

M41 The effects of DDGS inclusion on pellet quality and pelleting performance. A. C. Fahrenholz*^{SC}, K. C. Behnke, and L. J. McKinney, *Kansas State University, Manhattan.*

A set of experiments was conducted to determine the effects of distillers dried grains with solubles (DDGS) on pellet quality and pelleting performance when used in corn-soy diets. All batching and mixing, processing, and subsequent testing was completed at the Department of Grain Science Feed Processing Center at Kansas State University. Observations on the viability of using DDGS were based on pellet durability index (PDI), energy usage measured in kilowatt-hours per ton (KWH/ton), production rate, and bulk density. In the pilot experiment DDGS were added to a non-nutritionally balanced diet as a replacement for corn at levels of 10%, 20%, 30%, and 40%. There were no observed significant differences in pellet quality across all levels of DDGS addition, but there were differences in production rate and bulk density. In the second experiment DDGS were added to a formulated diet at levels of 10%, 20%, 30%, and 40%, and each was compared to a control diet. In this experiment all ingredients were varied to retain nutritionally similar diets. In this case energy consumption showed no significant differences among treatments, while pellet quality, throughput, and bulk density all showed significant differences. In the final experiment DDGS were pelleted and then reground and added at levels of 10%, 20%, and 30% to a formulated diet. These diets were then pelleted and compared to a control diet with no added DDGS and to diets with unprocessed DDGS added at the same levels. At levels above 10% the diets containing unprocessed DDGS had significantly lower pellet quality than the control, while the diets containing pelleted and reground DDGS showed no significant difference from the control at any level. Significant effects were also observed for production rate, energy consumption, and bulk density. The researchers concluded that the use of standard DDGS in pelleted feeds is certainly feasible, and although pellet quality may be significantly lower for feeds containing DDGS, the practical value is likely not affected. Further, the data demonstrates some benefits of using DDGS that have been pelleted and reground.

Key Words: DDGS, pelleting, PDI, throughput, reground

M42 The interactive effects of glycine, creatine, and fishmeal supplementation to corn-soybean meal diets on broiler growth performance. A. Waguespack*^{SC}, T. Bidner, and L. Southern, *Louisiana State University, Agricultural Center, Baton Rouge.*

Two experiments were conducted to evaluate growth performance of Ross x Ross 708 broilers fed supplemental Gly, creatine, or fishmeal (FM) in corn-soybean meal (C-SBM) diets. Both experiments were conducted in brooder batteries from 0 to 18 d posthatching. Treatments had 6 reps with 6 birds per pen. In both experiments, all diets were formulated to provide 1.27% standardized ileal digestible Lys. In Exp. 1, dietary treatments were: control (C), C + 0.283% Gly, C + 0.05% creatine, C + 0.11% creatine, and C-SBM + 3% FM. The addition of FM increased ($P < 0.10$) gain (ADG) and the Gly addition tended to increase ADG compared with broilers fed the C diet. Gain:feed (GF) was increased ($P < 0.04$) by the Gly addition, both creatine levels, and by FM compared with the C diet. In Experiment 2, the purpose was to determine the additive effects of supplemental Gly, creatine, and FM. The dietary treatments were control (C), C + 0.357% Gly, C + 0.05% creatine, C-SBM + 3% FM and all possible 2 way combinations. The data were analyzed as three 2x2 factorially arranged experiments (Gly x FM, Gly x creatine, and creatine x FM). In the Gly x FM analysis, FM increased ($P < 0.02$) ADG and feed intake (ADFI), and Gly increased (Gly x FM, $P < 0.05$) GF more in broilers fed the C diet than in those fed the diet with FM. In the Gly x creatine analysis, creatine increased ($P < 0.05$) ADG, and Gly increased (Gly x creatine, $P < 0.08$) GF in broilers fed the C diet but not in those fed the diet with creatine. In the creatine x FM analysis, FM increased ($P < 0.02$) ADG and ADFI. In general, there was an increase in ADG and GF in broilers fed FM compared with those fed the C diet, but there was no further increase in these responses by addition of Gly or creatine to the diets with FM. The individual or combined additions of Gly and creatine increased ADG and GF to levels that were not different from those of broilers fed the diet with FM. These data suggest that FM increased growth performance of broilers and that all or part of this response is due to the FM providing Gly and creatine.

