turkey breast roll, Quality, Irradiation

362 Breast meat characteristics and responses to acute heat stress in three broiler great-grandparent (GGP) lines. V. E. Cooke^{*}, R. R. Hunter, and M. A. Mitchell, Roslin Institute (Edinburgh), Midlothian, UK.

Previous studies in our laboratory have shown that broiler GGP lines exhibit differences in muscle membrane integrity, stress sensitivity and

meat quality attributes. This study compared the appearance and physical properties of the breast meat of a further three commercial GGP lines (Lines A, B and C). These lines differed according to their genetic origins and recent selection history. The birds were reared under standard conditions to 6 wks of age. 6 birds per line were crated and exposed to a controlled 3 hr heat stress (30°C/75%RH). 6 control birds per line were crated and exposed to a control climate (21°C/50%RH). The birds were killed 48 hrs after the heat stress. The carcasses were chilled for 24 hrs at 6°C. The right breast fillets were then excised from the carcass, weighed and frozen at -20°C. Fillets were thawed over 24 hrs at 6°C and estimates of water loss (thaw loss) were obtained. The color and degree of hemorrhaging of the fillets were measured. The fillets were then cooked for 30 mins at 90°C and left to cool for 5 hrs. Assessment of meat texture was performed on standard sections of meat. The heat stress treatment did not result in alterations of any of the meat quality attributes measured. Line C had the highest mean body weight (2.6 kg) and fillet weight (0.225 kg) (P≤0.05), although the % breast yield was greater in Lines B and C (both 8.6%) compared to Line A (7.4%) (P≤0.05). The fillets from Lines B and C also exhibited greater incidence of hemorrhaging (P≤0.05) and greater thaw loss (P≤0.05) compared to Line A. There were no line differences in fillet color or texture. The phenotypic differences in meat characteristics detected between the three commercial GGP lines may be indicative of genetic differences. Birds with higher % breast yields produced breast meat with greater water losses and more extensive hemorrhaging. Understanding the cellular mechanisms that elicit these inter-line differences in breast meat characteristics may enable the development of innovative methods for genetic selection.

Key Words: Broiler, Meat quality, Genetic selection

363 Physicochemical properties of Korean Ogol chicken, the cross-bred Ogol chicken and broiler meat. H. S. Chae^{*1}, C. N. Ahn¹, Y. M. Yoo¹, B. Y. Park¹, J. M. Lee¹, S. G. Yun¹, and Y. I. Choi², ¹National Livestock Research Institute, RDA, ²Dept. of Animal Science, Chungbuk National University.

This study was conducted to compare the biochemical properties between Korean Ogol chicken, the cross-bred Ogol chicken and broiler meat. A total protein content of the cross-bred Ogol chicken was higher than Korean Ogol chicken in both sexes with 23.6 and 23.57% compared to 22.8 and 22.20% in male and female, respectively. These were substantially higher percentages than the 21.73% in broiler breed. In total fat content, there was a significant difference in males and females between the Ogol breeds with 0.69 and 0.91%, respectively. However, this was a significantly (P<0.05) lower percentage than 1.92% in broiler breed. The cross-bred Ogol chicken showed a significantly higher calcium ion content, with 103.67ppm and 118.00ppm in male and female, respectively, than traditional broiler breed (73.80ppm). The cross-bred Ogol chicken contained significantly (P<0.05) higher essential amino acids (cystine, serine, lucine, phenylalanine, arginine, proline) than the broiler breed. In fatty acid composition, the cross-bred Ogol chicken contained higher unsaturated fatty acids, with 34.22 and 26.23% for males and females, respectively, than the Korean Ogol chicken containing 29.76 and 24.59% for males and females, respectively. These were substantially higher levels compared to 19.59% in broilers. Higher trend in DHA level was observed in the cross-bred Ogol chicken (5.47% and 2.89% for male and female, respectively) compared to the Korean Ogol chicken (2.92% and 1.00%). CIE L* for cross-bred Ogol chicken were 56.97 and 58.06 for male and female, respectively, whereas broiler meat showed 62.88. Collectively, these color properties were higher than Korean Ogol chicken.

