

90th population percentiles had small, medium, and large relative diameters, respectively. Mean VLDL particle diameter within each of these size categories and the mean diameter of the total population of VLDL particles were determined. Percentages of total serum cholesterol recovered in VLDL, low (LDL), and high density lipoprotein particle classes were also determined. A 12 wk FMG inoculation did not affect the parameters investigated, except for PP, and the percentages of cholesterol recovered in the VLDL and LDL particle classes. At 46 wk, fasting significantly decreased VLDL cholesterol percentages in both control and FMG-inoculated birds. However, at 46 wk, fasting resulted in signifi-

cantly lower PP concentrations in only FMG-inoculated birds. Fasting significantly decreased PP at 34 wk and percentage LDL cholesterol at 46 wk in only uninoculated birds. Conversely, fasting increased percentage LDL cholesterol at 34 wk in only uninoculated controls. FMG inoculation at twelve weeks of age alters the effects of fasting on PP and percentage serum LDL cholesterol concentrations in commercial laying hens. These effects may be mediated through age-related altered states in antibody formation and the assembly of lipoprotein particles in the liver.

Key Words: Fasting, Lipoproteins, *Mycoplasma gallisepticum*

Environment and Management - Enteric Bacteria

127 In vitro selection of enteric microflora for potential use as a competitive exclusion culture against Campylobacter in poults. H. P. Bhaskaran¹, L. R. Bielke¹, G. Nava¹, J. L. Vicente¹, P. J. Blore¹, G. Tellez¹, A. M. Donoghue², J. A. Byrd³, B. M. Hargis¹, and D. J. Donoghue^{*1}, ¹Department of Poultry Science, University of Arkansas, Fayetteville, Arkansas 72701, ²USDA/ARS PPPSRU Fayetteville, Arkansas 72701, ³USDA/ARS FFRSU College Station, TX.

The administration of nonpathogenic microflora in neonatal poultry has been employed to reduce or eliminate the colonization of enteric pathogens. This concept, also called competitive exclusion (CE), although effective against Salmonella, has not consistently worked against Campylobacter. Most CE cultures are developed by randomly collecting enteric bacteria without any preselection criteria for bacteria. It may be possible to enhance the efficacy of a CE against Campylobacter by preselecting enteric microflora with the ability to inhibit Campylobacter, *in vitro*. With this goal, an assay was developed to test individual isolates with the ability to reduce or eliminate Campylobacter growth, *in vitro*. Individual isolates were obtained from cecal material of both juvenile and adult poultry. Isolates were serially diluted (103, 104 and 105 CFU/well) and added to 96 well polystyrene plates containing 1x104 CFU *C. jejuni* or *C. coli*/well. Plates were incubated at 42 C in a microaerophilic environment for 22 to 24 hours. Following incubation, a 1 uL loop from each well was streaked onto Campy-Cefex and incubated at 42 C in a microaerophilic environment for 24-48 hours. Approximately 30 isolates were identified with the ability to inhibit *C. jejuni* or *C. coli* growth *in vitro*. Preliminary studies using combinations of these isolates in neonatal poults demonstrated some efficacy against Campylobacter colonization. This research demonstrates *in vitro* efficacy of isolates against Campylobacter, however additional research will be required to identify combinations of isolates with the ability to consistently inhibit Campylobacter colonization *in vivo*. Funded in part by the USDA Food Safety Consortium.

Key Words: Campylobacter, Enteric microflora, Competitive exclusion, Foodborne pathogens

128 Use of lactic acid bacteria in conjunction with a commercial organic acid treatment may reduce initial Campylobacter colonization in turkeys. J. S. Holliman^{*1}, G. Nava¹, J. L. Vicente¹, L. R. Bielke¹, K. Cole¹, A. M. Donoghue², J. A. Byrd³, B. M. Hargis¹, M. Tellez¹, and D. J. Donoghue¹, ¹Department of Poultry Science, University of Arkansas, Fayetteville, Arkansas 72701, ²USDA/ARS PPPSRU, Fayetteville, Arkansas 72701, ³USDA/ARS FFRSU, College Station, TX.