Key Words: broilers, glycine, creatine, growth

Processing and Products / Pathology / Physiology

M43 Comparison of organ weights of two strains of broiler chickens. O. M. Sogunle*, O. T. Sonubi, L. T. Egbeyale, O. O. Adelaye, and A. O. Fanimu, *University of Agriculture, Abeokuta, Ogun State, Nigeria.*

This study was conducted to compare the organ weights of Arbor acre and Marshal MY strains of broiler chickens at both starter and finisher phases. A total of 198 a-day old broiler chickens (99 birds per strain) were used in the experiment which lasted 28 days (1-28days) for the starter and 28 days (29-56days) for the finisher phases, respectively. The birds were replicated thrice to contain 33 birds per replicate. The data obtained were subjected to a t-test at 5% level of significance. The results showed that live weights of the birds increased ($P > 0.05$) with age but higher in Arbor acre (1.33) at the finisher phase. However, the dressing percentage ($P > 0.05$) gave higher values of 72.5 and 85.5 for Marshal MY strain at the starter and finisher phases, respectively. In addition, Marshal MY strain had the higher percent liver values of 2.66 and 2.18 at both starter and finisher phases, respectively but showed

significant ($P < 0.05$) difference only in the starter phase. It was concluded that Marshal MY strain is a better strain to Arbor acre when the dressing percentage is considered in poultry meat production.

Key Words: Marshal MY, arbor acre, organ weights, liver, dressing percentage

M44 Cacass evaluation of finishing broilers fed fermented cocoa bean shell-based diets. A. O. Akinsoyinu*¹, M. D. Olumide², and R. A. Hamzat³, ¹Department of Animal Science, University of Ibadan, Ibadan, Oyo State, Nigeria, ²Kolmat Farms Limited, Erunmu, Ibadan, Oyo State, Nigeria, ³Purdue University, West Lafayette, IN.

Proper handling of many agro-allied by-products has the potentials of enhancing their utilization as feed ingredients. Cocoa bean testa constitutes economic waste in that the cocoa industries in Nigeria invest huge

amount of money in disposing it. Theobromine is an established anti nutritional factor in cocoa bean testa. Hence this study focused on evaluating the effect of fermentation on the carcass of finishing broiler.

Three hundred and seventy five (375) broiler chickens were randomly allotted to five dietary treatments replicated thrice in a completely randomized design. The dietary treatments were: A (0% CBT –control); B (5% fermented CBT); C (10% fermented CBT); D (15% fermented CBT); and E (20% fermented CBT). After feeding the birds for eight weeks, ten finished broilers per replicate were randomly selected for carcass evaluation. The parameters studied were: plucked, eviscerated, visceral organ, dressed, breast, drumstick and thigh weights. The breast, dressed, drumstick, head, leg neck, gizzard, liver heart and thigh percentages were also determined. Significant differences ($P < 0.05$) occurred in all carcass parameters studied in all the diets. The noticeable trend in the result indicated that fermentation of the cocoa bean testa, enhances the carcass values of finishing broilers.

Key Words: fermentation, cocoa bean testa, broilers, carcass evaluation

M45 Evaluation of a live *Salmonella* vectored coccidiosis vaccine with TRAP Upstream (TRAP US) and CD 40L epitopes in broilers.

