66 Effect of pH of alkaline salts of fatty acids on the inhibition of bacteria associated with poultry processing. A. Hinton Jr.* and K. D. Ingram, Russell Research Center, Athens, GA.

The agar diffusion assay was used to examine the effect of pH on the ability of alkaline salts of 3 fatty acids (FA) to inhibit growth of bacteria associated with poultry processing. FA solutions were prepared by dissolving 0.5 M concentrations of caprylic, capric, or lauric acid in separate aliquots of 1.0 M potassium hydroxide (KOH). Citric acid was added to the FA-KOH mixtures to reduce the pH of separate portions of the solutions to 9.5, 10.5, 11.5, 12.5, or 13.5. Solutions were sterilized by passage through 0.2 µm filters. Agar media was then prepared, sterilized, tempered to 50°C, and inoculated with 10⁶ colony-forming-units/ml of Campylobacter jejuni, Escherichia coli, or Salmonella Typhimurium. Inoculated agar was poured into Petri dishes and allowed to solidify. Wells were made in solidified agar, and 0.1 mL of FA-KOH solutions was added to separate wells. Inoculated agar plates were incubated, and zones of inhibition of bacterial growth around the wells filled with FA-KOH mixtures were measured. Results indicated that reducing the pH of caprylic acid-KOH to 13.5 and the pH of capric acid-KOH mixtures to 12.5 produced significant decreases in the size of zones of inhibition of C. jejuni, but reducing the pH of these solutions to 9.5 produced no differences in the size of zones of inhibition of E. coli. However, while lowering the pH of caprylic acid-KOH solutions to 13.5 produced a significant reduction in the size of zones of inhibition of Salmonella Typhimurium, decreasing the pH of capric acid-KOH mixtures did not result in changes in the size of zones of Salmonella Typhimurium. Lowering the pH of lauric acid-KOH solutions to 12.5 produced significant decreases in the size of the zones of inhibition of all 3 isolates. Findings demonstrated that the pH of solutions of alkaline salts of FA may play a role in the antibacterial activity of these surfactants toward bacteria associated with poultry processing. Therefore, the pH of FA-KOH mixtures should be considered when formulating these solutions for use as poultry processing sanitizers.

Key Words: caprylic acid, capric acid, lauric acid, potassium hydroxide, agar diffusion assay


Car cass chilling during broiler processing is a critical step in preventing growth of both pathogenic and spoilage bacteria. The objective of this study was to compare the microbiological quality of air- and water-chilled broiler carcasses processed at the same commercial facility. For each of 4 replications, 15 broilers were collected from the same commercial processing line after evisceration, after spraying with cetylpyridinium chloride (a cationic disinfectant), and after air chilling (AC) or water immersion chilling (WIC). All carcasses were quantitatively examined for mesophilic aerobic bacteria, Escherichia coli, coliforms, and Campylobacter as well as for the presence of Salmonella and Campylobacter. No significant differences (P > 0.05) were seen between air and water chilling for E. coli or coliforms, or for the incidence of Salmonella and Campylobacter. Lower numbers of Campylobacter were recovered from WIC as opposed to AC carcasses (P < 0.05), but the incidence of Campylobacter on WIC carcasses was similar, suggesting that some Campylobacter were injured rather than killed during WIC. In-line spraying with the disinfectant effectively decreased the incidence of Salmonella and Campylobacter on pre-chilled carcasses; however, cells presumably injured by the sanitizer recovered during chilling. Therefore, on-farm intervention strategies remain critically important in minimizing the spread of microbial contaminants during processing.

Key Words: poultry, air chill, water chill, Salmonella, Campylobacter

68 Effects of modified atmospheric packaging (MAP) on safety and quality of breast fillets and drumsticks. T. Yalamanchili*1, V. K. Sunkara2, L. D. Thimnopson2, and C. Z. Alvarado3, 1Texas A&M University, College Station, 2Texas Tech University, Lubbock.