Key Words: Korean Ogol chicken, Cross-bred Ogol chicken, Broiler, Biochemical properties

364 Carcass characteristics, total lipids and fatty acid composition of broilers fed conjugated linoleic, n-6 or n-3 polyunsaturated fatty acids. G. Cherian^{*}, M. P. Goeger, and L. K. Mathew, Department of Animal Sciences, Oregon State University, Corvallis, OR 97331-6702.

Two experiments were conducted to evaluate yield, proximate analysis and fatty acid composition of market-ready broiler carcasses from four different polyunsaturated fatty acids (PUFA) diet regimes. Diets in Experiment 1 contained conjugated linoleic (CLA), sunflower oil (SFO, n-6 PUFA), flax oil (FLO, n-3 PUFA) or fish oil (FO, long chain n-3 PUFA)

for a 42-day feeding trial. In Experiment 2, diets containing CLA, SFO, FO and animal fat (AF) were fed from Day 21 onwards. All the diets were isocaloric and isonitrogenous. Feeding CLA, n-6 or n-3 PUFA did not alter the carcass dry matter, crude protein, ash, total fat, breast and wing meat yields in either trial ($P>0.05$). However, thigh meat yield was lower in CLA, n-3 and n-6 PUFA than AF birds in Trial 2 ($P<0.05$). Feeding CLA resulted in lower live weight in both trials than other fat sources. The carcass fatty acid composition was altered by dietary treatments ($P<0.05$). The total content of c9t11 and t10c12 CLA isomers in carcasses constituted 3.3% and 8.3% in CLA-fed birds in Experiments 1 and 2, respectively ($P<0.05$). No CLA was detected in other treatments. Total saturated fatty acids were highest in CLA-fed birds with a concomitant reduction in monounsaturated fatty acids ($P<0.05$). Diets containing FO resulted in an increase in carcass C22:6n-3 and SFO resulted in an increase in C18:2 n-6 and C20:4n-6 ($P<0.05$). Total PUFA was lowest in the carcass lipids of CLA-fed birds ($P<0.05$).

Key Words: Broilers, Carcass characteristics, Conjugated linoleic acid, Polyunsaturated fatty acid, Carcass fat

365 Improved efficiency of intact crop removal for broiler breeder roosters and hens during manual evisceration. R. J. Buhr^{*1}, D. V. Bourassa², J. L. Wilson², and D. L. Fletcher², ¹USDA-ARS Russell Research Center, Athens, GA, ²The University of Georgia, Athens, GA.

Using a technique that demonstrated improved efficiency of intact crop removal for broilers, experiments were conducted to determine the effectiveness of the technique in 40 and 41-wk-old broiler breeder roosters and hens. The technique involved (after scalding defeathering, and cutting off the head) separating the neck parallel with the shoulders leaving the neck skin and crop intact. Individual carcasses were then suspended by their wings in a scale. The esophagus was grasped above the proventriculus within the thoracic cavity and the crop pulled through the thoracic inlet. The peak load required to remove the crop from the carcass was recorded, and it was determined if the crops removed were intact or broken. Body weight recorded at cooping was 4.8 kg for roosters and 4.2 kg for hens. Carcasses that had the neck separated prior to crop removal had significantly more crops removed intact (85%, 35 of 40) for both roosters and hens compared to only 20% removed intact (8 of 40 carcasses) for roosters and hens that the neck remained intact. In addition the load required to remove the crop was influenced by gender and treatment. Roosters required a higher load (5.7 kg) than hens (4.9 kg), and for roosters, separation of the neck resulted in a lower load (5.2 kg) to remove the crop than for carcasses that the neck remained intact (6.2 kg). The difference (0.2 kg) in the load recorded for crops removed intact and those that broke, was not significant ($P = 0.0511$). Separation of the neck prior to evisceration improved the efficiency of intact crop removal and thereby minimize the incidence of ruptured crop contents contaminating the carcass during evisceration.

