M7 Instrumental texture analysis of chicken patties elaborated with broiler breast fillets exhibiting Woody Breast characteristics
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Potential applications of chicken meat with woody breast (WB) condition in further processing products could provide processors alternatives to face this meat quality problem. The objective of this study was to evaluate the effect of the use of broiler breast fillets at varying degrees of WB severity on instrumental texture characteristics of chicken patties. A total of 54 breast fillets were collected from birds processed according to commercial practices and classified based on tactile evaluation in three WB categories (0 or 0.5 as normal-NOR; 1 or 1.5 as mild-MID, and 2.5 or 3 as severe-SEV). Instrumental compression analysis was performed to validate subjective scores. Nine treatments with six replicates of chicken patties were prepared: 100% NOR (T1), 66.67% NOR + 33.33% MID (T2), 66.67% NOR + 33.33% SEV (T3), 33.33% NOR + 66.67% MID (T4), 33.33% NOR + 66.67% SEV (T5), 100% MID (T6), 66.67% MID + 33.33% SEV (T7), 33.33% MID + 66.7% SEV (T8), and 100% SEV (T9). Chicken breast muscles (cranial region) were ground (3-mm plate), kneaded, formed (diameter: 87 mm, thickness: 15 mm; 85 g), vacuum packed (stored at -22°C), and grilled (core temperature reached 75°C). Texture profile analysis (TPA: hardness, cohesiveness, springiness, and chewiness) was performed using a texture analyzer (TA.XT Plus, Texture Technologies Corp.). Additionally, cooking loss, reduction in diameter and thickness were evaluated in cooked patties. Data were analyzed using an ANOVA with treatment factor fit as fixed effects. With exception to T1, T2, and T4, hardness, springiness, and chewiness of chicken patties decreased (P<0.05) as WB severity increased in the meat added to the mixture. Hardness, chewiness, and cooking loss presented a clear difference (P<0.05) among T1 (100% NOR), T6 (100% MID) and T9 (100% SEV). Cohesiveness, springiness, and reduction in diameter values varied (P<0.05) between the extreme treatments T1 and T9. These data indicate the use of broiler breast fillets with WB condition modifies significantly (P<0.05) instrumental texture characteristics of cooked chicken patties. However, the use of mixtures of chicken meat exhibiting normal and mild levels of WB severity could be considered by processors as an alternative in commercial chicken patty formulations.

Key Words: wooden breast, texture profile analysis, processing, poultry products, meat quality

M8 Meat quality attributes associated with Woody Breast and effect of location and freezing on fillet hardness
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Woody breast (WB) is a major myopathy in broilers characterized by hardness of the breast fillet and can be evaluated by human palpation with a severity scale of 0(normal) to 3(severe). The objective of this study was to determine instrumental and meat quality factors that are associated with WB scores that may potentially be used in sorting programs. Additionally, this study was to determine if there is a location effect (breast side) or effect of freezing on compression force (CF) of fillets. After commercial style processing and deboning (3 h postmortem), 207 breast fillets were collected and scored for WB. Thickness and length (cranial, caudal, and keel regions) of the Pectoralis major were measured with a caliper. CF was measured using Texture Analyzer II in four regions at the cranial part of the fillet on both the right(RS) and left(LS) sides. Color and pH were analyzed on the LS of the breast. The RS frozen at -20°C for 48 h and thawed for 24 h, and then CF was measured, along with cook loss, MORS, and BMORS. Pearson correlation coefficients and ordinal logistic regression were used. Paired t-tests were utilized to address the effect of side and effect of freezing on CF. Measurement responses were compared for the four categories of WB(0=normal, 1=mild, 2=moderate, and 3=severe) using Fit Model with JMP. The length measurements on the breast showed no difference (P>0.05) and small correlation. However, the thickness is correlated moderately (r=0.69) and could differentiate between the scores. A thicker breast denotes a higher severity of WB. In addition, CF of LS and RS sides of the breast fillet were significantly different (P<0.01), with the RS of the breast showing higher force. Freezing significantly decreased (P<0.05) CF of thawed fillets compared to pre-frozen fillets. Cook loss increased as severity for WB increased (P<0.05). Peak counts for MORS and BMORS were higher for the severe compared to the others (P<0.05). In conclusion, the thickness of the breast fillet may potentially be used for sorting purposes, possibly in combination with other sorting criteria. Freezing the breast meat improves the softness of the WB and differences exist between right and left fillets.