Packaging system of fresh meats may help restrict the growth of microorganisms and maintain the freshness. Two of the most commonly used packaging in retail are overwrap and vacuum pack. However, the use of mixed gases in MAP containing carbon monoxide, carbon dioxide or nitrogen has been less investigated. Therefore, the objective of this research is to determine the effect of the 3 gases on safety and quality of skinless boneless breast fillets (BF) and skinless boneless drumsticks (DR) stored at 4°C for 3, 7 and 14 d. Treatments included: (1) overwrap (control) (2) 0.4% CO/30% CO2/69.6% N2, (3) 30% CO2/70% N2, and (4) vacuum. Parameters observed were pH, color, peroxide value (PV), and TBARS for quality while APC on petrifilms, E. coli/coliforms and Salmonella for safety. Two-strain Salmonella cocktail was used to inoculate the sample to a concentration of 10⁶ cfu/ml. The pH of CO and vacuum packaged fillets were significantly lower than all other treatments after 14d of storage. The PV for both cuts in MAP treatments were not significantly different on d 7 and 14. However, the TBARS values of the drumsticks on 14d for all treatments were significantly different with CO having the lowest value followed by vacuum and CO2:N2. On the other hand, color was observed higher in L values on both cuts at 14d for CO and vacuum treatments while hue value of the CO treated packages was significantly lower giving a more red color than all other treatments. The chroma of DR in overwrap was higher than other treatments on 14d while CO and vacuum is higher on BF. The APC at 14d for BF was higher in overwrap than other treatments while DR was higher in APC for CO among treatments. The coliforms however, did not change in CO over time as compared with other treatments. As for Salmonella, the count was highest for vacuum and lowest for CO and overwrap for both BF and DR. These results indicate that MAP packaging may be beneficial in increasing the quality and safety of poultry products, and with the inclusion of 0.4% CO to the gas mixture, it may even be more beneficial to the producers and retailers.

Key Words: carbon monoxide, packaging, Salmonella, Campylobacter, color, pH

69 Characterization of a commercial poultry chiller. J. C. Butler* and P. A. Curtis, Auburn University, Auburn, AL.

Poultry is the number one agriculture commodity in Alabama, with more than 1.07 billion chickens produced in 2007 (USDA-NASS, 2008). Over 55,000 Alabamians are currently employed by the poultry industry, allowing this industry to contribute approximately 10% to the state’s economy (Alabama Poultry and Egg Association, 2008). Since the implementation of HACCP in 1998, water usage per bird has jumped from 5–6 gallons per bird to as much as 9 gallons. If a drought is severe enough, the plant could potentially face cutbacks and even...
temporary closings. This research focuses on the potential extended use of chiller water past the typical 2 processing shifts while it retains the ability to be an effective food safety intervention step. It could also lead to a decrease in the amount of waste water a plant makes, which would also lower costs significantly. Chiller water samples were taken every 3 h for 15 h into a processing shift. Samples were then analyzed for Enterobacteriaceae, total plate count, chemical oxygen demand (COD), pH and temperature. Other data, such as flow rate and antimicrobial utilized, were also recorded. The sampling was further separated by prechill chiller and the actual chiller. Results show that microbial counts were not affected by time, but were affected by location within the chiller. The microbial counts were also highly correlated with one another. COD levels remained constant after hour 9. Further research is being performed on additional Alabama processing plants as a continuation of the study.

Key Words: chiller, E. coli, chemical oxygen demand, poultry

70 The microbial differences between male vs. female broiler litter environments. D. L. Everett*, C. D. McDaniel, and A. S. Kiess, Mississippi State University, Mississippi State, MS.