Foodborne pathogens pose significant health risks to consumers. The leading causes of foodborne illness associated with poultry consumption are Campylobacter and Salmonella contamination. One strategy to reduce these enteric pathogenic microflora is the administration of nonpathogenic bacterial cultures to poultry, known as competitive exclusion (CE). Although current CE cultures have efficacy against enteric Salmonella colonization, these cultures have little if any consistent efficacy against Campylobacter. Recently, using *in vitro* selection techniques we have identified lactic acid bacteria (LABS) with potential anti-Campylobacter activity. To evaluate the ability of these LABS to reduce Campylobacter colonization in turkeys, neonatal poults were dosed on the day of hatch with various combinations of LABS and/or the commercial organic acids (OA) treatment, Performax (n=10poults/treatment). Three days following LABS treatment, Campylobacter(102 to 104) was administered to poults by oral gavage. On day 10, all poults were sacrificed and cecal contents enumerated for Campylobacter. In two separate

trials, at best, there was a 1 log reduction with either LABS or OA, alone. However, when LABS and OA were used together, there was up to a 3 to 4 log reduction in cecal Campylobacter content compared to controls. These results indicate that it is possible to significantly reduce Campylobacter concentrations in poults with the use of selective bacteria in combination with OA. The enhanced efficacy of our LAB cultures in the presence of OA may be due to OA's ability to favorably alter the enteric environment promoting LAB colonization. Funded in part by the USDA Food Safety Consortium and the USDA Foreign Agriculture Service (MX120).

Key Words: Campylobacter, Lactic acid bacteria, Competitive exclusion, Organic acids

129 Use of biofunctionalized nanoparticles to bind Campylobacter jejuni in poultry. J. L. Franklin*, B. W. Sheldon, J. L. Grimes, and M. J. Wineland, North Carolina State University.

Previous studies have demonstrated that mannose binds to gram-negative bacteria, reduces virulence, and prevents bacterial colonization of the GI tract of poultry. Two trials were conducted to examine the use of biofunctionalized nanoparticles (BN) to bind *Campylobacter jejuni* in poultry. The objective of trial 1 was to determine the effect of polystyrene cores on turkey poult performance to 6 wk with observation to 14 wk. The second trial examined if BN have a specific affinity for *C. jejuni* and would bind to and promote aggregation *in vitro*. The BN were composed of a polystyrene core containing D-mannose (4 molar % mannose) or a tyrgly-gly peptide (3 molar %) attached by a polyethylene glycol-tethered polymerization reaction. In the first trial, 240 day-of-hatch female poults were placed in 6 pens (6 m² with slatted floors). At 1 wk, poults were banded, weighed and reduced to 198 (33 per pen) then gavaged with various liquid polystyrene core materials. One to two poults per pen were gavaged with 0.1, 0.5 or 1.0 mL of each of the treatments. In all pens (1-6), 3 control poults were gavaged with distilled H₂O. BW was determined at wk 1, 3 and 6 with observations to 14 wk. All poults were provided H₂O and commercial feed *ad libitum*. BW means and gains were analyzed using regression analysis (P < 0.05). The second trial utilized an *in vitro* application to examine BN-bacterial activity. A field strain of *C. jejuni* was cultured at 42C in Brucella broth (BB) for 48h under microaerophilic conditions and then serially diluted with BB to 10⁴ cfu/mL. Aqueous BN suspensions were diluted 1:1, 1:10 and 1:100 in 0.1% peptone H₂O and mixed with equal volumes (1.5 mL) of suspended *C. jejuni*. The mixture was sampled at 0, 1, 5 and 30 minutes, spiral plated in duplicate onto Brucella agar and incubated as previously described. Trial 1 resulted in no significant differences in BW or BW gains due to treatments. Thus, the cores proved to be non-toxic to the turkey poults. In trial 2, the recovered BN-treated *C. jejuni* populations were reduced from 0-0.86 logs (0-86.2%) depending on exposure time and BN concentration. Although population reductions were observed, reductions might be attributed to cell aggregation rather than cell death.

Key Words: biofunctionalized nanoparticle, *Campylobacter jejuni*, poultry

130 Effect of oxytetracycline on tetracycline resistance in poultry Campylobacter spp. A. S. Fairchild*, J. L. Smith, U. Idris, J. Lu, and M. D. Lee, University of Georgia, Athens, GA 30602.