Key Words: Crop removal, Broiler breeders, Evisceration, Neck separation, Max load

366 Effect of antioxidants on the consumer acceptance of irradiated turkey meat. E. J. Lee^{*1}, J. Love², and D. U. Ahn¹, ¹Department of Animal Science, Iowa State University, ²Department of Food Science and Human Nutrition, Iowa State University.

Irradiation is a method of controlling pathogens, but consumer response to irradiated meat is lukewarm because of quality changes in irradiated meat. Most consumer studies on irradiated foods were carried out only using questionnaires without presenting real irradiated products, and tests using real products are needed to determine correct consumer response to irradiated meat. The objective of this study was to determine consumer acceptance of irradiated raw and cooked turkey breast meat with added antioxidants. Nonirradiated and irradiated controls (no antioxidant added) and two antioxidant treatments (tocopherol plus gallate, tocopherol plus sesamol, 0.5 mM each) were prepared and irradiated at 3 kGy with an electron beam irradiator. Consumer acceptance and chemical characteristics of raw and cooked meat were determined after 4 d of storage at 4 C. Antioxidant had no effect on the production of sulfur compounds, color change, and off-odor intensity of irradiated turkey breast meat, but addition of sesamol+tocopherol or gallate+ tocopherol was effective in reducing TBARS values and aldehydes, especially under aerobic conditions. Consumers could not distinguish odor

differences between nonirradiated and irradiated cooked turkey meat because large amounts of sulfur compounds were volatilized during cooking. Consumers preferred the color of irradiated raw and cooked meat to non-irradiated meat because the pink color of irradiated meat looked fresher than that of non-irradiated meat. Packaging method was more important than antioxidant treatment in reducing irradiation off-odor because S-compounds produced by irradiation were easily volatilized under aerobic packaging conditions. Therefore, the combined use of aerobic packaging and antioxidants is recommended to control lipid oxidation and off-odor, and improve consumer acceptance of irradiated poultry meat.

Key Words: Antioxidants, Irradiation, Packaging, Turkey breast meat, Consumer acceptance

367 Correlated responses to divergent selection for ascites incidence in broilers: Evaluation of meat quality characteristics. J. M. Balog^{*1}, H. O. Pavlidis², R. E. Wolfenden², L. Stamps², K. E. Nestor³, S. G. Velleman³, W. E. Huff¹, G. R. Huff¹, N. C. Rath¹, and N. B. Anthony², ¹PP&PSR/ARS/USDA, Fayetteville, AR, ²University of Arkansas, Fayetteville, AR, ³The Ohio State University, Wooster, OH.

Intense selection for growth, breast yield and feed conversion in broilers has led to significant physiological changes. For example, the incidence of ascites and atypical poultry meat has been increasing. Ascites syndrome is currently being managed with strategies designed to slow early growth. Since the causes of atypical meat are unknown, methods of curbing its incidence have not been elucidated. With a significant portion of poultry meat being further processed, atypical poultry meat raises real economic concerns. Because of the implied metabolic nature of these disorders, one may speculate as to a potential link between them. The objective of this study was to determine how divergent selection for ascites impacts meat quality. Ascites susceptible (SUS) and resistant (RES) lines were derived from a commercial pedigree elite line (REL). In two floor pen trials, sex-separated offspring from the eight generation of REL, SUS and RES lines were reared under typical broiler management conditions. In each trial, birds were processed at 42 and 56 days of age. Carcass yield and meat quality parameters were evaluated at each processing. Meat quality parameters included muscle pH, muscle color, water holding capacity, drip loss, cook loss, and tenderness. Tissue samples from the pectoralis major were taken at 24 hr post mortem and slides were prepared to evaluate the extracellular matrix. There were significant sex differences for yield data, but no significant differences in meat quality parameters due to the sex of the birds. There were no significant line differences in muscle pH. At 42 d, significant line differences ($P=0.05$) were observed for shear value, a measure of tenderness. The SUS line had a high shear value (decreased tenderness) as compared to the RES and REL lines at 42 d. At 56 d, however, there were no longer any significant line differences for shear value. At 42 and 56 d, significant line differences ($P=0.05$) were observed for the L, a, and b values associated with muscle color. These results indicate that selection for ascites susceptibility impacts several parameters associated with meat quality.