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Coccidiosis is caused by parasites of the genus *Eimeria*, belonging to Phylum Apicomplexa. EmTFP250 is a high molecular mass, asexual stage antigen from *Eimeria maxima* (*E. maxima*) strongly associated with maternal immunity in newly hatched chickens. Cloning and sequence analysis predict the antigen to be a novel member of the Thrombospondin-related anonymous protein (TRAP) family. Members of the TRAP family are microneme proteins, associated with host cell invasion and apicomplexan gliding motility. Three novel attenuated *Salmonella* Enteritidis strains (Δ SE) expressing TRAP oligopeptides in association with a potential immune-enhancing CD 40L sequence, on the outer membrane protein LamB, were developed. Broiler chickens were grouped based on treatment and 10^8 cfu/bird of one of three sequences, or vehicle alone, was orally administered to each group. At 21d of age, all groups were challenged with 10^4 sporulated oocysts of *E. maxima* orally. The mortality at 5d post-challenge was: TRAP -7/43 (16.3%); TRAP US-1/46* (2.2%); TRAP Downstream (DS) -6/43 (11%) and + control-10/46 (21.7%). These observations led to the conclusion that TRAP US may have a protective effect in *E. maxima* infected birds. To evaluate the efficacy of TRAP US as a potential vaccine candidate, a similar study was conducted based on the lines of the previous experiment. Broilers were orally vaccinated with 10^8 cfu/bird vehicle with TRAP US and CD 40L or sham vaccinated with saline. Coccidia challenge was performed with sporulated oocysts of *E. maxima* (10^5 oocysts/bird) at 3 wk of age. Body weight gain and lesions were evaluated 7 d post-challenge. Immunized birds, with an ~31%* reduction in weight gain when compared to the controls, showed marked improvement in performance. Further, in a second trial, mortality in the vaccinated birds (6/48)* was significantly lower than the controls (17/50) and performance was better in the vaccinated birds, even though not significant. These three studies underscore the potential of EmTFP250 as a candidate for a recombinant vaccine targeting coccidiosis in chickens. (* $p < 0.01$ as compared to control).

Key Words: *Eimeria*, *Salmonella*, coccidiosis, apicomplexa, TRAP

M46 Effects of supplemented arginine and antioxidant vitamins on xanthine- and NADH-oxidase activities in the lung of hypoxic broilers. J. Bautista-Ortega*^{SC}, E. A. Ellis, and C. A. Ruiz-Feria, Texas A&M University, College Station.

Two trials were ran to study the effects of supplemented arginine (Arg) and antioxidant vitamins (E and C) on Xanthine- (XO) and NADH-oxidase activities and nitrotyrosine in lung tissue of broilers exposed to hypoxia (simulated 10000 ft). They were kept in wire cages with continuous light and free access to feed (ME 3200 kcal/kg and CP 23%) and water. In both experiments, chicks were assigned to 3 dietary treatments: CTL (corn-soy), HA (CTL + Arg 0.8%) and AEC (HA + vitamin E 200 IU /kg + vitamin C 500 mg /kg). Chicks were kept in normoxia for 4 days and then exposed to hypoxia for 38 days (trial 1, n=60) or from day 7 to 28 (trial 2, n=51). Five additional control birds were raised in normoxia and fed the CTL diet. Weekly hematocrit, right ventricle/total ventricle weight ratio (RV/TV), heart rate, S-wave amplitude ECG and PHS incidence were measured. In trial 1, lung samples were collected from 3 6-wk-old birds per treatment and from 5 normoxic broilers (2 10-day-old and 3 5-wk-old birds) fed the CTL diet. We made a non-quantitative cytochemical determination of xanthine- (XO) and NADH-oxidase (NDHO) activities with the CeCl₂ method, which detects H₂O₂. Nitric oxide (NO) was localized by the presence of nitrotyrosine. There were no differences in the variables measured in both trials. There were similar high XO and NDHO enzymatic activities in the lung tissue from broilers fed the 3 experimental diets as well as from the 5-wk-old normoxic broilers. We observed a low enzymatic activity in lung samples from the 10-day-old control broilers. To our knowledge, this is the first time that nitrotyrosine and H₂O₂ have been localized in broiler lung tissue in connection with XO and NDHO. NO bioavailability plays a key role in pulmonary hypertension syndrome and it is important to accurately determine its concentration and cellular localization. A quantitative study of enzymatic activity and nitrotyrosine will identify the effects of antioxidant vitamins and Arg at a cellular level in broilers younger than 6 weeks.

Key Words: nitrotyrosine, hypoxia, arginine, antioxidant vitamins, pulmonary hypertension syndrome

M47 Incubation temperature and post-hatch transport stress effects on innate immunity and heat shock response in commercial broilers.