Key Words: Woody breast, Compression force, fillet thickness, location, freezing

M9 The effect of multiple levels Arginine and/or vitamin C on performance, meat yield and incidence of white striping and woody breast when supplemented in combination with low digestible amino acid grower diets
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Prior research indicates feeding vitamin C, a higher ratio of dArg: dLys or a grower diet with a lower digestible AA (dAA) content can potentially mitigate the presence and severity of white striping (WS) and woody breast (WB) in high-yielding broilers. The objective of the current study was to define the optimal level of dArg: dLys and vitamin C that could alter the incidence and severity of WS and WB. A total of 2,240 broilers were distributed between 7 treatments consisted of 10 replicate pens with 32 broilers per replicate. Relative to a commercial-type Control diet (Trt 1) that contained a four-phase program (starter, grower, finisher, and withdraw), the following nutritional strategies were investigated: Trt 2. Reduce the dAA in only the grower phase by 15%, and feed the same starter, finisher, and withdraw diets as in Trt 1; Trt 3. As 2, with a dArg: dLys of 124%; Trt 4. As 2, with a dArg: dLys of 136%; Trt 5. As 2, with 100 ppm Vitamin C; Trt 6. As 2, with 200 ppm Vitamin C; Trt 7. As 2, with 124 dArg: dLys and 100 ppm of Vitamin C. Performance was measured on days 15, 29, 43, and 50. On d 51, 9 birds per pen were processed to obtain boneless, skinless breast meat yields and breast fillets were examined for the incidence and severity of WS and WB. Comparing the Trts 1 and 2, reducing the amino acid density in the grower phase negatively impacted BW and FCR (p<0.011). At the end of the growout (d 50), no differences in BW were observed (p = 0.547); however, the two supplemental dArg levels and the highest vitamin C level gave the best reduction in FCR when compared to Trts 1 and 2. No differences were observed in Pectoralis major weights (p = 0.232) or yield (as a % of live weight; p = 0.149). Compared to Trt 1, the WS score was reduced by 13 and 9% in Trts 3 and 7, respectively (p<0.011). Similarly, the WB score was reduced by 19 and 18% in Trts 3 and 7, respectively (p<0.006). While the reduction in dAA in the grower phase had no effect on WS or WB, increasing the dArg: dLys through L-Arg supplementation did increase the proportion of 0/1 scores (p = 0.049). These data suggest that nutritional strategies can be potentially be used to mitigate the severity of WS and WB in high-yielding broilers while maintaining performance.

Key Words: Broiler, Arginine, Yield, Breast

M10 Application of advanced technologies to analyze modern meat quality issues, such as Woody Breast
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Recently developed meat quality problems in broilers, such as Woody Breast, highlight the lack of quantifiable, nondestructive research tech-
niques that can be used to effectively analyze emerging issues. Research was conducted to determine the application of highly advanced technologies, such as Magnetic Resonance Imaging (MRI), as accurate and exploratory quality measurement method for not only Woody Breast, but also future meat quality issues.

A pilot study was performed using a severely affected woody filet and a non-affected filet. These were scanned using a 7-Tesla Siemens MRI device for 45 minutes. Filets were scanned at every 4mm and images were generated using T1 and T2 spin relaxation times. Images were enhanced using ImageJ and showed visible differences between woody and normal filets. T1 relaxation times were significantly different for woody and non-woody filets at a significance level of p<0.05. The success of this study prompted further investigation to increase sample sizes and examine mildly affected filets. Three filets were selected as representatives of non-woody, mildly woody, and severely woody breasts and scanned using the methodology given above. A total of 9 samples were analyzed during the study. Significant differences in T1 and T2 relaxation times between different woody breast severities was determined using ANOVA with Tukey’s LSD at p<0.05.

Pilot study data indicated that average T1 relaxation time of woody breast was 845.88 ms, while the average T1 for the normal filet was 932.79 ms. These results demonstrate the potential to use highly advanced technologies, such as MRI, to study meat quality.