Antibiotics used in the poultry industry are under scrutiny because there have been increasing percentages of antibiotic-resistant bacteria observed in poultry raised for food production. There is concern that normal flora found in poultry may transfer antibiotic resistance to food-borne human

pathogens such as *Campylobacter*, acting as a reservoir for various resistance genes. Therefore, the hypothesis of this study is that antibiotic treatment in poultry selects for antibiotic-resistant bacteria. The objectives of the present study were to determine 1) if normal flora bacteria such as *Enterococcus* spp. and *E. coli* recovered from chickens displayed high levels of resistance to tetracycline, an antibiotic commonly used in the poultry industry, and 2) if a potential recipient of antibiotic resistance genes, *Campylobacter* collected from the same chickens, acquired resistance to tetracycline after oxytetracycline treatment. Commercial and university research flocks used in this study were sampled prior to and after an oxytetracycline (Oxytet) treatment. Flocks were surveyed for the prevalence of tetracycline (Tet) resistance in *Enterococcus*, *E. coli*, and *Campylobacter* isolates either by microbroth or agar dilution established by the NCCLS. Minimum inhibitory concentrations (MIC) for Tet remained at less than 2g/ml for all *Campylobacter* isolates from the university flock and commercial flock before and after treatment. However, when the commercial flock *Enterococcus* and *E. coli* isolates were screened, the MIC₅₀ values for pre- and post-treatment was >8g/ml. The percentage of university flock *Enterococcus* and *E. coli* isolates displaying an MIC value of >8g/ml Tet decreased from 100% pre-treatment to 85.7% and 93.3%, respectively post-treatment. In conclusion, even though representative normal poultry flora maintained high MIC values for Tet before and after Oxytet treatment, *Campylobacter* spp. from the same poultry did not acquire resistance to the antibiotic.

Key Words: Poultry, Antibiotic, Tetracycline, Resistance, Bacteria

131 Effect of Poultry Guard Litter Amendment (PGLA) on horizontal transmission of *Salmonella enteritidis*. J. L. Vicente*¹, G. I. Tellez¹, G. Nava¹, S. E. Higgins¹, A. M. Donoghue², D. J. Donoghue¹, L. A. Newberry¹, and B. M. Hargis¹. ¹Department of Poultry Science, University of Arkansas, Fayetteville AR 72701, ²USDA-ARS-PPPSRU University of Arkansas, Fayetteville AR. 72701.

In 2 Expts, low level (LL: 75lb/1000 ft²) and high level (HL: 150 lb/1000 ft²) PGLA was spread manually on the top of the litter 24 h prior to chick placement. In Expt 1, used pine litter shavings (23% moisture) were used. Three hundred day of hatch broiler chicks from a commercial hatchery were obtained and randomly assigned to three groups (control, LL, and HL) with four replicate pens per treatment. Two hundred-forty chicks were placed immediately in the pens (20 chicks/pen: 24 ft²/pen) and the other 60 chicks were challenged with 7500 CFU of SE (seeders) and placed in a separate holding pen. Seeders (5) were placed in each experimental pen 24 h after placement. At day 11, cecal tonsils were aseptically removed for recovery of *Salmonella* following 24-h tetrathionate enrichment with subsequent plating on BGA agar (n=10/pen). Either LL or HL PGLA prior to chick placement reduced (P< 0.05) SE recovery in Exp. 1 as compared to controls (Control: 28%, LL: 0%; HL: 3%) 11 days after placement, and increased (P< 0.05) body weight 21 days following placement. Low levels of SE were recovered from all groups in Exp. 1 at 21 days-of-age. Similarly, application of PGLA in Exp. 2 (new litter) reduced (P< 0.05) SE recovery from ceca of chicks cultured at 11 days (Control: 46%; LL: 23%; HL: 18%) but no difference (P> 0.05) in recovery was noted by day 21 (Control: 28%; LL: 13%; HL: 15%). Body weights through 21 days were unaffected by PGLA treatment of new litter in Exp. 2. These data suggest that PGLA treatment of new or used litter may reduce early horizontal transmission of *Salmonella*. Enhanced 21-day performance of chicks on used litter treated with PGLA may suggest that other low-level pathogens were reduced by treatment, although further studies are necessary to confirm and extend these findings.

Key Words: *Salmonella enteritidis*, PGLA, Horizontal transmission, Broiler chicks, Litter

132 Evaluation of environmental factors on the presence of *Salmonella* and *Campylobacter* at different sites through the broiler production continuum. J. A. Byrd*¹, R. H. Bailey², R. W. Wills², M. L. Rybolt², L. F. Kubena¹, and D. J. Nisbet¹. ¹USDA ARS, SPARC, Food and Feed Safety Research Unit, College Station, TX., ²College of Veterinary Medicine, Mississippi State University.