Few studies have tested the microflora of litter when male and female broilers are raised separately. If differences in the number of bacteria do exist, management strategies that improve the litter environment can be established. The objective of this study was to compare the level of bacteria, yeast and mold in litter where male, female, or straight-run broilers have been raised. A total of 216 sexed broilers were placed into 18 different pens (6 pens/3 treatments) filled with fresh pine shavings. A sample of litter (100 g) was collected on d 0, 21, 28 and 31. Ten grams of each pooled litter sample was diluted 1:10 in buffered peptone water and then serial diluted. One hundred microliters from each dilution was plated onto anaerobic agar, sarboraud dextrose agar, or MacConkey agar in duplicate to culture anaerobes, yeasts and molds, and total coliforms, respectively. Plates were incubated for 24 h at 37°C either aerobically or anaerobically. After 24 h of incubation, plates were counted. Data was analyzed using a randomized complete block design with a split plot over days and sex. Means were separated using Fishers protected least significant difference test. Statements of significance were based on P < 0.05. No microbial difference in the litter environments between the different broiler sexes was observed. Anaerobic counts from male, female, and straight-run treatment pens were 6.81, 6.86, and 6.58 mean log cfu, respectively. Yeast and mold growth for male, female and straight-run treatment pens were 6.68, 6.68, and 6.66 mean log cfu, respectively. Total coliform counts for male, female, and straight-run treatment pens were 6.21, 6.09, and 6.14 mean log cfu, respectively. In conclusion, raising straight-run broilers can provide broiler producers with a litter environment that is just as safe as a litter environment where male and female broilers are raised separately. Also, by placing straight-run broilers flocks, broiler producers are making a more economical choice since sexing broiler chicks requires additional time and labor costs.

Key Words: Salmonella, cell culture, invasion, hilA, hilD, gene expression


Salmonella Enteritidis (SE) is a major food-borne pathogen transmitted through poultry products. Chickens serve as the reservoir host of SE; reducing the cecal carriage and shedding of the bacterium in chickens would decrease contamination of meat and eggs. This study investigated the efficacy of feed supplemented with carvacrol (CR), a plant-derived, GRAS molecule, for reducing SE colonization in 19-d old broiler chicks. In 3 separate trials, day-old chicks (n = 65 per trial) were randomly assigned to 5 groups (n = 13 per group): CR control (no SE, no CR), positive control (SE, no CR), negative control (no SE, no CR), treatments (SE, 0.6 or 0.9% CR). Water and feed were provided ad libitum. At 9 d of age, birds were inoculated with 8.0 log10 cfu of a 4-strain mixture of nalidixic acid resistant SE. After 24 h, 3 birds from each group were sacrificed to ensure colonization with SE. Ten birds from each group were euthanized 10 d after SE challenge, and pathogen populations in the cecum and cloaca were enumerated. CR at 0.9% reduced cecal and cloacal SE counts by ~4 log10 cfu/g in trial 1 (P < 0.05), and decreased SE by 1.4 log10 cfu/g of cloacal contents (P < 0.05) with no reduction in cecal SE in trial 2. In trial 3, 0.9% CR reduced cecal SE by 0.9 log10 cfu/g (P < 0.05) with no change in cloacal SE populations. Carvacrol at 0.6% decreased cecal SE counts by 1 log10 cfu/g and 2 log10 cfu/g in the first and second trials (P <

To evaluate the impact of litter Salmonella status during feed withdrawal, 2 pens of broilers (n = 10/pen) in separate rooms were challenged with marker strains of either Salmonella Montevideo (nalidixic acid resistant) or Salmonella Heidelberg (streptomycin resistant) by gavage. Three d post-challenge 1 pen of broilers for each Salmonella strain was switched and all pens subjected to a 12 h feed withdrawal. The litter surface of each pen was sampled by stepped-on drag swabs before switching broilers and after the feed withdrawal period. Broilers were euthanized and the crop and ceca were aseptically removed for Salmonella isolation following enrichment and streaking onto both Brilliant Green Sulfa (BGS)+nalidixic acid (200ppm) and BGS+streptomycin (200ppm). For broilers that remained in challenged pens, only the challenge Salmonella was recovered from the litter before and following feed withdrawal. For the switched broilers, S. Heidelberg was recovered from litter in each pen in both trials and S. Montevideo was recovered from both pens in one trial. Broilers challenged with S. Heidelberg that remained in their pens only had S. Heidelberg recovered from crops and ceca 20/20. From the broilers challenged with S. Montevideo that remained in their pens, only challenge Salmonella strain was recovered from crops 3/20 and ceca 13/20. Those broilers challenged with S. Heidelberg and switched to S. Montevideo pens had only S. Heidelberg recovered from the crops 20/20 and ceca 18/20. In contrast, for broilers challenged with S. Montevideo and switched into S. Heidelberg pens, their crops had either S. Montevideo or S. Heidelberg recovered from 4/20, but only S. Montevideo recovered from the ceca 16/20. S. Heidelberg remained colonized in 100% of challenged broiler crops and ceca and when exposed to S. Montevideo in the litter during feed withdrawal, S. Montevideo was unable to colonize. Colonization of the crop during feed withdrawal by Salmonella appears to depend on the challenge and litter Salmonella status. However, ceca Salmonella status following feed withdrawal appears only influenced by the challenge Salmonella.