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Manipulation of environmental conditions induces subsequent immune and stress responses. Heat shock proteins play a role in reaction to cellular stress and work with the innate immune system to maintain homeostasis. This study evaluated effects of embryonic incubation temperature and post-hatch transport stress on gene expression of heat shock protein 70 (Hsp70) and a defensin, gallinacin-2 (Gal2), in the intestine and immune organs of broilers. Cobb 500 eggs were incubated with the following shell temperatures during early and late incubation: low (L:36.7°C), standard (S:37.5°C), and high (H:39°C). Eggs were incubated at S from E8-14, and combinations of L or S during early (E0-7) incubation, and S or H during late (E15-21) incubation, yielding four incubation treatment groups: LH, LS, SH, and SS. Chicks were separated into two transport groups at hatch: control (1) and stressed (2), for 8 total treatments: LS1, LH1, SS1, SH1, LS2, SH2, SS2, and SH2. On d0, 4, and 6 post-hatch, bursa, spleen, thymus and small intestine

were collected from each treatment to evaluate Gal2 and Hsp70 expression. Changes in intestinal Gal2 expression were most responsive over time (temp x age) to LS treatment. Birds from LS incubation had the highest Gal2 expression at d0; however, expression was comparable to other treatments at d4 or d6. Control and stressed transport birds had similar Gal2 expression to d4 (transp x age), with an expression increase in stressed groups by d6. Immune organ expression of Hsp70 was comparable in the LH and SS group, which were both lower than the LS group. Incubation under LH conditions impacted Hsp70 expression the most dramatically (temp x age) with the lowest expression at d0 and an increase to d6, while other treatments decreased from d0 to d4 and increased to d6. Transport stress caused differential responses of incubation groups with increasing post-hatch age (temp x transp x age) in the intestine. Results suggest that stress-inducible proteins may be either protective or detrimental in response to external stressors, directly impacting overall post-hatch performance.

Key Words: incubation, heat shock protein, gallinacin

M48 Effects of *in ovo* injection of L-carnitine on subsequent broiler chick hatchability and growout performance. M. M. Keralapurath*^{SC}, E. D. Peebles, R. W. Keirs, A. Corzo, L. W. Bennett, S. K. Womack, and R. Pulikanti, *Mississippi State University, Mississippi State.*

The effects of *in ovo* injection of L-carnitine on hatchability and subsequent growout performance of 672 Ross x Ross broiler chicks from a young breeder flock were determined. Fertilized eggs were injected in the amnion with L-carnitine (0.5, 2.0, or 8.0 mg / 100 µl commercial diluent) on Day 18 of incubation using an Avitech Intellilab™ injector. Three control groups (non-injected, and injected with or without diluent) were also included. Incubation length (hatch time) was recorded every 4 h beginning at 468 h and ending at 516 h. Embryonic mortality and hatchability were examined, and on Days 0 and 3 posthatch, 2 birds from each of 4 replicate groups (tray levels) within each treatment were necropsied for collection of liver, yolk sac, and breast, pipping, thigh and gastrocnemius muscle samples. On Day 10 posthatch, liver, and breast, thigh and gastrocnemius muscle samples were also collected from 2 birds from each replicate group and weighed. Relative weights of the liver, yolk, and gastrocnemius muscle samples, and moisture contents of all the tissues sampled were determined. Mortality, BW gain and feed conversion were calculated at regular intervals through Day 10 posthatch. There were no treatment effects on embryonic mortality, hatchability, hatch time, or relative tissue weights. These results are in agreement with previous work conducted using SCWL eggs. However, on Day 3 posthatch, the 0.5 mg L-carnitine treatment resulted in a significantly higher moisture content of the pipping muscle when compared to the 8.0 mg treatment and the diluent-injected control group. *In ovo* injection of L-carnitine at 0.5, 2.0 and 8.0 mg / 100 µl did not influence embryogenesis, hatchability, or broiler chick performance through 10 d posthatch.