Poultry companies continue to produce safe and wholesome products, all the while facing increased regulatory pressure to control certain organisms indigenous to the production system. Although many risk factors that contribute to *Salmonella* and *Campylobacter* levels have been identified, precise identification of the most effective sites for intervention

have not been established. The present study compares environmental parameters on *Salmonella* and *Campylobacter* at different points of production. One broiler house on 5 different farms from 2 geographical locations with six consecutive flocks per house were studied (Location A and Location B for a total of 10 houses). Internal (IET) and external environmental temperature (EET), relative humidity (RH), litter moisture (LM), and litter water activity (Aw) were recorded. Preharvest sample points included: tray pads (10/house), litter (10/house), and whole bird rinse (20 birds/house). Postharvest samples included: post-feather removal (20/flock), pre-chill (20/flock), and post-chill immersion carcass rinses (20/flock). All samples were evaluated for *Salmonella* and *Campylobacter*. Location A had higher EET, and internal house RH compared to Location B which had higher IET, LM, and litter Aw values. The incidence of *Salmonella* detected from environmental and carcass samples were not significantly different from Location A versus Location B with the exception of an increase in pre-harvest whole bird wash at location B (30/600) versus location A (8/605). Environmental samples and all carcasses evaluated within the processing plant had higher *Campylobacter* recovery incidence at Location B versus Location A. Data from this study may help poultry professionals understand how environmental factors may affect foodborne pathogens in poultry and the difficulty that may be encountered in making risk management decisions.

Key Words: *Campylobacter*, Environmental, *Salmonella*

133 Utilization of the nitrate reductase pathway for determining sensitivity of a competitive exclusion culture. J. L. McReynolds*¹, R. C. Anderson², J. A. Byrd², T. L. Poole², R. W. Moore¹, L. F. Kubena², and D. J. Nisbet². ¹Texas A&M University, Department of Poultry Science, ²USDA-ARS, Southern Plains Agriculture Research Center, College Station, Texas 77845.

Poultry, the most frequently implicated vehicle for human food borne salmonellosis, represents the largest reservoir of *Salmonella* in animal agriculture. Previous reports have shown that some bacteria, including *Salmonella*, utilize a dissimilatory nitrate reductase enzyme (NR) in anaerobic environments. This enzyme reduces nitrate to nitrite and also has been shown to co-metabolize chlorate to cytotoxic chlorite. The present investigation was performed to evaluate the susceptibility of a competitive exclusion culture (CE) to the chlorate ion. A commercially available CE product was evaluated for its nitrate reductase activity and therefore its chlorate sensitivity. The 29 constituent bacteria of the CE culture, encompassing 10 different genera of which 15 strains are facultative and 14 are obligate anaerobes. Isolates (in triplicate) were cultured in 10 mL of Viende LeVure-broth containing 5 mM sodium nitrate or 10 mM sodium chlorate. Bacterial growth (OD 625 nm) was measured at the 0, 3, 6 and 24 h time and 1 mL aliquots were removed concurrently for colorimetric determination of nitrate content. Of the 15 different facultative strains, 11 were NR +, 3 were NR ++, the remaining were NR negative (with + and ++ relating to >0.1 to < 1.0 mM and > 1.0 mM nitrate utilized within 6 h, respectively). Of the obligate anaerobes evaluated, 3 were NR +, the remaining were NR negative. Of the total NR positives, fifty percent were chlorate sensitive, as evidenced by marked inhibitions in growth over the 24 h incubation period. The results of this study combined with *in vivo* studies (data not shown) suggest that although some of the bacteria are affected by chlorate, the combined affect of the CE culture and a chlorate product are effective in killing these foodborne pathogens and are apparently not critical for CE function in poultry.

Key Words: Chicken, Chlorate, Competitive exclusion, Nitrate

134 Evaluation of a simple *in vitro*-selected probiotic consisting of nine non-pathogenic bacteria to prevent *Salmonella* infection in broiler chicks. A. D. Drake*¹, C. M. Pixley¹, D. A. Johnson¹, S. E. Higgins¹, G. M. Nava¹, G. I. Tellez¹, D. J. Donoghue¹, A. M. Donoghue², and B. M. Hargis¹. ¹University of Arkansas, ²USDA-ARS-PPPSRU.