Key Words: Woody Breast, Magnetic Resonance Imaging, meat quality, MRI, Wooden Breast

M11 Investigating a Bioactive Ingredient with the Potential to Reduce Wooden Breast Toughness during Further Processing Meredith Johnson*,†, Avery Smith, Jasmine Kataria, Ivey Wise, Amit Morey Auburn University

The poultry industry is facing a meat quality issue known as wooden breast (WB) which renders the meat tough in texture and leads to consumer complaints and economic losses. The poultry industry does not have any solution to improve the texture of WB meat and utilize it in whole muscle products. Therefore, research was conducted to determine the effect of adding external proteolytic enzyme to improve WB filet texture. Severe WB fillets were obtained from a local processor. Fillets (n=5 per trial; 3 trials) were grinded separately and divided into 25-gram containers. A commercially available proteolytic enzyme was dissolved in water to obtain a concentration of 2.5 mg/mL, 5 mg/mL, and 10 mg/mL from which 1 mL was incorporated in ground WB samples (n=3/treatment x 3 trials). Ground WB without treatment and added with 1 mL of water served as control samples. All the samples were placed at 4°C for 24 h and were frozen at -80°C. Ground WB samples (n=3/trial) were also frozen immediately upon grinding to determine initial collagen content. Samples were analyzed for total, soluble, and insoluble collagen content. Data was analyzed using one-way ANOVA with Tukey’s LSD to determine significant differences.

Data indicated that the total, soluble, and insoluble collagen content in wooden fillets was 19.5, 4.9, and 14.6 mg/g, respectively. Insoluble collagen content reduced significantly to 5.8 mg/g after enzyme treatment (10 mg/mL). Thus, there is potential to improve texture of WB meat using proteolytic enzymes and help the poultry industry to utilize WB meat.

Key Words: protease, collagen, Wooden Breast, texture

M12 Acoustic Signatures of Woody Breast: Converting Woody Breast Scans into Sound as a Simple Diagnostic Tool Divya Srinivasan*,†, Amit Morey* Johns Creek High School; †Auburn University

Wooden breast is a novel meat quality issue leading to significant consumer complaints. One of the methods to reduce the incidence of woody breast is to detect and remove the affected fillets from the processing line. At present, hand-palpation is the standard method used to detect woody breast in the industry, however advanced technologies such as ultrasound, elastography and MRI, generally used for tumor detection, are being studied at Auburn University. The images and scans obtained from the highly sophisticated methods are difficult to read and analyze, limiting the methods to lab scale. In order to make these techniques available in the field, there is a need to simplify the analysis of the images and make instant decisions.

For the High School Science Fair Project, a research was conducted to determine if ultrasound, elastography and MRI scans can be converted to sound and that the breast fillets with varying woody breast severities have different acoustic signatures.

Freshly deboned broiler (8-9 lbs live wt.) breast fillets with varying degree of woody breast severities were procured from a commercial slaughter facility. Each fillet was scored as below: 0-normal fillet; 1-mildly woody; 2-medium woody and 3-severe woody. Samples were subjected to ultrasound and elastography analysis at Auburn University Veterinary Clinic. Scans from each fillets were imported to a freely available software called PhotoSounder (1.9.0 Demo) and translated into sound frequency profile of each image and flipped 270°. Sound patterns were generated for each fillet scan and heard to detect differences.

The sound frequency profile of normal and severe woody breast fillets exhibited distinct patterns. Sound patterns generated from the various woody breast scan indicated audible differences. The novel proof-of-concept research can be used as a simple tool in addition to advanced technologies to detect woody breast by field personnel without significant training.