Key Words: Meat quality, Ascites syndrome, Extracellular matrix, Carcass yield, Broilers

368 Endotoxin-mediated pink color defect in chicken breasts. J. R. Claus^{*1}, M. E. Cook¹, M. Yang¹, L. M. Sammel¹, J. Sagili¹, and Z. F. Oberman¹, ¹Department of Animal Sciences, University of Wisconsin-Madison.

Endotoxin (cell wall of *E. coli*) is known to induce the release of nitric oxide from macrophages and increase the circulating levels of nitrite and nitrate. Since the exposure to endotoxin is high during harvest of broilers prior to slaughter, we hypothesized that endotoxin exposure could adversely affect broiler meat color. Broilers (approx. 2.6 Kg live wt.) were injected with 1mg/Kg body weight, ip, with *E. coli* (O55:B5) endotoxin. Treated birds (TRT, n=8) were slaughtered at 16 hours after injection along with non-injected controls (CON, n=8). Birds were electrically stunned and bled. Breasts were deboned 45 minutes after stunning, placed in plastic bags and submerged in iced water. Chroma meter color (CIE L*a*b*) and reflectance (R) spectrophotometric measurements were measured on the lateral surface of the raw breasts on the day of harvest. Raw breast reflectance determinations included estimates of: deoxymyoglobin (%R474nm/%R525nm), metmyoglobin (%R572nm/%R525nm), oxymyoglobin (%R610nm/%R525nm). Boneless, skinless breasts were vacuum packaged and stored (2 C) overnight

before being cooked (80 C water, 77 C internal temperature). After heat processing, one randomly selected breast was selected from each bird and stored (2 C) for 1 or 9 days in the dark. Chroma meter measurements and reflectance measurements were obtained after exposing a cross section of the anterior area of the breast. Reflectance determinations included estimates of: nitrosylhemochrome (NIT, %R650nm/%R570nm) and nicotinamide hemochrome (NIC, %R537nm/%R553nm). No differences were found between CON and TRT in the raw breasts. However, the TRT breasts were darker (CIE L*) on both storage days and more red (CIE a*) on day 1 compared to CON. The pigment estimate for NIC increased from day 1 to day 9 in the TRT breasts but did not increase in the CON breasts. Endotoxin exposure may represent a new mechanism responsible for the sporadic pink color defect in uncured, cooked poultry.

Key Words: Broilers, Endotoxin, Breasts, Color, Pink defect

369 Effect of regular and modified starches on the structure of chicken breast meat batter. S. Barbut*, *University of Guelph*.

The effect of adding regular and modified starches (corn, potato) and a cold-swelling starch on the structure of white meat batters was studied. The cook loss was scientifically reduced by all starches (50-95% compared to the control), with modified starches performing significantly better than regular ones. All starches, except the cold-swelling starch, increased the cooked meat batter hardness, indicating their participation in the gel structure forming process. Light microscopy, using both regular and polarized light, revealed the transformation of native uncooked starch granules into the gelatinized form, except the cold-swelling starch that was already pre-gelatinized. Scanning electron microscopy assisted in studying the contribution of the starches to the meat gel structure and revealed close interactions between the meat protein matrix and some of the gelatinized starches after the cooking process.

Key Words: Chicken, Meat, Microscopy, Texture, Starch

370 Residue determination of some B-lactam antibiotics in table eggs. Rehab Mousa*, *Assiut University / Intercova*.

For determination of ampicillin, amoxycillin and ceftiofur (a third generation cephalosporin) in egg yolk, a high-performance liquid chromatographic (HPLC) method was developed. Antibiotic residues were extracted in acetonitrile and fat was excluded by filtration and evaporation. Antibiotics were separated by ion-paired HPLC on a phenyl column with ultraviolet detection. Results were compared with those of a diffusion test. A relationship between HPLC profiles and the microbiological sensitivity tests showed that the HPLC method was a sensitive and specific tool for residue estimation.