Previously, we have demonstrated that a simple probiotic consisting of 9 air-tolerant bacteria, could prevent *Salmonella enteritidis* (SE) infection in turkey poults. Presently, these 7 *Enterobacteriaceae* and 2 lactic acid bacteria were combined into a single culture and were tested for prophylactic ability to inhibit SE colonization in neonatal broiler chicks. In exp 1, day-of-hatch chicks were randomly divided into five pens (n=20/pen). All chicks were orally gavaged and 3 pens were treated with probiotic culture in the drinking water for four consecutive days. Controls were

gavaged with 0.9% sterile saline solution and received no probiotic in the drinking water. Group B received the highest dose of 2.9×10^5 cfu by oral gavage and 1.20×10^7 cfu/ml in the drinking water. Groups C and D received serial 100-fold dilutions of the highest dose. All chicks were challenged 48 h after placement with 4.60×10^3 cfu SE. Cecal tonsils were sampled 48 h post-challenge and cultured for presence or absence of SE. We recovered SE from 87% of non-treated control chicks, and from all treatment groups receiving the probiotic SE was recovered with a lower ($p < .05$) incidence (B=55%, C=20%, D=35%). Group C also had lower ($p < .05$) incidence of SE recovery than group B. In exp two, four groups ($n=40$) of chicks were placed on the day-of-hatch. Two pens were treated by inclusion of the probiotic culture (4.89×10^4 cfu/ml) in the drinking water for three days, and the other two pens received no probiotic in the water (non-treated control). Ten seeder chicks per group were challenged with 1.25×10^5 cfu SE on the day-of-hatch, and placed in each of the treatment groups 24 h later. On day eight, liver-spleen and cecal tonsil samples were collected from the 10 seeder chicks and 20 contact chicks in each group. SE was recovered in the cecal tonsils with a lower ($p < .05$) incidence from the groups that received the culture in the drinking water (32%) as compared to controls (82%). These data suggest that a relatively simple and defined probiotic culture can reduce SE infection in neonatal chicks.

Key Words: Chickens, Salmonella, Probiotic

135 Supplementation of an experimental chlorate product in broiler drinking water prior to slaughter reduces Salmonella. M. R. Burnham*, J. A. Byrd, J. L. McReynolds, R. C. Anderson, L. F. Kubena, K. J. Genovese, Y. S. Jung, and D. J. Nisbet, ¹USDA-ARS, SPARC, Food and Feed Safety Research Unit, College Station, Texas 77845.

The objectives of this study were to evaluate the effectiveness of an experimental chlorate product (ECP) water supplementation procedure 1 week prior to slaughter on the reduction of *Salmonella* in the crop and ceca of market-age broilers, and its subsequent effects on performance. At 6 wk of age, one hundred and sixty broilers were randomly assigned to eight groups of twenty birds and placed in floor pens containing fresh pine litter. Prior to placement, each bird was orally challenged with 10^9 *Salmonella Typhimurium* (ST). Seven days prior to slaughter and at each day thereafter, one randomly assigned group of birds was provided 1x ECP (containing 15mM chlorate ion equivalent) added to the drinking water for the remainder of the week. In essence, birds began to receive ECP in their water supply at either 1, 2, 3, 4, 5, 6, or 7 d prior to slaughter. Performance variables investigated were BW, water and feed consumption, feed conversion, and mortality. Crop and cecal contents were aseptically collected and spread on BGA plates to enumerate ST. Birds exposed to ECP for 4-7 d consumed significantly more water than those not exposed or exposed to ECP for 1-3 d. Litter samples from the pens of birds exposed to ECP for extended periods of time had significantly higher moisture content than birds not exposed or exposed for fewer days. Litter moisture significantly increased with extended days of exposure to ECP. ECP supplementation in the drinking water of broilers at 4-7 d prior to slaughter significantly reduced the incidence of birds positive for ST in the crop and also significantly reduced ST 1-2 log in the crop and ceca when compared to those not exposed or exposed to ECP for 1-3 d. These results indicate that ECP water supplementation prior to slaughter effectively reduces *Salmonella* in broilers, and may potentially reduce the risk of contaminating poultry products. ECP supplemented in the drinking water of broilers may provide a novel intervention strategy that effectively reduces *Salmonella* in market age broilers.

Key Words: Broilers, Experimental chlorate product, Performance, *Salmonella Typhimurium*, Water supplementation

136 The use of chicken IgY in a sandwich enzyme-linked immunosorbent assay for the detection of Escherichia coli O157:H7. H. H. Sunwoo*¹, M. S. Kang², and J. S. Sim¹, ¹Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Canada, ²Department of Animal Biotechnology, Che Ju National University, Je-Ju Do, Korea.