Key Words: hatchability, *in ovo*, L-carnitine, moisture, pipping muscle

M49 Blood, pipping muscle, and liver metabolic relationships in broiler embryos preparing for hatch. R. Pulikanti*^{SC}, E. D. Peebles, R. W. Keirs, L. W. Bennett, S. K. Womack, and M. M. Keralapurath, *Mississippi State University, Mississippi State.*

The developmental relationships between blood, liver, and pipping muscle compositions of broiler embryos during incubation were determined. Ninety eggs obtained from a commercial source were incubated on 3 replicate tray levels (30 eggs per tray) for 19 d. On Days 15 and 19 of incubation, 10 live embryos per tray level were necropsied to collect plasma, liver and pipping muscle samples. The liver and pipping muscle samples were analyzed for glucose, glycogen, fat, and protein concentrations, and plasma samples were analyzed for refractive index (RI), and glucose, lactate, triglyceride, protein, and calcium concentrations. Changes in liver and pipping muscle compositions between Days 15 and 19 have previously been reported. In the current study, increases in plasma triglyceride and lactate concentrations were observed between Days 15 and 19. On Day 15, RI was negatively correlated with liver glucose, pipping muscle fat and plasma lactate concentrations, and Day 19 RI was positively correlated with Day 15 plasma calcium concentration. Day 19 plasma triglyceride and Day 15 pipping muscle glycogen concentrations were positively correlated, and Day 15 plasma calcium concentration was positively correlated with Day 19 RI and liver protein concentration. Furthermore, on Day 19, plasma glucose was negatively correlated with liver glycogen concentration. These results suggest that the hydration status of Day 15 embryos, as reflected by RI, is inversely related to Day 15 plasma lactate, liver glucose, and pipping muscle fat concentrations, and that Day 15 pipping muscle glycogen is positively related to subsequent plasma triglyceride concentration on Day 19. Additionally, on Day 19, liver glycogen and plasma glucose concentrations are inversely related. This and previous studies suggest that plasma RI in a Day 15 broiler embryo may serve as an indicator of subsequent hatching success.

Key Words: broiler, embryo, metabolic profile, pipping muscle, plasma

M50 Small bird programs: Impact of phase-feeding and strain on yield, fillet dimension, and meat quality of broilers. V. B. Brewer*^{SC}, J. L. Emmert, J-F. C. Meullenet, and C. M. Owens, *University of Arkansas, Fayetteville.*

Phase-feeding (PF) has been effective at maintaining broiler growth while reducing production cost, but the impact on different broiler strains grown in a small-bird production scenario has not been assessed. An experiment was conducted to determine the effects of decreasing dietary amino acid (AA) levels using the PF approach on yield, fillet dimensions, cook loss, and tenderness of three commercial broiler strains selected for small-bird markets (40 d old). During PF, birds were fed one of two dietary treatments: diets with average industry nutrient levels, or diets with phased levels of AA. PF treatments were formulated to match the nutrient requirements at 18d (high nutrient) and 40d (low nutrient). High and low nutrient density diets were blended to produce rations containing AA levels that matched the predicted PF requirements over two-day intervals; diets were switched every other day. Treatments were replicated in 6 pens; each pen contained 15 males and 15 females. 180 birds per treatment (2 diets X 3 strains) were commercially processed at 40 and 42d. Breast fillets were harvested at 2, 4, and 6 h postmortem (PM). Muscle pH was measured at time of debone, and fillet dimensions (FD), color (L*a*b*) and pH were measured at 24 h. Fillets were cooked to 76 C and cook loss was calculated, followed by Meullenet-Owens Razor shear (MORS) analysis. Diet, strain and gender had little impact on fillet yield. Strain, gender, and debone hour had significant effect (P < 0.05) on FD. Strain A had significantly longer fillets than strain C, and B was intermediate. Strain A had significantly wider fillets than strains B

and C. There were no differences in FD due to PF; however uniformity was improved (indicated by SD and CV). Deboning early resulted in significantly shorter and narrower fillets. Strain and PF treatment did not affect pH, color, cook loss or MORS. Deboning at 2h PM resulted in higher MORS energy indicating decreased tenderness. The results of this study suggest PF does not adversely affect yield or meat quality of broilers in small-bird programs regardless of strain.