Key Words: Antibiotics, Eggs, Residue

371 Effects of refrigerated holding time on pH and tenderness of commercially marinated broiler breast parts. Y. C. Chen* and T. C. Chen, *Mississippi State University, Mississippi State, Mississippi*.

Tenderness is one of the most important palatability factors regarding meat acceptance (Miller et al., 1995). Several reports have shown that

4 to 6 hr of postchilling time is required for tenderness development of chicken meat (Goodwin, 1984; Lyon et al., 1985; Shelton, 1985). Little or no report was available on the tenderness of commercially marinated broiler breast parts during refrigerated storage.

Commercial marinated chicken breast parts were obtained from a processing line and held at refrigerated temperature (4+1°C). The pH values from breast meat and drip collected from the meat were measured daily for 4 days. For each 24 hr of storage, 8 pieces of breast parts were flour-predusted, battered and re-floured before frying in a commercial style deep-fat fryer at 168.3°C for 12 min (Yang and Chen, 1979). After cooling for 20 min, Warner-Bratzler (WB) shear values were obtained from the fried breast meat. The measurement for the WB shear values were taken from the parallel muscle fiber orientations. Data were analyzed statistically.

The pH of breast meat increased (P<0.05) continuously for 2 days during refrigerated holding while the drip pH decreased (P<0.05) during this period. Holding marinated meat parts for 2 days increased (P<0.05) the tenderness of breast meat as shown by lowered (P<0.05) WB shear readings. The largest (P<0.05) change in pH value and WB shear value were noted after 1 day of marinating. Results also showed that the drip pH values decreased with the holding time. This rapid drop (P<0.05) in drip pH values occurred after 1 and 3 days of holding storage in the refrigerator.

Data suggested that a storage time of 2 days in the refrigerator should be considered for commercially marinated chicken breast parts prior to the deep fat frying.

Key Words: Commercially marinated chicken breast parts, Tenderness, pH, WB shear value, Storage time

372 Effects of monensin and sodium chlorate on *Salmonella* *Infantis* colonization in broilers. G. Kumar, S. K. Varghese*, R. M. Fulton, and E. T. Ryser, *Michigan State University, East Lansing, MI*.

Two hundred and ten *Salmonella*-free broilers were raised on feed with or without monensin. All chicks were orally infected on day 3 with *S. Infantis* at 10⁸CFU/bird. Caecal colonization by *S. Infantis* was evaluated on days 7, 10, 14, 21, 28, 35, and 42. Both groups had similar caecal concentrations of *S. Infantis*, indicating that monensin was not an effective means of reducing *S. Infantis* colonization. Next, 150 *Salmonella*-free broilers were divided into four groups, three of which received a commercial sodium chlorate solution days 10, 20, and 38 for four consecutive days with the last group given no sodium chlorate treatment. All chicks were orally infected on day 3 with *S. Infantis* at 10⁸CFU per bird. Caecal colonization and liver invasion by *S. Infantis* were assessed on days 7, 10, 14, 17, 20, 24, 27, 30, 38, and 42 with fecal swab samples also analyzed on days 11, 12, 13, 15, 16, 18, 19, 21, 22, 23, 25, 26, 28, 29, 39, 40, and 41. Birds receiving sodium chlorate on days 10 and 20 yielded significantly lower caecal populations of *S. Infantis* up to 7 days after treatment (P<0.05) compared to the untreated control group. No significant reduction of *Salmonella* was observed in birds treated with sodium chlorate on day 38 and in the liver invasion. However fecal shedding of *S. Infantis* decreased 2.0 to 3.5 logs three to four days after treatment with sodium chlorate on days 10 and 20.

Key Words: *Salmonella* *Infantis*, Monensin, Sodium chlorate, Broilers