Key Words: Elastography, Woody Breast, Sound, Data, Detection

M13 “Functional Ice”, a Novel Sustained Antimicrobial Release Mechanism, to Improve Salmonella food safety of raw poultry parts during storage Jasmine Kataria*,†, Meredith Johnson, Avery Smith, Laura Bauermeister, Amit Morey Auburn University

Antimicrobials used during poultry processing do not suppress Salmonella during storage and transportation thus potentially increasing food safety risks. There is a need to develop novel methods to deliver antimicrobials to ensure safety of raw poultry during storage and transportation. A novel sustained antimicrobial delivery mechanism termed “Functional Ice” (FICE) (Patent Pending) was developed and validated against Salmonella on raw chicken thighs during storage. Aqueous solutions of sodium tripolyphosphate (2.5% and 5% w/v) and sodium lactate-sodium diacetate (1% and 2.5% v/v) were frozen to make FICE while tap water ice acted as a control. Nalidixic acid resistant (35µg/ml) Salmonella Typhimurium suspensions were inoculated (100 uL) on raw boneless, skinless thigh meat pieces, allowed 1 h attachment time (final inoculum 10^7 CFU/sample), placed in FICE treatments and sampled at 0, 12, 24, 36 and 48 h. Samples (n=3/sampling point) were individually rinsed (1 min) with 30 ml of phosphate buffer saline solution, rinsates were serially diluted, spread plated on XLT4 with nalidixic acid (35µg/ml) and incubated at 42°C for 24-32 h. Viable Salmonella colonies were reported as log CFU/mL of rinseates. Significant differences among treatments were determined using ANOVA with Tukey’s LSD at p<0.05. Salmonella levels were reduced (p<0.05) by >1 log within 12 h by FICE made with STPP 2.5 and 5% compared to ice during the 48 h refrigerated storage. FICE made with sodium lactate-sodium diacetate treatments were not as effective as STPP in reducing Salmonella. FICE demonstrated the potential to improve food safety during raw poultry storage.

Key Words: Functional Ice, Salmonella, storage, transportation, poultry

M14 The antimicrobial effects of Defenstat™ against Salmonella Typhimurium on boneless skinless ground chicken breast Clarissa Harris*,†, Sally Williams University of Florida

One of the most effective approaches for reducing consumers’ risk of foodborne illness is to treat the processed poultry products with antimicrobials. Biological interventions are efficient solutions for reducing foodborne ill-
M15 Evaluation of the efficacy of electrochemically activated water against Salmonella Heidelberg isolates Daiane Wilsmann*GS, Daiane Carvalho, Abrahão Martins, Gabriela Zottis, Thales Furian, Vladimir Nascimento Federal University of Rio Grande do Sul

Salmonella spp. is among the microorganisms of greatest concern in poultry and public health. According to 2017 data from the European Union Rapid Alert System for Animal Food and Feed (RASFF), S. Heidelberg was the most isolated serovar in poultry meat and poultry meat products exported to the EU until October 2017, representing more than 12% of all Salmonella isolates during the above mentioned period. Electrochemically activated water (EA) is a technology that makes it possible to produce a biocide from water, salt and electricity. Through membranes electrolysis, EA generators produce free radicals, hypochlorous acid and free chlorine, which are considered non-toxic and biodegradable compounds. In this context, the objective of this study was to evaluate the efficacy of EA against 30 S. Heidelberg isolates of avian origin. Concentration of 50 ppm of free chlorine was used at 4°C with the contact times of five and fourth minutes (simulating chiller conditions) and 200 ppm at 25°C with the contact time of ten minutes (simulating disinfection conditions) were tested. The viable cells count was performed using the dilution technique and Drop-Plate counting. The data were analyzed by T student test (PASW Statistics 18). The mean bacterial count of the treatment at 50 ppm with five minutes contact was 2.6 x 10^4 CFU / mL, and at fourth minutes obtained a count of 1.1 x 10^4 CFU / mL (p<0.05). The treatment at 200 ppm with 10 minutes contact reduced totally the bacterial count on 26 isolates. In four samples the mean bacterial counts showed a significant difference between treatments of 200 ppm for 10 minutes (1.3 x 10^2 CFU / mL) when compared to the control group (7.2 x 10^4 UFC / mL). These data show that a longer contact time reduces the microbial load demonstrating the importance of the permanence time of the microorganism in contact with the EA. All evaluated treatments resulted in a decrease in the mean bacterial count of the 30 strains of Salmonella Heidelberg. It was concluded that, in general, 50 and 200 ppm EA was efficient against S. Heidelberg, showing that this product has an antimicrobial potential to be used at the food industry.