Key Words: broiler, phase-feeding, strain, fillet dimensions, tenderness

M51 Recovery of muscle proteins extracted from broiler dark meat by pH shifting processing. V. Moayedi Mamaghani*^{SC}, Y. Xu, and M. Betti, *University of Alberta, Edmonton, AB, Canada.*

Over the past 25 years, emphasis has been placed on improved distribution and marketing of further processed breast meat products. This has resulted in excess supplies and depressed returns for broiler dark meat. The major problems with broiler dark meat are color, higher fat content, and stability. One approach to increase the utilization of dark meat is to remove pigments and fat to make the resulting product more acceptable for the production of further processed meat products. The purpose of this experiment was to examine the use of alkali extraction, ranging from pH 10.5 to 12.0, to recover myofibrillar proteins from broiler leg meat. Meat was finely chopped with added water and proteins solubilized by adjusting the pH in 0.5 increments between 10.5 and 12.0 with 2 N NaOH. Following solubilization, the pH was adjusted to 5.2 with 2 N HCl to precipitate the proteins which were then centrifuged and recovered to determine protein yield, fat removal, total heme pigments concentration and protein denaturation measured as protein solubility. The experiment was replicated using 4 independent batches of meat (N = 16). The results indicated that protein yield (wet basis) increased from 81.3% to 94.2% with extraction pH ($p < 0.01$). A significant negative correlation was found between protein yield and total protein solubility ($r = -0.79$; $p < 0.001$), indicating that higher pH of extraction resulted in more denaturation. Total protein solubility had the lowest value at pH extraction of 12.0 (40.8 mg/g vs. 45.4, 63.2, 67.2 mg/g for pH 11.5, 11, 10.5 respectively; $p < 0.001$). Around 50% of the fat was removed from broiler dark meat by the extraction with no significant differences within treatments. On average, the fat content of the extracted meat was 3.0%. Total heme pigments content was decreased to values comparable to those found in the breast meat (0.6 mg/g).

Key Words: dark meat, pH shifting, alkali extraction, myofibrillar proteins, further processing

M52 Efficacy of biosealed for concrete™ against multiple strains of *Salmonella* spp. and their biofilms on concrete surfaces. D. M. Paiva*^{SC}, K. Macklin, S. Price, D. Conner, J. Hess, and M. Singh, *Auburn University, Auburn, AL.*

Salmonella is an important foodborne pathogen often associated with poultry and highly prevalent in poultry processing plants. In this study, efficiency of BioSealed for Concrete™ for prevention of bacterial attachment, colonization, and antimicrobial effects of this product on multiple strains of *Salmonella* (*S. Enteritidis*, *S. Kentucky*, *S. Typhimurium*, *S. Seftenberg* and *S. Heidelberg*) in concrete cement blocks was evaluated. Cement blocks were divided into four different treatment groups: A)

No Biosealed application, B) Biosealed applied before inoculation, C) Biosealed applied after inoculation, or D) Biosealed applied before and after inoculation. The cultures were prepared by inoculating *Salmonella* strains into brain and heart infusion broth (BHI) and incubating at 39 °C for 24 h. Cement blocks were inoculated by submerging in BHI broths containing one of the five *Salmonella* strains and incubated at 39 °C for 24 h (ca. 10⁹ CFU/ml). External surfaces of the blocks were swabbed using sterile swabs, which were placed in 10 mL peptone water (PW). The cement blocks were broken in half and interior surfaces were swabbed to determine *Salmonella* spp. levels. Following 24 h of incubation of XLD plates at 39 °C, survival population of *Salmonella* on internal surfaces varied among strains. On the external surface of cement blocks, significantly lower populations of all the five strains of *Salmonella* ($P < 0.05$) were observed for treatments C and D when compared to treatments A and B. When comparing treatments A and C, as well as groups B and D, Biosealed was shown to be efficient for biofilm removal on concrete surfaces. No significant difference was found when comparing groups A and B suggesting that the product has poor residual effect. Therefore, Biosealed for concrete is a potent antimicrobial but should not be substituted for good sanitation practices, nor should it be utilized as an isolated measure to control bacterial colonization on concrete surfaces.