Key Words: Salmonella, litter, feed withdrawal, crop, ceca

75 Prevalence of pathogens associated with eggs and the environment of conventional cage and free range egg production. D. R. Jones*, K. E. Anderson, and J. Y. Guard, USDA Agricultural Research Service, Egg Safety and Quality Research Unit, Athens, GA. 2Department of Poultry Science, North Carolina State University, Raleigh.

Alternative egg production methods are becoming more popular with US consumers. As the drive to expand the retail shell egg market to accommodate consumer shifts proceeds, a need arises for additional information to ensure processing methodologies result in safe eggs from all egg sources. A study was conducted to determine if there were differences in the prevalence of Salmonella, Listeria, and Campylobacter on and within eggs and in the environment of a sister flock of conventional cage and free range laying hens. Microbial sampling occurred approximately every 6 weeks between 20 and 79 wks of age. There was a significantly greater (P < 0.0001) prevalence of Campylobacter present in the free range nest boxes (NBS) compared with free range grass (FRG) and conventional cage swab (CS) samples (number of positives: 8 NBS; 1 FRG; 0 CS). Seven isolates of Listeria innocua were detected with no significant difference in prevalence between the treatments. Isolates were associated with egg shells (2 free range floor; 1 cage) and the free range environment (2 NBS; 2 FRG). There were 21 Salmonella isolates detected between all sample locations. There was no significant difference in the prevalence of Salmonella detection between the treatments. Additional studies are needed to fully understand the impact of alternative production methods on the prevalence of pathogens in nest run eggs.

Key Words: egg, microbiology, conventional cage, free range, environmental

In the last year much discussion has taken place on the level of acceptable nicarbazin residues permitted in US broilers destined for export to Russia. While no official notification of residue limits has been published, US broiler producers have commonly discussed a residue limit of 1 ng/g (1 ppb) for meat intended for this market. Due to limitations in assay technology, nicarbazin residues in the range of 1 ppb had never been measured before 2010. As a result of this situation, an experiment was conducted to determine the levels of nicarbazin residues in broiler meat when the drug was fed at 100 ppm (with bacitracin MD and roxarsone) for a 14-d period in a commercial environment. Nicarbazin residues were measured in leg quarter meat approximately every 4 d over a 50-d period following nicarbazin exposure. Leg quarter meat was sampled and analyzed for nicarbazin residues using HPLC MS/MS techniques. Results indicated that for the first 7 d following nicarbazin withdrawal, residues in muscle meat decreased from 1223 ppb at d 0 to 6.75 ppb at d 7. By 18 d post nicarbazin feeding, residues of 2.3 ppb were recorded. At 22 d withdrawal, residues below 1 ppb (0.736 ppb) were first observed. Subsequent residues values measured up to 46 d withdrawal were all in the approximate range of 1 ppb. At 2 time points (28 and 50 d post nicarbazin withdrawal) muscle residue values slightly exceeded the 1 ppb limit (1.1 and 2.3 ppb, respectively). The results of this test indicate that under commercial conditions nicarbazin residues of approximately 1 ppb can be achieved with an appropriate withdrawal period. Periodically however, it is possible that residue values can exceed the 1 ppb limitation. We suggest that consumption of nicarbazin-containing feed particles in the litter during the withdrawal period probably accounted for the slight increase in residue values at 28 and 50 d withdrawal.

Key Words: nicarbazin, residues, coccidiosis, anticoccidial