Key Words: SalmonellaHeidelberg, ElectrochemicallyActivatedWater, Poultry

M16 Evaluation of poultry water treatments during feed and water withdrawal on water usage and Salmonella prevalence in broilers Caitlin Harris*GS, Ming Teo1, Larry Lu1, Connie Mou1, Kevin Gottilla1, L Bartenfeld1, Dianna Bourassa1, Brian Fairchild1, Brian Kiepper1, R Buhr12 University of Georgia; 1USDA-ARS US National Poultry Research Center; 2Auburn University

Acidic water treatments during feed and water withdrawal were evaluated as a potential preharvest Salmonella intervention. The hypothesis for the study was the addition of acidified water treatments during feed and water withdrawal should impact the recovery of Salmonella from broiler crops and ceca. Previous data indicates that adding 50 ppm hydrogen peroxide in combination with citric acid (pH 5.0 or 6.2) to drinker lines during feed and water withdrawal may have depressed the number of Salmonella positive crops and ceca. On day 1, 6 wk old broilers were challenged with 1.0 mL of 10^6 CFU Salmonella Typhimurium marker strain, distributed into 12 pens (12 broilers/pen, 144 total), and provided feed and water ad libitum. On day 3 post challenge, pens were connected to carboys containing treatment or control (tap) water. Treatments included: hydrogen peroxide (50 ppm) pH adjusted to 5.0 or 6.2 with citric acid and sodium bisulfate (pH 3.2). Feed consumption and water usage were monitored by weight at beginning and end of trial. The 3 pens/treatment were assigned to one of the following feed/water withdrawal times: 12 h feed/ 6 h water withdrawal, 6 h feed/ 0 h water withdrawal, 6 h feed/ 0 h water withdrawal, or 0 h feed/ 0 h water withdrawal. On day 6 after feed/water withdrawal, 6 broilers/pen were euthanized and crops and ceca were aseptically collected for microbiological analysis. Crops and ceca with buffered peptone water were stomached and the rinseate streaked onto brilliant green sulfur agar plates with nalidixic acid (200 µg/mL); plates and samples were incubated at 37°C for 24 h. Plates were restreaked from enriched rinseate if direct plating was negative then incubated. One-way ANOVA was used for analysis of water usage and feed consumption data and no significant differences were found. For Salmonella data, Fisher’s exact test was used for statistical analysis and the water treatments did not differ significantly from the control for both crops (65% +) and ceca (79% +). There was significantly lower Salmonella recovered for enriched crops between full fed vs. 12 h (P=0.0032) and 6 h (P=0.0010) feed withdrawal. Results indicated that the acidic water treatments did not impact feed consumption, water usage, or Salmonella recovery from the crops or ceca after feed and water withdrawal.

Key Words: Salmonella, broilers, water, withdrawal

Metabolism & Nutrition - Enzymes

M17 Effects of mineral level, nutrient density, and phytase level on broiler performance and breast meat yield Austin Jasek*GS, Kyle Smith1, Jon Broomhead2, Jason Lee1 Texas A&M University; 2Agrivida

The objective of the current study was to evaluate the impact of mineral level, nutrient density, and phytase concentration on male broiler performance and breast meat yield. A total of 2,304 Ross 708 male broilers were randomly assigned to 8 dietary treatments consisting of 8 replicates pens of 36 broilers each. The experiment was a 2 x 2 x 2 factorial design that included two nutrient densities (control and reduced density with a re-duction of 2, 4, and 6% amino acids and 1, 2, and 3% in energy for the starter, grower, and finishers, respectively), two levels of phytase (1000 and 4,500 FTU/kg), and two mineral levels (control and reduced by 0.15% P and 0.12% Ca). Birds were fed a crumbled starter (d 0-14) and a pelleted grower (d 14-28), finisher (d 28-41), and finisher2 (d 41-47). Average body weight (BW), mortality corrected feed conversion ratio (FCR), and feed consumption (FC) were determined on d 14, 28, 41, and 47. FCR was also adjusted (aFCR) to a common BW through d 41 and 47. On d 48, 5 birds from each replicate were randomly selected for evaluation

Poult. Sci. 97(E-Suppl. 1)