Key Words: *Salmonella*, biofilms, concrete, sealer, antimicrobial

M53 Organoleptic and compositional effects of feeding distillers dried grains with solubles on broiler meat. R. E. Loar*^{SC}, M. W. Schilling, and A. Corzo, *Mississippi State University, Mississippi State.*

Recently, associated feed costs have reached record highs due to recent increases in ingredients used in diet manufacturing for broilers. As a result, there has been a gradual shift towards the use of alternative feedstuffs such as distillers dried grains with solubles (DDGS). In the current study, we evaluated the effects of feeding DDGS on meat quality and the consumer acceptability of broiler breast meat. A randomized complete block design with 12 replications per treatment (12 broilers/experimental unit) was used to determine the effects of DDGS inclusion on breast and thigh meat quality. Ross × Ross 708 males were grown on diets that contained either 0 or 8% DDGS. At 42d, birds were processed and boneless skinless breast meat and thighs were collected for evaluation from birds within each treatment group. Fatty acid profile and lipid peroxidation (TBARS) tests were performed on the thigh meat while the breast meat samples were evaluated for pH, color (CIE L*, a*, b*), cooking loss, shear force and taste panel data.

No differences ($P > 0.05$) were found in breast meat between treatments with regard to pH, cooking loss, shear force, breast meat color and consumer acceptability of texture. As far as flavor and overall acceptability were concerned, consumers preferred ($P < 0.05$) the control treatment over the DDGS treatment. However, in the sensory difference test, consumers could not distinguish ($P > 0.05$) between the DDGS and control treatments. The DDGS treatment showed some differences ($P < 0.05$) in fatty acid composition of the thigh when compared to the control. With higher percentages of linoleic and total polyunsaturated fatty acids it is possible that the DDGS treatment may be more susceptible to oxidation. Overall, the inclusion of 8% DDGS in the diet did not adversely affect the resulting broiler meat, and both treatments resulted in high quality breast and thigh meat.

Key Words: broiler, distillers dried grains with solubles, sensory testing

M54 A survey of the microbiological profile of chicken carcasses at the sell-by date. S. M. Russell*, *University of Georgia, Athens.*

A study was conducted to determine the differences in the microbiological profiles of chicken carcasses at their sell-by date. Groups (14) of carcasses (3 each with the same P-number, sell-by date, and label) were purchased from local retail outlets. Groups were separated based on label information. The groups included: 1) eight groups of normally produced (N) carcasses using antibiotics during growout and chemical disinfection during processing; 2) two groups of antibiotic free, normally processed (NAF) carcasses, 3) three groups of all natural, antibiotic free, all vegetable diet, normally processed carcasses (NAFAV), and 4) one group of all natural, free range, antibiotic free, organically grown and organically processed chickens (AFORFR). Carcasses were stored at 3°C until their sell-by date, then sampled by rinsing. Aerobic plate counts (APC), *E. coli* counts (EC), and psychrotrophic plate counts (PPC) were conducted. Log₁₀ APC for the N groups were 6.43, 7.51, 7.09, 5.88, 7.34, 6.65, 6.05, and 4.59, for the NAF groups were 6.18 and 7.40, for the NAFAV groups were 6.41, 6.03, and 5.53, and for the AFORFR group was 7.16. Log₁₀ EC for the N groups were 1.07, 0.03, 1.09, 0.64, 0, 0.51, 0.26, nad 1.88, for the NAF groups were 0 and 0.66, for the NAFAV groups were 1.72, 1.37, and 2.18, and for the AFORFR group was 0.76. Log₁₀ PPC for the N groups were 7.11, 7.98, 7.83, 7.77, 7.89, 7.52, 6.59, and 6.45, for the NAF groups were 7.14 and 7.53, for the NAFAV groups were 7.25, 7.77, and 7.24, and for the AFORFR group was 8.32. Chickens reared without antibiotics on all vegetable diets produced carcasses with significantly higher (P=0.026) *E. coli* counts (average of 1.76); however, these carcasses also had the lowest average APC's (average 5.99). It is possible that, because no antibiotics were used during growout, the potential for *E. coli* infections that cause air sacculitis and inflammatory process (IP) in these groups is increased. Interestingly, the chickens reared free range, organically with no antibiotics had significantly higher (P=0.0065) spoilage bacterial counts (8.32), but EC were fairly low (0.76).