Enterohaemorrhagic *Escherichia coli* serogroup O157 has emerged as an important food-borne pathogen. Conventional microbiological and antibody-based tests for the detection of *E. coli* O157:H7 in food products are both costly and time-consuming. An alternative test kit for screening of large numbers of samples for *E. coli* O157:H7 is in dire need.

In the present work, we developed a modified sandwich enzyme-linked immunosorbent assay (S-ELISA) technique to detect *E. coli* O157:H7 from food samples using an anti-*E. coli* O157 mouse monoclonal IgG as the capture-antibody and chicken anti-*E. coli* O157:H7 IgY as the secondary-antibody. The anti-*E. coli* O157:H7 IgY was harvested from eggs laid by laying hens (23 weeks of age, Single Comb White Leghorn) after immunization of formalin killed *E. coli* O157:H7 (v241; 10^9 colony forming unit; cfu), and further purified by gel chromatography on Sephacryl S-300 followed by ammonium sulfate precipitation. The purity of the IgY preparation was more than 99% determined by sodium dodecyl sulphate-polyacrylamide gel electrophoresis. The IgY fraction of gel-chromatography was subjected to a quantitative ELISA to measure the concentration of both total IgY and specific anti-*E. coli* O157:H7 IgY. The content of the specific IgY was 9.2% of total immunoglobulins. The optimal dilutions for the capture-antibody and the secondary-antibody were 1:4,000 and 1:1,500, respectively. The sensitivity (cfu/ml) of S-ELISA for the *E. coli* O157:H7 was repeatedly examined with 10 replicates of each sample and a standard curve was plotted. The result shows that this new method can detect as low as 10^4 cfu/ml of *E. coli* O157:H7 in food samples. These data suggest that chicken IgY-based S-ELISA is reliable, inexpensive and sensitive for a routine screening application for *E. coli* O157:H7 for the food safety.

Key Words: Sandwich ELISA, *Escherichia coli* O157:H7, Food safety, Egg yolk antibody

137 Investigating the effects of probiotics on chick quality and broiler production efficiency. E. E. O'Dea*, G. M. Fasenko, G. E. Allison, D. R. Korver, J. J. R. Feddes, and G. Tannock, University of Alberta, Edmonton, Alberta, Canada.

Increased stresses on broilers introduced through modern production practices and genetic selection predispose birds to infections of the gastrointestinal tract (GIT). Previous research has indicated that administration of probiotics (live microbial cultures isolated from the GIT) to chickens improves feed conversion, weight gains, and decreases the numbers of bacterial pathogens in the GIT. Interbac[®] and Pro-Avi[®] are the only two probiotic products approved by the Canadian Food Inspection Agency for use in poultry. This experiment investigated the effect of administration of these products on broiler mortality and production efficiency. Chicks were obtained from a 28 week-old Hubbard Hi-Y breeder flock and divided into the following four groups: 1) Group 1-no probiotics, 2) Group 2-Interbac[®] administered in drinking water, 3) Group 3-Interbac[®] administered by spray prior to placement, 4) Group 4-Pro-Avi[®] mixed into the feed. The chicks were reared in 4 identical pens per group and the probiotic products administered according to manufacturer's directions. Individual body weights were obtained for all birds at hatch and at 6 weeks of age, and from a sub-sample of birds during weeks 1 to 5. Weekly feed conversion and mortality were calculated. First week and total mortality over the trial were not significantly different among the treatments. There were no significant differences among the treatments in feed to gain ratio during weeks 1 to 6 or over the entire trial. Chick weights at placement were significantly different ($P=0.0001$) with the birds destined to receive the probiotics via the spray (39.2 ± 0.2 g) being heavier than the control (38.6 ± 0.2 g), feed (38.7 ± 0.2 g), or water (38.7 ± 0.2 g) treatment groups which did not differ from one another. These significant differences in chick weights at placement carried through to shipping weights at 6 weeks ($P=0.0007$). The birds that received Interbac[®] via the spray (1757 ± 28 g) were significantly heavier than the birds in the control (1708 ± 28 g), feed (1706 ± 28 g) or water (1672 ± 28 g) treatment groups, which did not differ from one another. Preliminary data analysis indicates that administration of Interbac[®] via a spray may improve broiler weight gains. This experiment is being repeated with chicks produced by the same breeder flock at 43 and 57 weeks of age.

Key Words: Broiler, Chick quality, Probiotics, Production efficiency, Intestinal microflora

138 Demonstrated effects of S6-strain Mycoplasma gallisepticum inoculation on hematocrit and serum calcium in two different flocks of commercial layers between 20 and 58 week of age. E. Y. Basenko*¹, E. D. Peebles¹, P. G. Gerard¹, S. L. Branton², and S. K. Whitmarsh¹, ¹Mississippi State University, Mississippi State, MS, ²USDA ARS, SCPR, Mississippi State, MS.