Key Words: broiler, carcass, sell-by date, *E. coli*, psychrotrophic plate count

M55 A new method for analyzing yolk contamination in egg white preparations. W. Berry*, S. Oates, L. Stevenson, and P. Curtis, *Poultry Science Department, Auburn University, Auburn, AL.*

Yolk contamination impairs the functionality of egg white preparations and increases the potential for bacterial growth in egg white products. The usual upper limit for yolk contamination of egg whites at 0.05%. However, measuring the actual amount of yolk contamination is difficult. Current methods for analyzing yolk contamination in egg white are based on measurement of lipid. These methods are complex and error prone. They often require the use of toxic solvents or involve significant expense for purchase and maintenance of equipment. It is clear that a rapid, simple, accurate, and inexpensive method for measuring yolk contamination in egg white is needed for industrial applications. Objective: Develop a sensitive assay capable of detecting 0.01% yolk contamination in egg white. Methods: The assay is based on quantifying a yolk associated marker protein by an enzyme-linked immunoassay rather than by assaying yolk lipids. The initial challenge was to identify and evaluate candidate immunological reagents. The required range of avian-specific antibodies are not currently available,

so antibodies directed at other species had to be evaluated. The second problem was interference from the complex egg white matrix. It was desirable to avoid extraction steps for the sake of speed and simplicity of the assay in an industrial environment. Various reagents were tried for ameliorating interference from the egg white matrix. Results: Eventually two commercially available antibodies were found to be suitable for the assay and combination of reagents and procedures were found which reduced matrix interference to an acceptable level. An example of a typical assay result is presented in the table. Current efforts are directed towards refining the method to make it as simple, rapid, and robust as possible for use in industrial quality assurance programs. A provisional patent application protecting this technology was filed with the U.S. Patent and Trademark Office in late 2007.

Percent Yolk in Egg White

% yolk	0	.001	.01	.1	1
abs 405	.01	.024	.030	.114	.307

Key Words: yolk, egg white, contamination, assay, analysis

M56 Influence of water hardness on the ability of water to rinse bacteria from the skin of processed broilers. A. Hinton Jr.* and R. A. Holser, *Russell Research Center, Athens, GA.*

Experiments were conducted to examine the effect of water hardness on the ability of water to rinse bacteria from the skin of processed broiler chickens. Very hard water (200 ppm total hardness) was prepared by dissolving 0.38 g calcium chloride (CaCl₂) and 0.175 g magnesium chloride hexahydrate (MgCl₂·6H₂O) per liter of distilled water. Moderately hard water (100 ppm total hardness) was prepared by diluting 1 part very hard with 1 part distilled water, and distilled water was used as a soft water rinse. Skin samples were taken from breasts of broiler carcasses obtained from a local processing facility, cut into 1 g pieces, and stored at 4°C. Five consecutive 1 min rinses of skin samples were performed in 20 ml, fresh aliquots of distilled, moderately hard, or very hard water. Rinsed skin samples were stomached in a solution of 0.01 M potassium phosphate buffer with 0.025% ethylenediaminetetraacetic acid (EDTA) to recover bacteria remaining on the skin. Rinsates from stomached skin were decanted, and bacteria in the rinsates were enumerated on Plate Count (PC), Levine Eosine Methylene Blue (EMB), Campylobacter (CA), Pseudomonas (PS), and Staphylococci (ST) Agars. Results indicated that significantly (P < 0.05) fewer bacteria were recovered on CA and PS Agars from skin rinsed in distilled water than from skin rinsed in moderately or very hard water, and significantly fewer bacteria were recovered on EMB Agar from skin rinsed in distilled water than from skin rinsed in very hard water. There was no significant difference in the number of bacteria recovered on ST or PC agar from skin washed in distilled, moderately hard, or very hard water. Findings from these experiments indicate that water hardness can play a role in the ability of water to rinse away intestinal bacteria, such as campylobacters and Enterobacteriaceae, and spoilage bacteria, such as pseudomonads, from the skin of processed broiler chickens. Poultry processors may be able to reduce the number of these bacteria on processed poultry by monitoring and controlling the hardness of water used in processing operations.

Key Words: water hardness, bacteria, broiler skin