The effects of the S6 strain of Mycoplasma gallisepticum (S6MG) on blood characteristics of Leghorn chickens between 20 and 58 wk of age were examined. A total of 160 Hy-Line W36 strain hens were housed in negative pressure isolation units. Birds were inoculated with S6MG at either 10, 22 or 45 wk of age. Control birds received sham inoculation at 10 wk of age. Each treatment had 4 replicate units with 10 birds per unit. Birds were bled from a wing vein and the following blood characteristics were determined at Weeks 20, 24, 43, 47, and 58: hematocrit (HCT), plasma total protein, and serum cholesterol, triglycerides, and calcium (SCA). In this experiment, a different flock of birds was used to determine if effects due to S6MG inoculation on various blood parameters were similar to those in a previous study. Only the flock and housing arrangements were different in this trial. In the current trial, S6MG inoculation affected levels of plasma total protein, HCT and SCA. Birds inoculated with S6MG at 10 wk of age had significantly higher HCT levels when compared to controls at Week 20. At Week 58, HCT levels were significantly lower in birds inoculated with S6MG at 10 wk when compared to controls. Across Weeks 47 and 58, SCA levels were noted to be significantly higher in birds inoculated at 22 wk of age when compared to controls and those inoculated with S6MG at 45 wk of age. At Week 43, birds inoculated with S6MG at 22 wk of age had significantly lower SCA levels when compared to those inoculated at 10 wk. Only HCT and SCA were affected by S6MG treatment in both the current and previous trials. Furthermore, in both trials birds inoculated with S6MG at 45 wk of age had significantly lower SCA levels across Weeks 47 and 58 when compared to those inoculated with S6MG at 22 wk of age. It is concluded that HCT and SCA levels in commercial layers were affected during pre- and post-peak production. Effects of S6MG inoculation on HCT levels may be related to MG colonization of red blood cells and subsequent physiological compensatory responses in the bird. Future research will be conducted to further examine the relationships between endocrine status, SCA levels and eggshell quality in commercial layers after being inoculated with S6MG.

Key Words: Mycoplasma gallisepticum, Hematocrit, Serum calcium, Inoculation, Commercial layers

139 A turkey model for evaluating the efficacy of adsorbents to ameliorate the toxic effects of aflatoxin. D. R. Ledoux*¹, J. N. Broomhead¹, Y. C. Chen¹, A. J. Bermudez¹, G. E. Rottinghaus¹, and W. W. Robey², ¹University of Missouri, Columbia, MO, ²Cargill Feed Applications, Minnetonka, MN.

Two 21-day experiments were conducted to determine if the turkey could be used as a model for evaluating the efficacy of adsorbents (hydrated sodium calcium aluminosilicates, HSCAS) to ameliorate the toxic effects of aflatoxin (AF). Dietary treatments fed (5 reps of 5 poult) from day 1

to 21 in Exp. 1 included: (1) 0 µg AF/kg + 0% of HSCAS-A; (2) 0 µg AF/kg + 1.0% HSCAS-A; (3) 250 µg AF/kg + 0% HSCAS-A; (4) 250 µg AF/kg + 0.25% HSCAS-A; (5) 250 µg AF/kg + 0.50% HSCAS-A; (6) 250 µg AF/kg + 0.75% HSCAS-A; and (7) 250 µg AF/kg + 1.0% HSCAS-A. Exp. 2 was similar to Exp. 1, except a different HSCAS was used (HSCAS-B), the concentration of AF was 200 µg/kg, and there were 7 reps of 5 poults each. AF was supplied by *A. parasiticus* culture material that contained 986 mg AFB₁/kg. The addition of 1.0% HSCAS to the diets did not negatively affect (P > .05) poult performance in either experiment. In Exp. 1, compared with controls (P < .05), poults fed 250 µg AF/kg had lower body weight gains (BWG, 34%), reduced liver weights (LWT, 25%), and increased kidney weights (KWT, 26%). Supplemental HSCAS-A at ≥ 0.50% reduced the growth depressing effects of AF, whereas supplemental HSCAS-A at ≥ 0.25% and ≥ 0.75% reduced the negative effects of AF on KWT and LWT, respectively (P < .05). In Exp. 2, compared with controls (P < .05), poults fed 200 µg AF/kg had lower BWG (17%), reduced LWT (29%), and increased KWT (33%). Supplemental HSCAS-B at ≥ 0.75% prevented the growth depressing effect of AF (P < .05). Supplemental HSCAS-B at ≥ 0.50% reduced (P < .05) the negative effects of AF on KWT. Results indicate that both adsorbents were effective in reducing some of the toxic effects of AF in the young turkey. Data also suggest that the turkey is a more sensitive model for evaluating the efficacy of adsorbents to ameliorate the toxic effects of AF, and at levels reported to cause toxicity under field conditions.

Key Words: Adsorbent, Aflatoxin, Turkeys, Model

140 Incidence of breast blisters in turkeys and their effect upon meat quality. S. Kakarla*, H. D. Chapman, and C. M. Owens, University of Arkansas, Fayetteville, ARK-72701.

Breast blisters, also known as "Enlarged Sternal Bursa", commonly occur in commercially reared turkeys. This study examined the effect of breast blisters on indices of meat quality including the decline in breast muscle pH post mortem and the L* value (a color measurement of lightness, determined on the posterior region of the left breast fillet). A flock of 250 day-old debeaked Nicholas tom turkeys were placed in 48 pens in groups of 15 per pen and reared to 14 weeks of age. At 14 weeks each bird was examined by manually palpating and visually inspecting the unfeathered skin for the presence of breast blisters. A total of 5.6% of the birds were found to have fully developed breast blisters. Fourteen birds with blisters, and a similar number of controls with no blisters were processed at 18 weeks of age. The breast meat from birds with blisters showed a significant (p<0.005) decrease in pH from 0.25 hrs to 4 hrs postmortem (6.04 and 5.80 at 0.25 and 4 hrs, respectively) as compared with control birds with no blisters (which showed a normal pH change of from 6.18 to 6.20 at 0.25 and 4 hrs). There was no significant difference in the L* value between the blister group and the control group. Since a rapid decline in muscle pH reduces the shelf life of meat, it is concluded that breast blisters not only affect costs due to the requirement for breast trimming, but also cause losses due to deterioration in meat quality.

Key Words: Turkeys, Breast blisters, Postmortem pH decline

Nutrition - Nutrition A

141 Effect of dietary calcium on intestinal phytase activity and phytate-phosphorus utilization in Pekin ducklings. J. K. Rush*¹, R. Angel², K. M. Banks¹, K. L. Thompson¹, and T. J. Applegate¹, ¹Purdue University, ²Univ. of MD, College Park.

Higher concentrations of calcium (Ca) in the diet may decrease phytate-phosphorus hydrolysis because of the chelation of Ca with the phytin molecule. Therefore, 192 drakes were fed 0.6, 0.8, 1.0, or 1.2 % Ca from 7 to 17 d of age (6 birds/pen and 8 pens/treatment). Non-phytate phosphorus (nPP) was determined to be 0.46 %. Excreta was collected from 15 to 17 d of age and the left tibia was collected at 18 d of age. Duodenal and jejunal mucosa was collected on 18 d of age from treatments with 0.6 and 1.2 % Ca for determination of intestinal phytase activity. Body weight gain was greatest when the ducklings were fed the 1.0 % Ca diet and different (P < 0.05) from that of the 0.6 % Ca, but not different (P > 0.05) from birds fed the 0.8 and 1.2 % Ca diet. Tibia ash percentage was not significantly affected by dietary Ca (P > 0.05). Tibia ash weight, however, was significantly greater in the birds fed 1.0 % Ca as compared with those fed 0.6 and 1.2 % Ca (P ≤ 0.05), but not significantly dif-

ferent than birds fed 0.8 % Ca (P > 0.05). Specific phytase activity within brush border vesicles prepared from intestinal mucosa and vesicle Ca concentration was not significantly affected by dietary Ca (P > 0.05). A positive correlation, however, was found between the Vmax and the Ca concentration within the vesicles (r=0.59, P < 0.02). In conclusion, maximal duckling growth and tibia ash weight was realized when birds were fed 1.0 % Ca, which is significantly greater than the current recommendation of 0.6 % Ca for ducks as reported by the National Research Council (1994). Contrary to previous work in broilers, intestinal phytase was not significantly affected by dietary Ca concentration in ducklings. Additionally, the vesicle Ca concentration did not negatively affect the kinetics of the phytase assay.

Key Words: Calcium, Intestine, Phosphorus, Phytase, Phytate